

Prejudice, Contact, and Threat at the Diversity-Segregation Nexus: A Cross-Sectional and Longitudinal Analysis of How Ethnic Out-Group Size and Segregation Interrelate for Inter-Group Relations

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Extensive research explores how increasing ethnic out-group populations in society affects inter-group attitudes. Drawing on the threat and contact hypotheses, this study develops and tests a framework examining the role of segregation in the out-group size/prejudice relationship. We suggest that whether increasing minority share in a community generates processes of contact and/or perceived threat will depend on how segregated groups are from one another. This, in turn, will determine *when* high minority share communities have positive, negative, or null effects on inter-group attitudes. Using data from white British individuals in England, we observe that community segregation moderates the effect of community percent non-white British on prejudice, as well as mechanisms of positive inter-group contact and perceived threat. Residents of more homogeneous communities report relatively warm inter-group attitudes, regardless of how segregated they are. Residents living among high proportions of out-group where the groups are *integrated* report an improvement in out-group attitudes. It is only residents living among large out-group populations where groups are more *segregated* from one another—at the nexus of high minority share *and* high segregation—who report colder out-group attitudes. This higher prejudice is driven by *both* lower positive contact and higher perceived threat in these communities. Using two waves of cohort panel data, longitudinal analysis provides more robust evidence in support of the diversity-segregation nexus framework: communities becoming more ethnically mixed *and* segregated see prejudice increase, while those becoming more mixed *and* integrated see stable, or

This work was supported by the Economic and Social Research Council (grant number ES/L011255/1) and by the Leverhulme Trust (grant number F08 594/B). Please address correspondence to James Laurence, Cathie Marsh Institute for Social Research, University of Manchester, 2.11 Humanities Bridgeford Street, Oxford Road, Manchester M13 9PL, UK; e-mail: james.laurence@manchester.ac.uk.

somewhat improving, relations. Collectively, this paper shows that mechanisms of positive contact and threat appear conditional on both the size of out-groups in an area *and* how segregated groups are from one another, generating key differences in when and how increasing ethnic out-group size affects inter-group relations.

Introduction

Concern regarding the growing ethnic diversity of many countries has assumed prominence in recent public and political debates. Be it the re-emergence of far-right parties or voting patterns driven, in part, by immigration fears, such as the UK decision to leave the EU (Clarke, Goodwin, and Whiteley 2017) or the US election of Donald Trump (Major, Blodorn, and Blascovich 2016; Pettigrew 2017), we appear to be (re-)entering a period in which rising ethnic minority populations are perceived as a threat to societal cohesion. This public and political debate overlaps with academic debates stretching back over sixty years into how increasing out-group populations affect inter-group attitudes, broadly divided into two opposing theories: the threat and contact hypotheses. The evidence for whether out-group attitudes worsen (threat hypothesis) or improve (contact hypothesis) as the size of ethnic out-groups increases remains mixed, suggesting the relationship may be more complex and potentially contingent on other factors (Hopkins 2010; Rocha and Espino 2009). In this paper, we aim to explore the largely overlooked role of segregation in this debate.

Extensive research demonstrates how segregation can emerge from inter-ethnic economic disparities, housing discrimination, or preferences for co-ethnic cohabitation (Bobo and Zubrinsky 1996; Clark and Fossett 2008; van Ham and Feijten 2008). Segregation may also be a product of greater perceived threat and prejudice, stemming from rising out-group populations (Blanchard 2007; DeFina and Hannon 2009). However, as well as being a product of inter-group dynamics, segregation itself has long been hypothesized to play a causal role in generating and/or sustaining pejorative out-group attitudes; for example, by limiting opportunities for contact (Allport 1954; Blau 1977). Recent work into how the minority share in an environment affects prejudice has begun exploring the role of segregation alongside out-group size in fomenting inter-group tensions (Biggs and Knauss 2012; Kawalerowicz and Biggs 2015; Rocha and Espino 2009; Schlueter and Scheepers 2010; Uslaner 2012). This is the approach taken in this paper.

Building on these studies, we outline a framework incorporating segregation into the debate into how ethnic out-group size affects prejudice via mechanisms of positive contact and threat. We focus on one particular dimension of segregation: how *evenly* groups are distributed across an area (for a review of other dimensions of segregation, see Massey and Denton [1988]). We highlight how the *size* of out-group in an area and the *evenness* with which groups are distributed across it form (largely) distinct area characteristics; the result is that high minority share communities can be either highly segregated or highly integrated (Rocha and Espino 2009; Uslaner 2012). Drawing on this idea, we suggest that living among high proportions of ethnic out-group members will only harm inter-ethnic

relations in communities where groups are segregated from one another; that is, communities at the diversity-segregation nexus. In other words, the impact of community out-group size on prejudice will be moderated by the level of segregation in a community. This will emerge because whether increasing out-group size triggers processes of inter-group contact and/or perceived threat will depend on both the size of out-group in a community and its level of segregation. This paper thus aims to explore whether community segregation moderates the effect of community out-group size on inter-group contact and/or perceived threat and how this, in turn, may drive differences in prejudice across diverse integrated and segregated communities. It draws on cross-sectional data to explicitly test the mechanisms of positive contact and perceived threat and longitudinal data to test for more robust evidence in support of the posited causal framework.

Theoretical Framework

Ethnic Out-Group Size and Inter-Ethnic Attitudes: The Threat and Contact Hypotheses

Theories into how out-group size in an environment affects prejudice are generally divided into the threat and contact hypotheses (for a full discussion of theories, see [Oliver and Wong \[2003\]](#)). The threat hypothesis states that “a superordinate group (e.g., whites) becomes more racially hostile as the size of a proximate subordinate group increases...threaten[ing] the former’s economic and social privilege” and increasing prejudice ([Key 1949](#); [Oliver and Wong 2003](#), 568). This hostility may be driven by concerns regarding realistic or perceived threats to one’s resources, such as competition for jobs, housing, and political power ([Bobo 1983](#)), or symbolic/cultural threats to a group’s value systems ([Kinder and Sears 1981](#)). In contrast, other studies have suggested that increasing out-group size may actually reduce prejudice via increasing rates of positive contact between groups. Widespread individual-level evidence demonstrates that positive contact can rescind negative out-group attitudes, especially under particular conditions (such as voluntary, cooperative, common-goal-orientated contact) ([Allport 1954](#); [Pettigrew 1998](#)). Even extended positive contact (contact with an in-group member who has out-group contact) appears to reduce prejudice ([Vezzali et al. 2014](#); [Zhou et al. 2018](#)). The theory follows that as out-group size increases, opportunities for positive inter-group contact also increase, leading to reduced prejudice in more diverse areas ([Laurence 2014](#); [Oliver and Wong 2003](#); [Wagner et al. 2006](#)).

Extensive research has applied this theoretical framework to test how out-group size affects prejudice. However, the evidence base remains generally mixed, with studies demonstrating negative associations between out-group size and out-group attitudes (e.g., [Dustmann and Preston 2001](#); [Putnam 2007](#); [Schlueter and Scheepers 2010](#); [Taylor 1998](#)), positive associations (e.g., [Gundelach 2014](#); [Wagner et al. 2006](#)), and no association (e.g., [Laurence 2014](#); [Stein, Post, and Rinden 2000](#)). This mixed evidence base suggests the relationship is likely more complex than currently operationalized and that whether

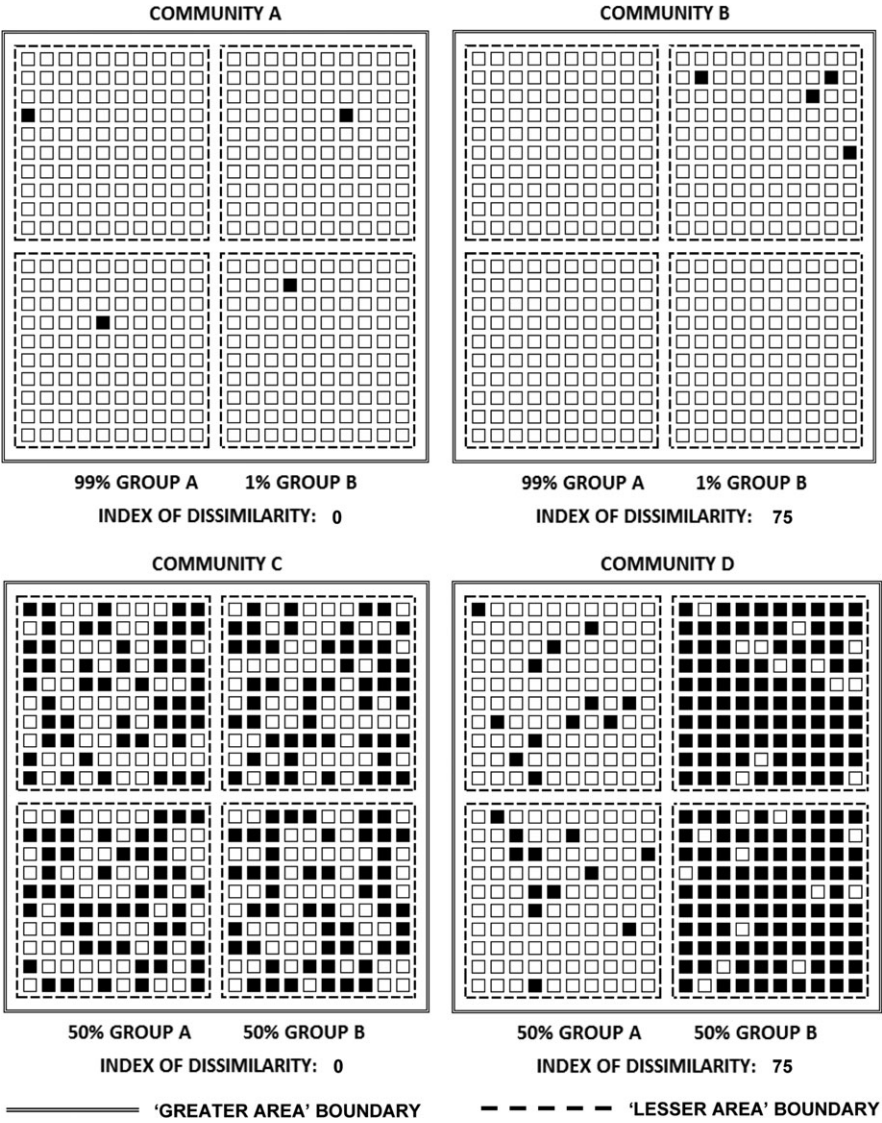
out-group size improves or undermines relations, and whether it triggers contact and/or threat, may depend on other factors. For example, studies show how out-group size may stimulate threat over contact when out-group issues are highly politicized, such as in salient political debates over immigration (Hopkins 2010), or under conditions of depressed economic outlooks (Filindra and Pearson-Merkowitz 2013). Processes of contact and threat may also operate simultaneously but at different geographic levels, with negative effects (threat) predominating at the smallest and largest levels but positive effects (contact) most salient at the meso-level (Kaufmann and Goodwin 2016). However, a potential issue with much of the literature is that it largely focuses on how out-group size alone affects prejudice. Yet, how living among larger out-group populations affects prejudice, and whether it triggers processes of threat and/or positive contact, may depend not only on the size of the out-group in an area but also on how groups are distributed across it, that is, the level of segregation (Rocha and Espino 2009; Uslaner 2012).

Segregation, Out-Group Size, and the Contact and Threat Hypotheses

Segregation broadly captures some degree of the spatial separateness of group residential patterns across a set of smaller geographic areas (“lesser areas”) that compose a larger geographic unit (“greater area”). While segregation can be conceived across different dimensions (e.g., clustering, isolation, centralization), the most widely examined dimension is the degree of *evenness* with which groups are distributed across an environment (Massey and Denton 1988). A crucial feature of evenness is that it forms a largely distinct characteristic of a community from the size of out-group in an area, and calculating the degree of evenness is, broadly speaking, unaffected by the size of the groups being compared. The most commonly applied segregation measure, the Index of Dissimilarity, reflects this distinction between out-group size and evenness of distribution (see below) (Massey and Denton 1988; van der Waal, de Koster, and Achterberg 2013). This point can be demonstrated graphically.

Figure 1 outlines four “greater areas” (each made up of four “lesser areas”). Segregation is measured using the Index of Dissimilarity, with 0 being completely integrated and 100 being completely segregated. This figure demonstrates how equally high minority share communities (communities C or D) or equally low minority share communities (communities A or B) can have very different levels of segregation.¹ When studies examine how living in high minority share communities (“greater areas”) affects prejudice, they compare inter-group attitudes in communities A and B (given they are equally more homogeneous) with attitudes in communities C and D (given they are equally more heterogeneous). Studies therefore *implicitly* treat the effects of living in community C or D as being equal; however, the differences in segregation mean the lived experiences of residents in these communities are likely to be very different (similar issues exist with studying the effect of segregation²). Such differences in segregation between communities may have crucial implications for how living in high minority share areas affects processes of positive contact or perceived threat, in turn conditioning how out-group size affects inter-group attitudes (Biggs and Knauss 2012; Rocha and Espino 2009; Uslaner 2012).

Figure 1. Four hypothetical ethnic contexts



Notes: household positions within each 'lesser area' were selected using a random number generator.

The Moderating Role of Segregation for the Contact and Threat Hypotheses

The contact theory suggests that increasing out-group size increases opportunities for positive contact; however, contact opportunities may depend not only on the size of out-groups in an area but also on how groups are distributed

across it (Blau 1977; Pettigrew, Wagner, and Christ 2010; Uslaner 2012). In integrated communities, residents' neighborhoods (the "lesser areas" within the community) will be highly mixed, providing frequent opportunities for direct/extended positive contact. However, in segregated areas, positive contact opportunities will be more restricted. Residents will likely be living in more homogeneous neighborhoods. Furthermore, segregated communities may lead to segregated local institutions, for example schools, civic groups, or workplaces, further delimiting opportunities for positive contact (Reardon, Yun, and Eitle 2000; Laurence 2016). Under this framework, residents of low minority share integrated or segregated communities should report similar inter-group attitudes: fewer opportunities for contact mean any segregation in such areas would only lead to marginal differences in contact for most residents. In high minority share integrated areas, while exposure to out-groups may generate perceived threat, greater opportunities for direct/extended positive contact should neutralize any such threat. However, in high minority share segregated areas, nominal exposure to out-groups will generate perceived threat but opportunities for positive contact will be comparatively lower, resulting in higher prejudice (Rocha and Espino 2009; Uslaner 2012; Zingher and Steen Thomas 2014).

Alongside contact, community segregation may also moderate whether increasing out-group size generates greater perceived threat among residents. In segregated areas, out-groups will be more spatially concentrated, which may "exaggerate the degree of difference between groups," making the out-group "seem larger and more menacing than it is" (Allport 1954, 18–19). This may render perceptions of inter-group "difference...more visible, and...assimilation seem more uncertain," especially if areas take on stronger out-group characteristics; for example, where shops, schools, and community centers serving particular out-group cultural needs may foster a sense of exclusion/alienation (Biggs and Knauss 2012, 635). Spatial segregation may also enhance processes of group categorization, and perceptions of inter-group difference as spatial boundaries may become used as heuristics for the salience of group boundaries (Enos and Celaya 2018). If perceived threat is conditional on both out-group size and segregation, then in low minority share communities little difference should exist in prejudice between integrated/segregated communities, as low exposure is unlikely to generate threat for most residents.³ In high minority share segregated areas, threat perceptions would be greater and thus inter-group relations worse. However, in high minority share integrated areas, perceived threat would be lower, leading to comparatively more positive attitudes.

Taken together, this framework suggests that it will only be in high minority share segregated communities—at the diversity-segregation nexus—where inter-ethnic tensions emerge. While studies have tested the direct effect of segregation on prejudice alongside out-group size, observing mixed results (Kasara 2013; Kunovich and Hodson 2002; Sturgis et al. 2013), few studies have examined the *intersection* of segregation and out-group size. Biggs and Knauss (2012) show membership of far-right parties highest in high minority share segregated Local Authorities in England. Zingher and Steen Thomas (2014) find that a higher

percentage of African Americans in a voting precinct increases white turnout, but only where white/African American segregation is higher. Similarly, [Rocha and Espino \(2009\)](#) demonstrate that an increasing percentage of Hispanics in a metropolitan area is only associated with anti-immigrant feelings where whites and Hispanics are segregated from one another. [Laurence \(2016\)](#) demonstrates that living in a diverse immediate neighborhood is only negatively associated with neighbor trust if it is nested within a segregated wider community. These studies provide initial support for the outlined framework. However, to our knowledge, no research has looked at whether the association between out-group size and mechanisms of positive contact and perceived threat may be moderated by segregation, nor whether differences in contact/threat can account for why segregation appears to condition how out-group size affects prejudice. Studies have also investigated the interaction between out-group size and segregation solely using cross-sectional approaches, which may be problematic given the plausible alternative causal explanations (see section on Causality and Selection below). This paper therefore asks:

- Does the level of community segregation moderate the association between community percent out-group and prejudice?
- Does the level of community segregation moderate the association between community percent out-group and the posited mechanisms of: (1) positive contact and/or (2) perceived threat?
- How far do mechanisms of contact and/or perceived threat account for any observed moderating effect of community segregation on the association between community percent out-group and prejudice?
- Can testing this framework longitudinally provide more robust evidence that the posited moderating effect of segregation is not driven by unobserved individual- or community-level heterogeneity?

Data and Methods

Sample

This study uses two datasets. The first is the 2010 Managing Cultural Diversity Survey (MCDS). The MCDS is a two-stage random-location quota sample, designed to produce a representative sample of adults in England. Middle Super Output Areas (MSOAs) were used to capture respondents' communities in the first stage of sampling. MSOAs are designed to be approximately the same size (mean $n = 9,500$), regular shapes, and constrained by obvious boundaries (e.g., major roads), conforming to more accurate reflections of residential communities. The first stage involved stratifying MSOAs in England by their minority share (four bands of non-white British) and disadvantage score (three bands of socio-economic disadvantage) (producing a typology of 12 community classes), and a random sample of MSOAs was taken within each class. In the second stage, a random sample of individuals was selected from within each MSOA (response rate of 62 percent⁴). This unique dataset contains measures of

prejudice, threat, and contact, allowing us to explicitly test mechanisms of perceived threat and positive contact, and not simply infer their operation from the direction of the out-group size effect. Contextual-level data is taken from the 2011 UK Census.

We focus on the majority white British population, since the theoretical framework used has greater applicability to superordinate groups (Oliver and Wong 2003). The full sample of white British respondents was $n = 836$. Listwise deletion produced a final analytic sample of $n = 762$. Testing did not reveal any significant individual-/community-level differences among individuals with missing data. We also ran our models applying multiple imputation (MI) using chained equations; however, the results remained substantively similar. The data contains 205 MSOAs, resulting in, on average, four respondents per MSOA.

The second dataset applied is the 1970 British Cohort Study (BCS). The BCS is an ongoing longitudinal study, which sampled all individuals born in Great Britain in a single week in April 1970 and proceeded to gather detailed information on respondents at multiple stages of their life. We draw on two waves of data, age 29 (2000) and age 42 (2012), as out-group attitudes were only measured at these waves. The BCS provides a unique opportunity to test our framework over time. It is the only longitudinal British dataset containing measures of out-group attitudes with local area identifiers (to allow the linkage of community characteristics) that is also measured over a long-enough period to coincide with two UK Censuses: 2001 and 2011.

Cohort studies are susceptible to attrition over time. Between the first (1970) and ninth (2012) wave of the BCS, the attrition rate was 44 percent ($n = 16,569$ to $n = 9,354$) (Mostafa and Wiggins 2015). Of this, $n = 6,985$ were present in each wave between 2000 and 2012. For comparability with the MCDS sample, we restrict our BCS sample to wBritish individuals living in England ($n = 5,821$). The sample is further reduced with a loss of respondents with missing information on the dependent variable ($n = 5,096$), and further missing information on the independent variables results in a final analytic sample of $n = 4,924$. Of this, $n = 1,317$ did not move communities between 2000 and 2012 (stayers) and $n = 3,607$ did move (movers).⁵ To address issues of representativeness stemming from the loss of complete cases over time, we apply inverse probability weights (IPW), based on key variables known to predict attrition in British cohort studies⁶ (Hawkes and Plewis 2006; Mostafa and Wiggins 2015). To examine the impact of cases with missing data on our modeled variables, we applied multiple imputation (MI) using chained equations; however, the results were substantively similar and we report unimputed findings.⁷ The consistency of findings across the baseline, IPW, and MI approaches increases our confidence that missingness does not substantially bias our findings.

The UK provides an important case study to explore this framework. Research into the impact of the presence/absence of minority groups in a community, especially the role of segregation, has largely focused on the United States. Within the UK, inter-ethnic relations may be less affected by historical factors (e.g., the legacy of slavery), producing an important comparative case. Furthermore, community out-group size and segregation are not as highly

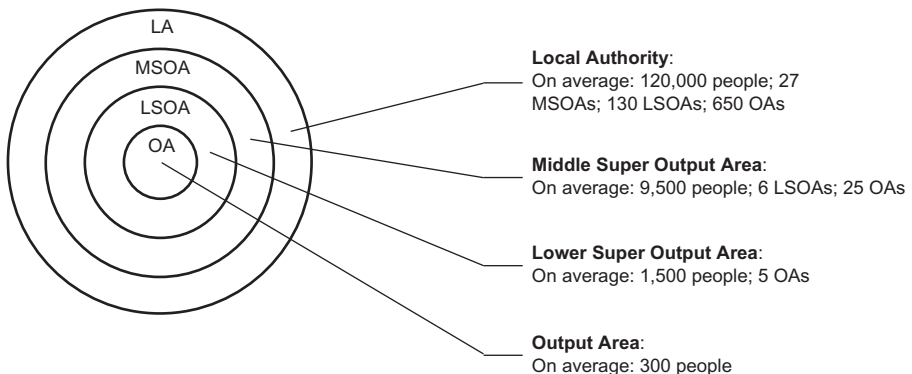
associated in the UK, providing greater opportunities to compare integrated/seg-
regated high minority share communities.

Scale of the Community

Figure 2 shows the structure of UK Census geographies. We use MSOAs as the area level of analysis (see above). In theory, the sociological/psychological processes associated with out-group size (threat/contact) are believed to stem from actual exposure to out-groups, which is more likely to occur within one's locality rather than at the larger city level⁸ (Oliver and Wong 2003). However, processes of contact/threat could operate at different levels (see Kaufmann and Goodwin 2016). We report the results using the MSOA as the community level; however, we experiment with measuring all contextual-level predictors at both the MSOA and (larger) Local Authority (LA) level, as well as mixing levels *within* models (e.g., looking at the impact of MSOA out-group size and LA segregation).

Theoretically, we could measure the community at *smaller* area levels than the MSOA, such as the Output Area (OA) level. Returning to figure 1, this would have implications for our analysis. First, if the “lesser areas” were OAs, and we measured out-group size at the OA level, then residents of “community C” would live in very mixed areas and residents of “community D” would likely live in more homogeneous areas (even though both would be in equally mixed “greater areas”). Cognitive testing suggests individuals broadly conceive of their local area (within which processes of residential exposure occur) as an area 15–20 minutes from their home (Green and Farmer 2003). This conforms more closely to the MSOA level. Measuring out-group size at smaller levels could thus lead to model mis-specification, especially in segregated areas, for example in assuming residents of “community D” experience low exposure to out-groups if they live in more homogeneous OAs, when their MSOA is very mixed. Research does suggest the impact of out-group size across the smaller (“lesser”) area can be *dependent* on levels of segregation across the larger (“greater”) area in which it is nested; for example, diversity across an individual's immediate

Figure 2. Structure of UK Census geography



neighborhood can lead to different inter-group outcomes depending on whether their immediate neighborhood is nested *within* a more segregated or integrated town or city (Laurence 2016). However, data restrictions mean the MSOA level is currently the smallest area level available at which we can conduct our analysis.

Outcome/Mechanism Measures

In the MCDS, out-group attitudes are measured using a feeling thermometer (0–100) item: “Please rate how you feel about the following groups on a thermometer that runs from zero to a hundred degrees. How do you feel about people from an ethnic minority background?” (where 50 is neither warm nor cold). To measure perceived threat, we use three questions tapping realistic threat: “People from ethnic minority backgrounds take good jobs away from white British people,” “The more political and economic power people from ethnic minority backgrounds have in this country, the more difficult it is for white British people,” and “People from ethnic minority backgrounds commit a lot of crime that affects white British people.” We use two questions tapping symbolic threat: “People from ethnic minority backgrounds and white British people have very different values” and “People from ethnic minority backgrounds threaten white British people’s way of life.” Ratings were made on a scale from 1 (strongly disagree) to 5 (strongly agree). These items load onto a single index of perceived threat (Eigenvalue: 2.43; Cronbach’s alpha: 0.83; lowest loading: 0.57).

To measure positive inter-group contact in the MCDS, we use whether a respondent has direct or extended out-group friendship ties. Out-group friendship ties are found to be particularly efficacious for prejudice reduction, since they represent a strong measure of intimate, positive contact (Pettigrew 1998). Two questions were used to form this measure: a direct cross-group friendship item asking “What proportion of your close friends are from an ethnic minority background?” and an extended cross-group friendship item asking “Thinking about your white British friends, what proportion of them have friends who are from an ethnic minority background?” Both items are measured on a scale of 1 = “None” to 5 = “Almost all or all.” However, proportional measures do not give an indication of the number of ties, and may conflate other processes. We therefore transformed these measures into two binary variables (0 = none and 1 = a few or more), capturing whether respondents have “out-group friends or not” and “extended contact or not.” The measures were then combined into a single nominal measure of: 0 = no direct/extended contact; 1 = extended contact only; 2 = direct and extended contact.⁹

The BCS contains two measures of out-group attitudes repeated in 2000 and 2012: “I would not mind if my child went to a school where half the children were of another race” and “I would not mind if a family from another race moved in next door to me.” Both are measured on a five-option Likert scale of “strongly agree” to “strongly disagree.” Given the close association of these measures, we combine them to create an individual’s mean score of out-group attitudes for each wave.¹⁰ The BCS does not contain measures of contact/threat.

Ethnic Composition and Segregation Measures

Out-group size is measured using percent non-white British in the community, which reflects the outcome/mechanisms questions in the MCDS data that ask white British respondents about their attitudes/behaviors regarding people from “an ethnic minority background.” We therefore test how far exposure to non-white British affects attitudes/behaviors toward non-white British. There may be issues if white British respondents do not conceive of individuals from “an ethnic minority background” as anyone who is not “white British.” However, in the survey, white British respondents are first asked questions about their attitudes toward “white British” people and then asked questions about people from “an ethnic minority background,” potentially priming them to think of all non-white British people. Further testing strengthened this idea.¹¹

As outlined, our study is concerned with the evenness dimension of segregation. We apply the Index of Dissimilarity (D) accordingly (Massey and Denton 1988). The D ranges from 0 (perfectly integrated) to 100 (perfectly segregated):

$$\frac{1}{2} \sum_{i=1}^N \left| \frac{b_i}{B} - \frac{w_i}{W} \right|$$

b_i = the population of *non-white British* in the i th area, that is, the “lesser area”; B = the total population of *non-white British* in the “greater area”; w_i = the population of *white British* in the i th area, that is, the “lesser area”; W = the total population of *white British* in the “greater area.”

This can be interpreted as the proportion of ethnic out-group in a community that would need to move between “lesser areas” to create a uniform distribution of groups across the “greater area.” As our hypothesis is that the impact of community (MSOA-level) out-group size on residents will depend on how segregated the community is, we measure segregation at the identical MSA level (and use the output area as the “lesser area”; see figure 2). Given our focus on white British respondents, we examine the D between white British and non-white British residents (see Appendix A.1 and A.2 for descriptive statistics of key MCDS/BCS community measures).

As discussed, the D has been criticized, as it is “insensitive to the actual interaction potential between the [area’s] groups, a factor...affected by the relative number as well as the pattern of spatial segregation” (van der Waal, de Koster, and Achterberg 2013, 761) (as outlined in figure 1). Alternative measures, such as the Isolation/Exposure Indices, exist that aim to combine the *size* and *distribution* of the out-group into a single measure. This (as expected if comparing isolation between the majority ethnic group and *all* minorities) is closely correlated with the out-group size alone. However, we are interested in how *both* the size and evenness with which groups are distributed across a community interrelate with prejudice, and suggest it will be the *intersection* of the two that matters.¹² Applying separate measures of percent ethnic out-group and the Index of Dissimilarity, and including an interaction between the two, will allow us to examine this intersection and test how inter-ethnic relations react at the nexus of increasing diversity and increasing segregation.

Individual and Community Covariates

At the individual level, we adjust for socio-demographic variables including age, children under 18 in household, gender, country of birth, and number of years in the MSOA. We also include key socio-economic status indicators, including National Statistics Socio-Economic Class group, employment status, and housing tenure, as well as education level (qualifications). At the community level, we adjust for (MSOA-level) community characteristics with indices capturing dimensions of disadvantage and urbanization. Factor analysis performed on a full range of community characteristics generated three indices: status disadvantage (percent not in managerial/professional occupations, percent without degrees: Eigenvalue 1.89); resource disadvantage (percent of households social renting, percent of households female lone parent, percent of economically active unemployed: Eigenvalue 1.97), and urbanization (percent aged 65+, density [persons per hectare], and turnover [rate of inflow plus outflow per 1,000 people between mid-2009 and mid-2010]: Eigenvalue 1.80). We also include the 2010 index of multiple deprivation: crime domain (a composite index of all types of crime).

Methodology and Analytic Approach

The first stage of this study will analyze the nationally representative, cross-sectional MCDS data. The advantage of the MCDS is that it contains both outcome (inter-group attitudes) and mechanism (contact and perceived threat) measures. The second stage will analyze the longitudinal BCS data. With two waves of data, we elect to apply two-wave change-score (CS) models (Johnson 2005). Although a more conservative test than lagged dependent variable models, a key advantage of the CS approach is that it accounts for all time-invariant/asynchronous unobserved heterogeneity that may bias our estimates.

Our MCDS response variables include continuous, ordinal, and nominal measures. We apply linear, ordered logistic, and multinomial regressions as appropriate. Analyzing the BCS, we model changes in out-group attitudes as interval data given the underlying concept is continuous and the intervals between points are approximately equal¹³ (Carifio and Perla 2007). As respondents are clustered within MSOAs, we also need to correct our standard errors for the clustering of residuals. We therefore apply random-intercept multilevel models. We also mean-center our community-level variables to minimize inflation of standard errors due to multicollinearity in the MCDS.¹⁴ Bootstrapped standard errors are applied.

Results

Out-Group Size, Segregation, and Out-Group Attitudes

We begin by examining the direct and conditional associations between community out-group size (MSOA-level percent non-white British: 0 to 100 percent), segregation (MSOA-level white British/non-white British Index of Dissimilarity: 0 to 100) and out-group attitudes (feeling thermometer running from 0 to 100).

To test whether the impact of percent non-white British is dependent on segregation, we include an interaction term between the two. Table 1 shows the parameter estimates of a series of multilevel linear regression models.

Model 1 (table 1) demonstrates a weak, non-significant negative association between community percent non-white British and out-group attitudes. Model 2 introduces the Index of Dissimilarity, which also has a non-significant negative association with out-group attitudes. In model 3, we add the interaction term between percent non-white British and segregation: this is strong, significant, and negative, suggesting the effect of community percent out-group on out-group attitudes is conditional on community segregation.

To examine this interaction, figure 3 plots a series of predicted feeling thermometer scores at varying levels of both percent non-white British and segregation (based on model 3, table 1).¹⁵ In low minority share communities, attitudes toward out-groups are warm (above 50) and there is no significant difference between integrated or segregated communities. As percent non-white British increases in more *segregated* communities, out-group attitudes become colder. However, in *integrated* communities, increasing out-group size is associated with a slight increase in warmth.¹⁶

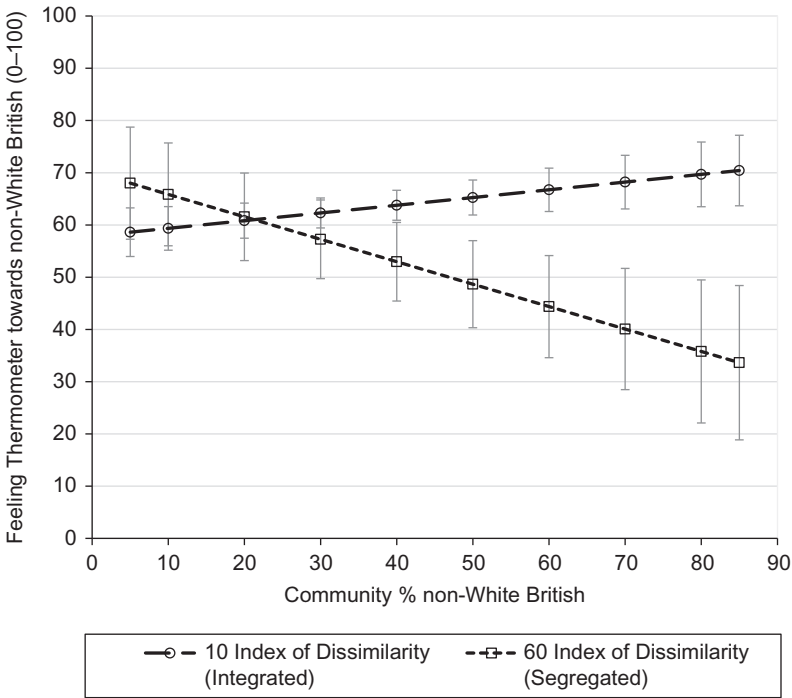
Table 1. Out-Group Size, Segregation, and Out-Group Warmth

Dependent variable	Model 1 Out-group warmth	Model 2 Out-group warmth	Model 3 Out-group warmth
<i>Community characteristics:</i>			
Index of crime	−2.491 (1.942)	−2.986 (1.971)	−2.780 (1.929)
Status disadvantage	0.448 (1.387)	1.221 (1.484)	1.083 (1.455)
Resource disadvantage	0.424 (1.655)	0.196 (1.662)	0.525 (1.633)
Urbanization	2.907* (1.435)	3.020* (1.437)	3.060* (1.405)
% non-white British	−0.028 (0.047)	−0.024 (0.047)	−0.013 (0.047)
Index of dissimilarity		−0.172 (0.118)	−0.310* (0.126)
% non-white British * Index of dissimilarity			−0.013** (0.004)
N (individuals)	762	762	762
N (communities)	205	205	205

Note: Significance levels: + 0.1; * 0.05; ** 0.01; *** 0.001; models contain all individual-level variables (although not shown); multilevel linear regression.

These findings confirm the first prediction of our framework: that community segregation moderates the impact of community out-group size on inter-group attitudes. We tested whether measuring out-group size/segregation at larger area levels produced different effects.¹⁷ Another possibility is that the impact of the composition/segregation of one's community may be conditional on the composition/segregation of the wider area (that is, the Local Authority) in which the community is nested. We thus tested for interactions between the MSOA/Local Authority levels but found little evidence that the wider area mattered substantively. We also explored whether the impact of the size/segregation of the non-white British population in our models is being driven by exposure to particular minority ethnic groups, rather than all out-groups.¹⁸ In addition, we examined whether the direct relationships, and interaction relationships, between minority share/segregation and out-group attitudes were non-linear or displayed any threshold effects.¹⁹ However, after full testing, our current model specifications appear the most robust. Next, we turn to whether segregation moderates the association between out-group size and our putative mechanisms of positive contact and perceived threat.

Figure 3. Predicted out-group feeling thermometer scores by percent non-white British and segregation (MCDS)



Notes: Values of % non-white British and segregation set at minimum/maximum values in the data (rounded to nearest 5); all other individual- and community-level variables set to mean; bootstrapped standard errors (1000 reps); 2010 Managing Cultural Diversity Study (MCDS) data.

Out-Group Size, Segregation, and Positive Contact and Threat

Table 2 shows the results of two sets of multilevel models predicting each mechanism. Models 1–3 (table 2) examine positive contact applying the nominal measure of direct/extended out-group ties: 0 = no direct/no extended contact; 1 = extended contact only; 2 = direct and extended contact. Multilevel, multinomial logistic regression models are applied, in which “no direct/no extended contact” is the baseline category.

Model 1 demonstrates that increasing percent non-white British is associated with a greater likelihood of reporting out-group friends. However, this association is non-linear, as observed by the negative quadratic term (model 2): while both direct and extended contact increases with a larger minority share, there are diminishing returns at higher levels. Segregation, however, has no direct association with contact. Model 3 then tests whether this non-linear association between percent non-white British and direct/extended ties is conditional on segregation, including an interaction term between quadratic percent non-white British and segregation. For both extended and direct contact, the interaction terms are significant and negative.

To understand this relationship, figure 4 plots predicted probabilities of possessing an out-group friend at various levels of community percent non-white British and segregation (derived from model 3, table 2). We see similar proportions of white British residents possessing out-group ties in more homogeneous communities (regardless of segregation). In integrated communities, as the proportion of non-white British increases, the likelihood of possessing an out-group tie also increases. In segregated communities, as the minority share increases, out-group friendships similarly increase. However, out-group friendships peak at around 40 percent non-white British; beyond this point, the likelihood of possessing an out-group tie declines. The result is that in communities with high proportions of non-white British (> 70 percent), residents of segregated communities are significantly less likely to possess out-group ties compared to residents in integrated communities.²⁰

We next examine how community out-group size and segregation relate to perceived threat (higher values equal greater threat on the index). Model 4 (table 2) demonstrates that neither percent non-white British nor segregation has a significant direct association with inter-group threat. Model 5 then includes our interaction between the two: the interaction is strong, significant, and positive, suggesting percent non-white British has a stronger positive association with threat at higher segregation.

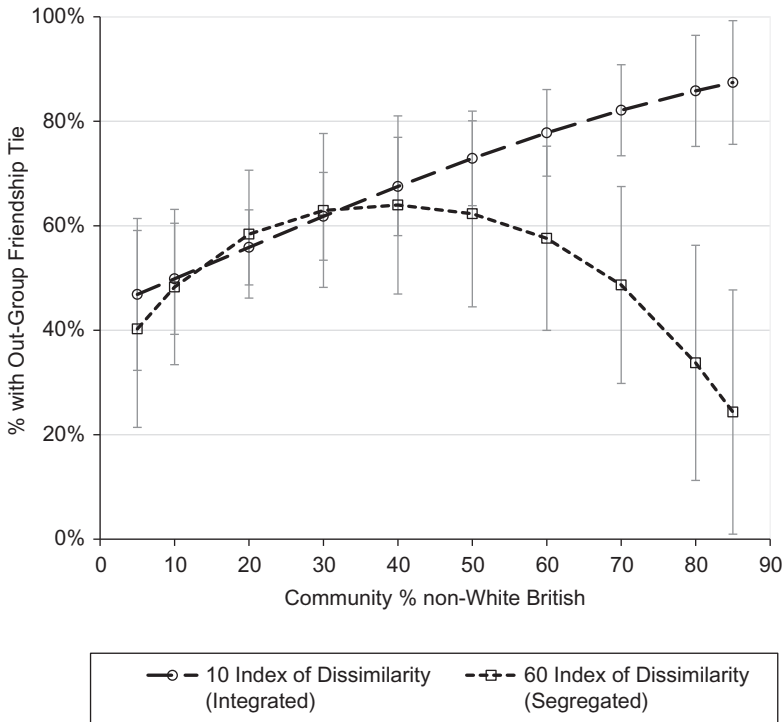
Figure 5 plots predicted scores of our index of perceived threat (based on model 5, table 2). Threat is comparatively lower at low proportions of out-group, regardless of segregation. There is no association between increasing percent non-white British and threat in integrated communities. However, increasing minority share in segregated communities is associated with higher threat, such that residents of high minority share segregated communities report significantly higher threat compared to residents of high minority share integrated communities (as well as low minority share integrated/segregated areas). We again tested for the presence of

Table 2. Out-Group Exposure, Segregation, and Contact and Threat

Outcome: Model type:	<i>Model 1</i>		<i>Model 2</i>		<i>Model 3</i>		<i>Model 4</i>	<i>Model 5</i>
	extended tie Multinomial logistic	direct tie Multinomial logistic	extended tie Multinomial logistic	direct tie Multinomial logistic	extended tie Multinomial logistic	direct tie Multinomial logistic	threat linear	threat linear
<i>Community characteristics:</i>								
Index of crime	0.0685 (0.298)	0.3615 (0.281)	0.0657 (0.293)	0.3728 (0.276)	0.0466 (0.287)	0.3774 (0.272)	−0.0118 (0.080)	−0.0163 (0.079)
Status disadvantage	0.0406 (0.256)	−0.1885 (0.234)	0.0458 (0.251)	−0.1909 (0.230)	0.1891 (0.249)	−0.0525 (0.229)	0.0094 (0.060)	0.0134 (0.059)
Resource disadvantage	0.1469 (0.280)	−0.0034 (0.260)	0.1394 (0.276)	0.0283 (0.255)	0.0754 (0.265)	−0.0383 (0.244)	0.0251 (0.068)	0.0130 (0.067)
Urbanization	0.0632 (0.232)	0.1275 (0.217)	0.0641 (0.228)	0.1279 (0.214)	−0.1131 (0.231)	−0.1018 (0.216)	−0.1467* (0.059)	−0.1480* (0.058)
% non-white British	0.0035 (0.008)	0.0176* (0.008)	0.0034 (0.008)	0.0197* (0.008)	0.0008 (0.009)	0.0164* (0.008)	0.0014 (0.002)	0.0010 (0.002)
Index of dissimilarity	0.0084 (0.018)	−0.0142 (0.017)	0.0075 (0.021)	−0.0301 (0.019)	0.0519 (0.033)	0.0314 (0.032)	0.0035 (0.005)	0.0081 (0.005)
% non-white British (squared)			−0.0001+ (0.001)	−0.0012 (0.000)	−0.0005 (0.001)	−0.0017* (0.001)		
% non-white British * Index of dissimilarity					−0.0005* (0.000)	−0.0006* (0.000)		0.0004* (0.000)
% non-white British (squared) * Index of dissimilarity					−0.0001* (0.000)	−0.0001* (0.000)		
N (individuals)	762	762	762	762	762	762	762	762
N (communities)	205	205	205	205	205	205	205	205

Note: Significance levels: + 0.1; * 0.05; ** 0.01; *** 0.001; models contain all individual-level variables (although not shown); baseline outcome of models 1–3 is “no direct/extended contact.”

Figure 4. Predicted percent with out-group friend scores by percent non-white British and segregation (MCDS)



Notes: Values of % non-white British and segregation set at minimum/maximum values in the data (rounded to nearest 5); all other individual- and community-level variables set to mean; bootstrapped standard errors (1000 reps); 2010 Managing Cultural Diversity Study (MCDS) data.

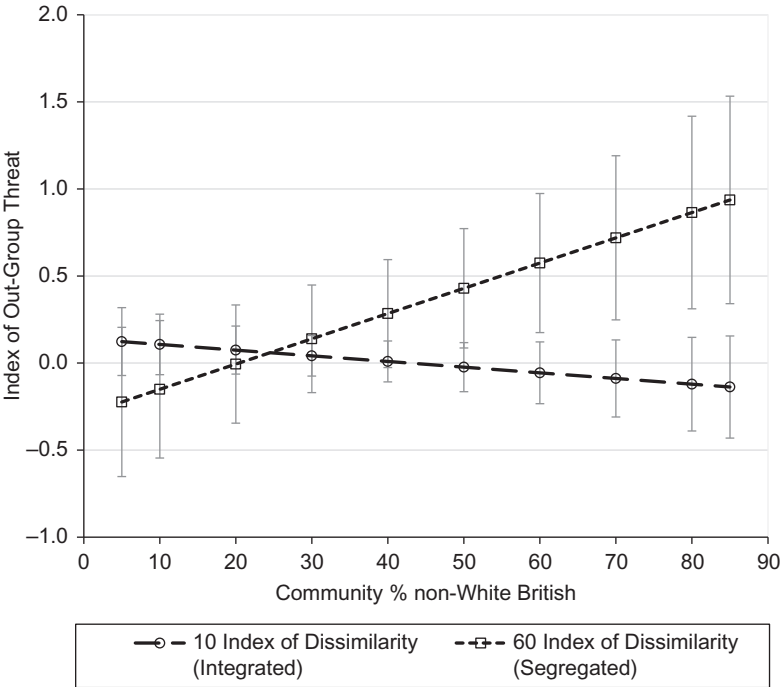
non-linearity in the association between minority share/segregation and perceived threat but found no evidence.

Collectively, these results show that processes of contact and threat are conditional on both out-group size and segregation. As discussed, different mechanisms may be more sensitive to larger/smaller area scales; however, tests demonstrated again that measuring the community at the MSOA level produced the most robust models for all outcomes. We next examine how far mechanisms of contact and threat can account for why out-group size is only associated with prejudice in segregated communities.

Explaining the Moderating Effect of Segregation on the Relationship between Out-Group Size and Inter-Group Attitudes

Our theoretical framework outlined potential explanations, based on the threat/contact hypotheses, for why out-group size will only negatively impact inter-group attitudes in more segregated communities. Table 3 shows the results of a series of multilevel linear models in which we test these explanations by adding

Figure 5. Predicted index of perceived out-group threat by percent non-white British and segregation (MCDS)



Notes: Values of % non-white British and segregation set at minimum/maximum values in the data (rounded to nearest 5); all other individual- and community-level variables set to mean; bootstrapped standard errors (1000 reps); 2010 Managing Cultural Diversity Study (MCDS) data.

measures of our proposed mechanisms in a stepwise fashion to our baseline model predicting the out-group feeling thermometer (generated in model 3, table 1). This allows us to examine how far our posited mechanisms mediate the key percent non-white British/segregation interaction for prejudice.

We begin by adding positive contact into the model (model 1, table 3). We first observe that direct ties/extended ties have positive associations with out-group warmth. However, upon including contact in the model, the segregation/percent non-white British interaction term is only reduced by 15 percent, compared to model 3 (table 1), and remains significant at $p < 0.01$. Studies have shown that having positive contact not only mediates the effects of community out-group size in an area but can also *moderate* the association between out-group size and inter-group attitudes. That is, studies show increasing out-group size only appears to increase prejudice among individuals without positive contact; among individuals with positive out-group ties, the size of out-group in a community has no association with inter-group attitudes (Laurence 2014; Stein, Post, and Rinden 2000). To test for this, model 2 includes an interaction term between extended and direct out-group ties and percent non-white British. First, the interaction term between “direct ties” and percent non-white British is

Table 3. Out-Group Exposure, Segregation, and the Mediating/Moderating Role of Contact and Threat

Dependent variable:	Model 1 Out-group warmth	Model 2 Out-group warmth	Model 3 Out-group warmth
<i>Community characteristics:</i>			
Index of crime	-3.233+ (1.886)	-3.161+ (1.888)	-3.152+ (1.807)
Status disadvantage	1.357 (1.423)	1.400 (1.423)	1.628 (1.364)
Resource disadvantage	0.493 (1.596)	0.337 (1.598)	0.237 (1.534)
Urbanization	2.932* (1.371)	3.015* (1.373)	2.162 (1.324)
% non-white British	-0.035 (0.046)	-0.212* (0.086)	-0.172* (0.082)
Index of dissimilarity	-0.276* (0.123)	-0.245* (0.124)	-0.227+ (0.119)
% non-white GB * Index of dissimilarity	-0.011** (0.004)	-0.009* (0.004)	-0.005 (0.004)
<i>Individual characteristics:</i>			
Cf. no direct/extended contact			
Extended tie only	6.877** (2.495)	10.433** (3.258)	9.327** (3.093)
Direct and extended ties	10.729*** (2.318)	15.063*** (2.909)	10.634*** (2.804)
Extended tie * % non-white British		0.161 (0.104)	0.147 (0.098)
Direct tie * % non-white British		0.225* (0.091)	0.188* (0.087)
Cf. threat quartile 1			
Threat quartile 2			-2.070 (2.201)
Threat quartile 3			-6.937** (2.321)
Threat quartile 4			-18.407*** (2.229)
N (individuals)	762	762	762
N (communities)	205	205	205

Note: Significance levels: + 0.1; * 0.05; ** 0.01; *** 0.001; models contain all individual-level variables (although not shown); multilevel linear regression.

significant and positive: predicted thermometer scores show individuals with direct ties at minimum and maximum percent non-white British report identical scores; however, individuals without ties see a significant 19-degree decline in warmth. In other words, increasing out-group size is only associated with prejudice among residents without direct ties with out-group members (the interaction term with “extended ties only” is not significant, although it is relatively strong). On inclusion of these moderating associations, the segregation/percent non-white British interaction term is reduced by a further 20 percent and to $p < 0.05$.

Differing rates of contact therefore account for part of the out-group size/segregation relationship: with the inclusion of contact (as mediator and moderator), the strength of the segregation/out-group size interaction term is reduced by 31 percent (model 3, table 1, to model 2, table 3). However, even after including contact in our model, the segregation/out-group size interaction term remains relatively strong and significant.

The second explanation we posited for why out-group size may have a stronger effect on prejudice in more segregated areas was that increasing out-group populations may only generate perceived threat among residents of more segregated communities. Previously, we observed that threat is indeed only higher in high minority share segregated areas (see figure 5). Model 3 therefore tests whether perceived threat can account for the stronger impact of out-group size on prejudice at higher levels of segregation. To test this, model 3 enters quartiles of our index of threat (with the lowest quartile excluded as baseline) to see how far threat mediates the percent non-white British/segregation interaction term. Model 3 demonstrates that greater perceived threat strongly predicts colder feelings toward non-white British. Furthermore, the percent non-white British/segregation interaction term is now reduced by a further 40 percent and rendered non-significant. Therefore, a key reason why prejudice is higher in high minority share segregated communities is also due to greater perceived threat among residents.

Our putative mechanisms of contact and threat, when both included in the model, collectively account for 61 percent of the out-group size/segregation interaction term, and render it non-significant (model 3, table 1, to model 3, table 3). A further question is how far contact and threat *independently* account for differences in prejudice between high minority share integrated and segregated communities; or whether, for example, the mediating role of contact operates via reducing perceived threat in high minority share integrated communities, which is why prejudice is lower. The evidence suggests both contact and threat *independently* mediate the stronger impact of out-group size in more segregated areas. First, both positive contact and threat continue to significantly predict prejudice when included together in the model. Second, as seen, even accounting for differences in contact, the percent non-white British/segregation interaction remains relatively strong and significant (as seen in model 2, table 3). Similarly, if we omit contact from the model and just include perceived threat, we observe that the percent non-white British/segregation interaction is $b: -.008$ ($p < 0.05$). This demonstrates that, even after accounting for

differences in perceived threat between communities, segregation continues to significantly moderate the impact of percent non-white British on prejudice, which can be accounted for when adding contact into the model (as seen in model 3, table 3). Segregation therefore appears to moderate the effect of out-group size on prejudice via its effect on levels of *both* contact *and* perceived threat.

Causality and Selection: Testing the Longitudinal Dynamics of Out-Group Size, Segregation, and Out-Group Attitudes

Our framework makes causal inferences, based on the threat/contact hypotheses, suggesting that communities becoming more ethnically mixed *and* segregated will result in greater prejudice while those becoming more mixed *and* integrated will see no harm to inter-group relations. However, patterns of out-group size/segregation do not simply emerge randomly. First, prejudice/ethnocentrism can drive selection processes into/out of high/low minority share neighborhoods (Bobo and Zubrinsky 1996; Krysan et al. 2009). Our findings may thus be driven by neighborhood self-selection. For example, the null association between out-group size and prejudice in integrated communities may result from less prejudiced individuals selecting in/not selecting out of high minority share areas; especially as high minority share segregated communities can become undesirable locations, leading to more tolerant individuals selecting out/not selecting in (Dustmann and Preston 2001).

Second, studies outline how patterns of segregation can emerge from prejudice/discrimination, in-group cohabitation preferences, economic disparities, and natural population/immigration rates (Bobo and Zubrinsky 1996; Clark and Fossett 2008; Finney and Simpson 2009; Krysan et al. 2009). Segregation (as a mode of social control to preserve economic/political/social status) may also emerge in response to perceived threat generated, for example, by increasing out-group size (Blanchard 2007; DeFina and Hannon 2009). Furthermore, segregation can have distinct historical roots, such as in Northern English towns (e.g., Oldham), where the decline of the textile industry and increasing competition for economic/social resources led to more mobile whites migrating away, while discriminatory council housing policies/harassment led to (enforced and self-)segregation of minority groups (Kundnani 2001).

This literature raises a key issue. If segregation can be driven by ethnocentrism, socio-economic decline, prejudice, or even historical inter-group tensions, our cross-sectional findings may simply be flagging those communities where segregation emerged as a consequence of prejudice already present, be driven by selection processes related to inter-group attitudes, or be capturing some other (potentially historic) characteristics of areas that affect inter-group relations.

We try to address some of these causal issues through testing our framework longitudinally. To do so, we turn to our second dataset: two waves of panel data, which measured out-group attitudes when respondents were aged 29 and 42. Using the BCS, we apply two-wave change-score models to look at how *changes* in community out-group size and *changes* in segregation, between 2000 and 2012, are associated with *changes* in out-group attitudes over the same

period. These models account for time-invariant/asynchronous unobserved individual-level heterogeneity. However, given the plausibility of alternative causal processes, we want to perform as strict a causal test as possible. We therefore restrict our analysis to individuals who remained in the same community between 2000 and 2012 (Laurence and Bentley 2016; Longhi 2013; Sandy et al. 2013). This approach allows us to separate actual changes over time in the characteristics of communities occurring around residents who do not move from changes in out-group size/segregation driven by individuals moving between communities with different characteristics. In turn, this helps account for time-invariant/asynchronous *community*-level unobserved heterogeneity, given we are looking at the same communities at both time points. This is important, as any observed effect of *levels* of out-group size/segregation may be confounded by some other omitted community feature. Focusing on stayers also helps further mitigate potentially confounding processes of self-selection. Although restricting ourselves to this subset of residents is not without limitations (see Discussion section), it provides the strongest robustness test available with our data. We include, where variables are time variant, the same individual-level controls as used for the MCDS analysis. At the community level, we control for changes in percent degree holders, percent unemployed, and density to tap status disadvantage, resource disadvantage, and urbanization.²¹

We begin by testing whether we can replicate the key cross-sectional findings of the MCDS data using the BCS, performing a pooled cross-sectional analysis of both waves of data among all respondents, with observations nested within respondents nested within communities (table 4). In model 1, neither percent non-white British (coded 0–100) nor segregation (coded 0–100) are significantly associated with out-group attitudes. Model 2 then tests the interaction term between the two, which is significant and negative. Predicted scores of out-group attitudes (ranging from more [0] to less [4] prejudiced) show that in low minority share integrated communities (5 percent non-white British; 10 segregation) or segregated communities (5 percent non-white British; 50 segregation), out-group attitudes remain comparatively high: 3.58 [CI: 3.54–3.62] and 3.64 [CI: 3.57–3.71], respectively. In high minority share integrated communities (85 percent non-white British; 10 segregation), out-group attitudes are similarly high: 3.66 [CI: 3.43–3.88]. However, in high minority share segregated communities (85 percent non-white British; 50 segregation), out-group attitudes are significantly lower: 3.08 [CI: 2.75–3.41]. These results closely mirror the findings of the MCDS data. Replicating the cross-sectional MCDS analysis in a second dataset thus demonstrates that the same patterns exist in our BCS data. The next step is to more robustly test this association.

We next perform a stricter test of the causal claims of the framework by applying two-wave change-score models, where all time-variant individual- and community-level measures and dependent variables are included as change scores.²² This is restricted to our subsample of respondents who did not move community between 2000 and 2012; as a note, we can replicate the pooled cross-sectional analysis (model 2) among our stayers sample alone as well.

Table 4. Change in Out-Group Size, Change in Segregation, and Changes in Prejudice among *Stayers* and *Movers*

Outcome	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Sample	Out-group attitudes All people	Out-group attitudes All people	Out-group attitudes Stayers	Out-group attitudes Stayers	Out-group attitudes Movers	Out-group attitudes Movers
Model type	Pooled cross-sectional	Pooled cross-sectional	Change-score	Change-score	Change-score	Change-score
<i>Community characteristics:</i>						
% unemployed	−0.02*** (0.005)	−0.017** (0.005)				
% with degrees	0.001 (0.001)	0.002 (0.001)				
Persons per hectare	−0.001 (0.001)	−0.001 (0.001)				
% non-white British	−0.001 (0.001)	−0.003 (0.002)				
Segregation	−0.002 (0.001)	0.001 (0.001)				
% non-white British * Segregation		−0.002** (0.001)				
Change in % unemployed			−0.008 (0.02)	−0.01 (0.02)	−0.008 [0.007]	−0.008 [0.007]
Change in % with degrees			0.002 (0.003)	0.002 (0.003)	0.001 [0.001]	0.001 [0.001]
Change in persons per hectare			0.003 (0.004)	0.003 (0.004)	−0.000 [0.000]	−0.001 [0.001]

(Continued)

Table 4. *continued*

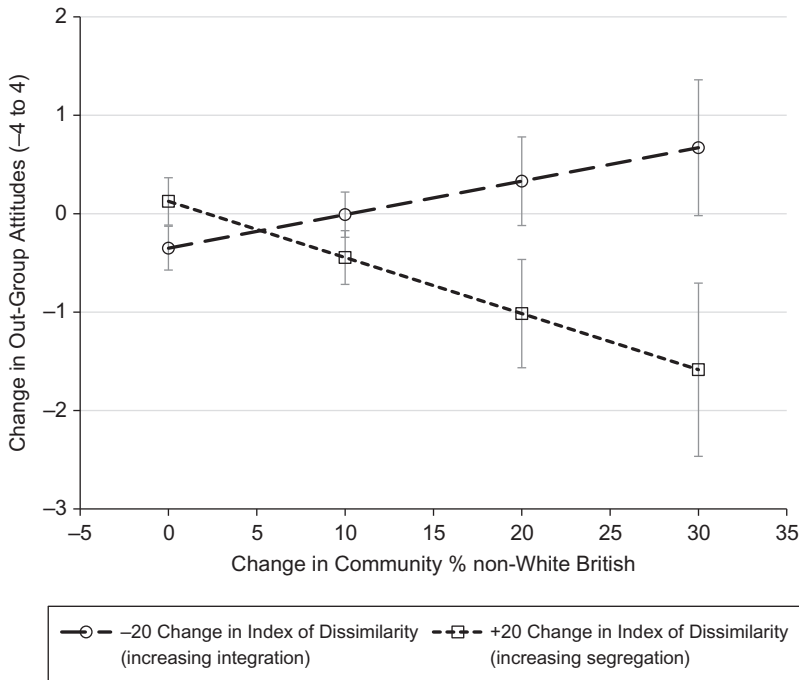
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Outcome	Out-group attitudes	Out-group attitudes	Out-group attitudes	Out-group attitudes	Out-group attitudes	Out-group attitudes
Sample	All people	All people	Stayers	Stayers	Movers	Movers
Model type	Pooled cross-sectional	Pooled cross-sectional	Change-score	Change-score	Change-score	Change-score
Change in % non-white British			0.001 (0.005)	-0.003 (0.005)	0.003+ [0.002]	0.003+ [0.002]
Change in segregation			0.004 (0.004)	0.011 (0.007)	-0.000 [0.002]	-0.000 [0.002]
Change in % non-white British * Change in segregation				-0.002** (0.001)		-0.000 [0.000]
N (observations)	9848	9848				
N (individuals)	4924	4924	1317	1317	3607	3607
N (communities)	3875	3875	1156	1156	2719	2719

Note: Significance levels: + 0.1; * 0.05; ** 0.01; *** 0.001; models contain all individual-level variables (although not shown); multilevel linear regression two-wave pooled-cross-sectional and change-score models.

Among the sample of stayers, communities generally only increased in percent non-white British (minimum change: -0 percent; maximum change: $+30$ percent) but saw both increases and decreases in segregation²³ (minimum change: -20 ; maximum change: $+20$). In model 3, we look at the independent associations between changes in out-group size and segregation and changes in prejudice: neither relationship is significant. In model 4, we test an interaction term between the two to examine whether the way a community becomes more diverse, be it in a more segregated or integrated form, matters (i.e., whether the effect of a change in out-group size is conditional on changes also in segregation): the interaction is significant and negative. Visualizing this relationship using predicted scores is critical to understanding this association.

Figure 6 plots predicted change scores of out-group attitudes (on a scale of -4 [maximum decline] to $+4$ [maximum improvement]) based on model 4 (table 4). Changes in percent non-white British and segregation are set to their maximum and minimum values for stayers. The results show that where no change occurs in out-group size, changes in segregation are, on average, associated with only marginal changes in prejudice and are not statistically significant from one

Figure 6. Predicted change in out-group attitudes by change in percent non-white British and change in segregation among stayers (BCS)



Notes: Values of change in % non-white British and change in segregation set at minimum/maximum values in the data (rounded to nearest 5); all other individual- and community-level variables set to mean; bootstrapped standard errors (1000 reps); 1970 British Cohort Study (BCS) data.

another.²⁴ As a community changes to become more diverse *and* integrated, where the minority share increases and levels of segregation are decreasing, residents are actually likely to become somewhat less prejudiced, at least at the largest increases in percent non-white British. However, as a community changes to become more diverse *and* segregated, where the minority share increases but levels of segregation also increase, attitudes toward out-groups deteriorate. These results closely mirror our cross-sectional findings: that it is high minority share segregated communities where inter-group relations are undermined; in high minority share integrated communities, attitudes remain largely unaffected and may even improve.

We can compare the impacts of changes in levels of community diversity/segregation occurring around individuals who did not move (stayers) with the attitudes of those respondents who moved between different communities with varying levels of diversity/segregation between 2000 and 2012 (movers). There is some evidence that changes in out-group size alone are associated with changes in out-group attitudes, with moves to areas with higher (lower) concentrations of non-white British associated with declines (increases) in prejudice (although only at a $p < .1$ level) (model 5). However, the interaction term between change in percent non-white British and segregation for movers is small and non-significant (model 6). Therefore, whether the move from a more or less diverse area also entails a change into a more or less segregated area is not associated with additional changes in attitudes; it is the size of out-group alone. However, we cannot identify whether respondents' attitudes changed before or after the move. Thus, this relationship could be driven by individuals' attitudes changing in response to the ethnic composition of their new destination community or, more likely, changing attitudes triggering a move to a more/less diverse community.²⁵

Discussion and Conclusion

This paper outlined a theoretical framework suggesting that how increasing proportions of ethnic out-group in a community affects prejudice will depend on how segregated the community is. In particular, it will be at the intersection of high diversity *and* high segregation—the diversity-segregation nexus—that inter-ethnic relations are most fraught. We argued that this would emerge because the effect of out-group size on processes of perceived threat and positive contact would also be conditional on area segregation. Applying cross-sectional data to test the mechanisms and longitudinal data to test for more robust causal evidence, our analyses find evidence in support of this framework.

We found that neither out-group size nor segregation are directly associated with out-group attitudes. However, there is a strong and significant interaction between the two. The result is that increasing out-group size *only* has a negative association with inter-group attitudes in more segregated communities. Segregation also moderates the association between out-group size and *both* contact and perceived threat. Where ethnic groups are integrated in a community, increasing out-group size has no association with perceived threat but is

strongly associated with more positive contact. Where groups are more segregated, increasing out-group size is associated with greater perceived threat, and although it is also associated with an increase in positive contact, this peaks around 40 percent non-white British, after which rates of contact subsequently decline again. Together, these differences in levels of contact and threat between high minority share integrated and segregated communities can account for a large part of their differences in prejudice.

An analysis of longitudinal data using a British cohort study demonstrates more robust evidence in support of this framework, providing greater confidence in the causal nature of these effects. Among individuals who remain in the same community over time, independent increases in either out-group size or segregation do not appear to change residents' prejudice. Similarly, when there is a simultaneous increase in community out-group size and decrease in segregation, attitudes tend to remain stable and may even improve somewhat. However, when out-group size and segregation in a community both increase simultaneously, prejudice appears to increase.

These findings have implications for the nascent literature investigating the intersection of out-group size and segregation. Current studies suggest that segregated communities result in a lack of opportunities for positive contact to mediate the growing perceived threat that stems from increasing out-group size (Biggs and Knauss 2012; Rocha and Espino 2009). This paper is the first to explicitly test this idea. We observe that part of the reason inter-group relations are worse in high minority share segregated communities is due to lower rates of positive contact. However, inter-group relations are also worse in high minority share segregated communities because it is only in more segregated communities that increasing out-group size appears to generate perceived threat. In other words, even after accounting for differences in contact between communities, out-group size continues to trigger more prejudicial attitudes in segregated communities via increasing levels of perceived threat. Furthermore, positive contact and threat appear to operate relatively independently; that is, residents of high minority share segregated communities evince negative attitudes because they report *both* lower contact *and* higher threat. There is also evidence to suggest that segregation may not simply constrain *opportunities* for positive contact as out-group size increases, as suggested in the literature. In segregated communities, positive contact does not simply increase at a lower rate as out-group size increases, as we might expect; instead, contact appears to decline again after an initial increase. One possibility is that in segregated communities, opportunities for positive contact may be further delimited beyond lower neighborhood mixing alone; that is, at a critical mass of out-groups in a segregated area, community institutions may take on stronger out-group characteristics (e.g., religious schools), leading to a further decline in opportunities. However, factors beyond pure opportunity structures may also inhibit rates of contact; for example, higher perceived group difference in these areas may lead individuals to choose not to engage in out-group encounters, or increase the likelihood that the contact that does occur is more negative.

This paper also has implications for the wider literature on how out-group size affects inter-group attitudes. A key advantage of this analysis is that we explicitly

measure mechanisms of contact and threat (and do not only infer their presence from the direction of the out-group size effect). Along with a number of studies (e.g., Laurence 2014; Schlueter and Scheepers 2010), we show that mechanisms of both threat and contact emerge as out-group size increases. However, this is the first study to demonstrate that these mechanisms are both dependent on community segregation. This conditionality helps reconcile somewhat the competing predictions of the contact/threat hypotheses. It also suggests that not accounting for segregation, especially in high minority share areas, may lead to key misinterpretations of the effect of out-group size on various outcomes.

We acknowledge that, notwithstanding the new insights gleaned, this study has some limitations. Our outcome/mechanism measures refer to all non-white British minority groups, collecting together minority populations with different migration histories, socio-political contexts, and processes of racialization (although initial testing suggested our findings were not driven by particular groups). Furthermore, reliance on a single attitudinal measure of prejudice (the feeling thermometer) is also a limitation of our study, not least through the risk of measurement error in our analysis. Future research will benefit from analyzing a range of measures, capturing different dimensions of inter-group attitudes, as well as the use of indices of prejudice, to overcome this limitation. This paper also focused on one particular dimension of segregation: (un)evenness. However, segregation across other dimensions (such as clustering) may have different implications for the mechanisms of contact/threat outlined here. Our focus has also been on the composition/segregation of respondents' own community. However, the composition/segregation of communities contiguous to one's own may also matter (Rydgren and Ruth 2013). Data limitations prevented a full analysis of this issue here, yet future research aims to explore how neighboring communities affect one's own inter-group attitudes.

Regarding our longitudinal analysis, we elected to apply two-wave change-score (CS) methods, as they possess a number of advantages for our aims over more dynamic approaches, such as lagged dependent variable or cross-lagged models, given the posited alternative causal explanations that may account for our findings and the availability of only two waves of data. One of the key concerns regarding our findings is that segregation may not affect prejudice but may itself be a product of prior prejudice already present in an area, other historical factors, or that both prejudice and segregation may be driven by some unmeasured feature of individuals or communities. By observing that segregation (and out-group size) change synchronously with inter-group attitudes, we can be more confident that segregation does not solely emerge as a product of the prejudice that is already present; we can also go some way toward discounting the role of other time-invariant features of either individuals or communities (although time-variant unobserved heterogeneity remains an issue). To be sure, the CS approach does not allow us to explore possible reciprocal effects: for example, how changes in prejudice among residents may also cause changes in segregation in an area, which cross-lagged approaches would allow us to explore. However, in the present study, we place greater weight on the advantages the CS approach provides to minimize the role of unobserved

heterogeneity, especially when we restrict our analysis to stayers. Furthermore, while cross-lagged approaches allow us to specify a temporal ordering, it can still be difficult to make strong claims regarding causal direction based on temporal order when only two waves of data are available (see below).

Our longitudinal analysis was therefore designed to perform the strictest test available of our theoretical framework through a particular focus on *changes* among individuals who remained in the same community over a twelve-year period. Despite the greater confidence this brings that at least part of our framework is likely causal, the approach also carries limitations. Generalizing from the findings of residents who *stayed* in the same community to all people may be problematic, as this group may comprise a unique subset of individuals. It may be that more tolerant residents elected to remain, or that those most adversely affected by out-group size/segregation had selected out before being sampled again in 2012. This approach may underestimate any negative effects. Alternatively, it may be less socially mobile individuals (for example, more socially/economically disadvantaged) who are more likely to remain. Given processes of threat may be greater among this group, our results may overestimate any negative effects (Oliver and Wong 2003).

Another potential limitation is that while we test the impact of changes in both out-group size and segregation, the impact of a *change* in one of these measures could be conditional on the *level* of the other. For example, increasing out-group size alone may undermine out-group attitudes even when segregation does not increase if a community is already segregated. Measuring changes (not levels) of *both* segregation and out-group size strengthens our confidence that it is these community characteristics playing a role, given such analyses of change address time-invariant unobserved community-level heterogeneity. However, changes in one could still be conditional on levels of the other.

Finally, with only two waves of data it is difficult to explore the temporal ordering of changes in our key independent/dependent variables. This may be problematic given theories that increasing out-group size could trigger perceived threat, leading to greater segregation (Blanchard 2007; DeFina and Hannon 2009). Our results could therefore be demonstrating that increasing out-group size triggers threat, which triggers segregation. However, we observe that it is only in certain communities that out-group size is associated with increasing segregation and prejudice. There would thus need to be some other factor determining in *which* communities increasing out-group size triggers threat and segregation. Studies suggest the level of fractionalization of the out-group population may be one driver of this, although we do not find evidence for this in our UK analysis²⁶ (DeFina and Hannon 2009). Future research should aim to use more waves of data to more thoroughly investigate these issues. A larger number of waves will be of particular benefit to future investigations into the impact of moving into/out of differently diverse/segregated areas. With only two waves, we could not identify temporal ordering to test whether changes in attitudes drive a move between communities with different ethnic compositions, or whether moving into/out of communities with different levels of diversity/segregation could itself trigger changes in attitudes.

To be sure, this paper's findings may have greater applicability to UK/European contexts, where natural population change and immigration are suggested to be just as important as prejudice/ethnocentrism in driving segregation (e.g., [Finney and Simpson 2009](#)). Ultimately, however, theories of whether segregation is a product of, or works to generate, prejudice may not be mutually exclusive. Various processes contribute to the emergence of segregation; however, the spatial properties of these segregated communities could, in turn, serve to perpetuate inter-group tensions, and potentially further exacerbate them. Marrying theories of segregation as cause/product of inter-ethnic tensions is critical for future work.

In spite of these limitations, these findings remain important. They suggest that increasing out-group size alone may not necessarily be problematic for inter-group relations. Instead, segregation may play a key role in fostering (or preserving) negative out-group relations, cultivating conditions under which increasing out-group populations lead to conflict. In sum, our research highlights that there is a need to integrate segregation into the classic threat/contact-hypothesis framework, and the inconclusiveness of the current evidence base may be partly due to its absence.

Notes

1. Evenness and out-group size may be empirically related (correlated), and theoretically the latter may cause the former (e.g., [Defina and Hannon 2009](#)); however, in their measurement they are largely independent of one another.
2. Studies of the direct effect of segregation *implicitly* treat the effects of living in community B or D (high segregation) as being equal, given their equal indices of dissimilarity. However, differences in out-group size mean the lived experiences of individuals in communities B and D are likely to be very different.
3. These threat processes may also depend on a critical mass of out-group to be activated, e.g., a minimum population is likely required before local amenities (shops, schools) take on a minority-group character.
4. Weights were applied to account for unequal sampling/non-response.
5. This proportion generally conforms to actual rates of individuals changing residence over an 11–12-year period for this age group ([Coulter and Scott 2015](#)).
6. For example, age mother left school or father's social class. Substantively similar conclusions are drawn from weighted and unweighted analysis. We also created separate weights accounting for attrition between the two waves of interest using full covariates, but applying these did not shift our results substantially.
7. We created fifteen imputed datasets, using all covariates in our models alongside key predictors of missingness from the literature ([Mostafa and Wiggins 2015](#)). Estimates from the analyses were combined according to Rubin's rules ([White, Royston, and Wood 2011](#)).
8. We find some evidence for this. Local Authority-level out-group size is not associated with a measure of frequency of "brief everyday encounters" with non-white British after accounting for the proportion of out-group at the MSOA level, suggesting it is at smaller areas that everyday encounters occur.

9. A very small n of individuals reported direct contact only. These are coded as “direct and extended contact,” although their inclusion/exclusion from this category does not affect the findings.
10. In a factor analysis, the two measures load together $> .6$ and display Eigenvalues of 0.93 (2000) and 0.78 (2012). They have alpha coefficients of 0.74 (2000) and 0.68 (2012).
11. When asked to self-report the proportion of people from “an ethnic minority background” in their neighborhood, this measure has a correlation with percent non-white British that is $r = .2$ points higher than for any specific non-white ethnic subgroup. This increases our confidence that white British respondents are thinking of *all* non-white British individuals, not just particular minority groups.
12. The minimum/maximum values of the D are constrained, to some extent, by the size of ethnic groups. However, the D is far more sensitive to the size of the areas used in its composition (Uslaner 2012). In our data, D and percent non-white British correlation is $r = .08$, although this is likely sensitive to the area level chosen (e.g., MSAO) and our study site (England).
13. Although treating them as ordered data does not change our findings.
14. We do not mean-center the BCS longitudinal analysis given shifting means over time.
15. Maximum/minimum values of segregation and percent out-group are set at the maximum/minimum values in our data, rounded to the nearest 5. Mean-centered minority share/segregation values are transformed back into actual values.
16. We also included a series of interaction terms between out-group size, segregation, and all individual/community-level controls in our models to test for confounding. However, none accounted for the key interaction.
17. We reran our models measuring out-group size and segregation using the larger Local Authority area as the community level. However, the interaction was weaker, only significant at a $p < 0.1$ level, and disappeared after including the MSAO-level relationship.
18. The inference of our current models is that high exposure to/segregation from all non-white British groups will elicit negative inter-group attitudes. However, the models may be driven by segregation from/exposure to specific out-groups (e.g., Muslims) that experience negative politicization. To test for this, we reran our models but included separate measures of the size of each ethnic subgroup and their segregation from white British, for example living among high percent Muslim/white British versus Muslim segregation, and so on. However, our current models analyzing all non-white British groups produce the best model fit; extensive testing also found the white British/non-white British interaction is the most robust when examined alongside each subgroup interaction (results available on request).
19. This included testing linear, quadratic, and cubed terms of out-group size in the models and interactions between these and the linear, quadratic, and cubed terms of segregation in various permutations. We also created categorical versions of out-group size/segregation and to look for specific threshold points. However, no evidence emerged.
20. We observe similar relationships for *extended ties*.
21. These variables show the highest loading on the full indices (and strongest association with the underlying latent variable). Using single measures instead of indices minimizes problems from measurement invariance. However, we tested all community-level variables and the results did not shift substantively.
22. We also experimented with including time-invariant characteristics (e.g., sex); however, as expected, these do not shift the model findings.

- 23. We are required to round minima/maxima values to the nearest 5 by the data providers to reduce disclosure risks.
- 24. This may depend on the size of out-group already present; for example, if a high minority share community becomes increasingly segregated (see Discussion section).
- 25. Furthermore, such models do not account for time-invariant unobserved community-level heterogeneity. There are also issues calculating correct standard errors to account for clustering when looking at movers given their level-2 cluster changes over time.
- 26. We thoroughly examined the role of ethnic fractionalization of the non-white British population and whether it moderated the associations between out-group size and contact, threat, prejudice, and segregation.

Appendix

Appendix A1. Community-Level (MSOA) Characteristics Descriptive Statistics—2010
Managing Cultural Diversity Survey

	Observations (<i>n</i>)	Mean	Standard deviation	Minimum	Maximum
All respondents					
% non-white British	762	32.48	24.48	2.81	84.61
Min (3)–10	215				
10–20	106				
20–30	101				
30–40	87				
40–50	72				
50–60	67				
60–70	59				
70—Max (85)	45				
Index of dissimilarity	762	20.14	8.28	7.37	62.88
Min (7)–10	15				
10–20	305				
20–30	246				
30–40	116				
40–50	66				
50—Max (63)	14				
Index of crime	762	0.14	0.64	–1.56	1.4
Index of status disadvantage	762	0.04	0.95	–2.31	1.62
Index of resource disadvantage	762	–0.12	0.86	–1.36	3.14
Index of urbanization	762	–0.23	0.89	–2.69	2.23

Appendix A2. Community-Level (MSOA) Characteristics Descriptive Statistics among All Individuals and Stayers—1970 British Cohort Study

	Observations (<i>n</i>)	Mean	Standard deviation	Minimum*	Maximum*
All respondents					
Change in % non-white British	5773	2.25	12.9	−75	90
Min* (−75%) to −60%	11				
−60% to −50%	20				
−50% to −40%	51				
−40% to −30%	69				
−30% to −20%	117				
−20% to −10%	224				
−10% to 0%	1,005				
0% to 10%	3,466				
10% to 20%	491				
20% to 30%	174				
30% to 40%	58				
40% to 50%	41				
50% to 60%	27				
60% to Max* (90%)	20				
Change in segregation	5773	−2.06	8.44	−50	40
Min* (−50%) to −30%	33				
−30% to −20%	102				
−20% to −10%	656				
−10% to 0%	2,778				
0% to 10%	1,839				
10% to 20%	302				
20% to 30%	48				
30% to Max* (40%)	15				
Respondents in the same community (w1 to w2)— <i>stayers</i>					
Change in % non-white British	1534	4.26	5.30	−5	30
Min (−5%) to 0%	29				
0% to 10%	1,333				
10% to 20%	132				

(Continued)

Appendix A2. continued

	Observations (<i>n</i>)	Mean	Standard deviation	Minimum*	Maximum*
20% to Max* (30%)	40				
Change in segregation	1534	−2.76	5.98	−25	20
Min* (−25%) to −20%	12				
−20% to −10%	139				
−10% to 0%	907				
0% to 10%	448				
10% to Max* (20%)	28				

Note: Cells combined to produce a minimum *n* of 10 respondents; *minima and maxima rounded to the nearest 5 percent; these are required by data owners to reduce risks of disclosure.

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