



ELSEVIER

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Social Science Research

journal homepage: www.elsevier.com/locate/ssresearch

Effects of absolute levels of neighbourhood ethnic diversity vs. changes in neighbourhood diversity on prejudice: Moderation by individual differences in personality

Laura Silva ^a, Franco Bonomi Bezzo ^{b,c,*}, James Laurence ^d, Katharina Schmid ^e

^a Sciences Po, Center for Research on Social Inequalities (CRIS), Paris, CNRS, France

^b Department of Social and Political Science, La Statale, University of Milan, Italy

^c Institut national d'études démographiques (INED), Paris, France

^d Economic and Social Research Institute, Dublin, Ireland

^e Universitat Ramon Llull, Esade, Spain

ARTICLE INFO

Keywords:

Neighbourhood
Ethnic diversity
Prejudice
Personality

ABSTRACT

This paper examines drivers of prejudicial attitudes among adults in the UK, focusing on the interaction between ethnic out-group size and personality traits. Leveraging data from the National Child Development Study (NCDS), we use two survey waves carried out in 2000 and 2008, just before and after the EU enlargement policy that drove a wave of immigration in the UK. We test the extent to which personality traits moderate the relationship between both *absolute levels* and *changes* in ethnic diversity at the local level, respectively, and prejudice. Key findings suggest that personality traits, in particular one's agreeableness, are important for conditioning how the proportion of non-white British in one's neighbourhood affects out-group attitudes. We observe a tendency towards polarisation in prejudicial attitudes between low-/high-agreeableness residents as their neighbourhoods become more diverse. These findings have important implications for theorising how contextual and individual characteristics jointly affect intergroup relations.

1. Introduction

Like many other Western European countries, the UK is becoming increasingly ethnically diverse.¹ In 2011, one-in-five people (20%) identified with an ethnic group other than white British in England and Wales, compared with 13% in 2001 (Jivraj, 2012). In Scotland, within the same decade, the proportion of non-white British rose by 29%, with the presence of some minority groups particularly, such as Polish and African individuals, increasing substantially (Simpson, 2014). This is the result of an expansion in the size of second and third-generation immigrant groups, as well as of a steady increase in the number of immigrants entering the country since the 2000s (The Migration Observatory, 2016). The increase in migration has been driven by a number of political processes, such as the EU enlargement in 2004, which provided free access to the European borders to eight countries in Eastern Europe (Watt and

* Corresponding author. Department of Social and Political Science, La Statale, University of Milan, Italy.

E-mail address: franco.bonomi@unimi.it (F. Bonomi Bezzo).

¹ We define ethnicity by adopting the official classification elaborated by the Office for National Statistics (ONS), which is the body responsible for carrying out the national Census. We define as non-White British all those individuals who do not identify themselves as part of the native population (which includes those who identify themselves as White English, White Scottish, White Welsh, White Cornish, White Norther Irish or British).

<https://doi.org/10.1016/j.ssresearch.2023.102919>

Received 10 February 2023; Received in revised form 3 July 2023; Accepted 10 August 2023

Available online 24 August 2023

0049-089X/© 2023 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Wintour, 2015; Dustmann et al., 2003).

With such an increase in ethnic diversity, it has become an urgent matter among scholars and policy makers alike to better understand the mechanisms underlying the formation of prejudicial attitudes of natives towards minority groups. Similarly, it is imperative to understand the influential factors that help explain when and for whom exposure to diversity will lead to higher or lower prejudicial attitudes. Understanding what leads to the development of prejudicial attitudes is indeed at the core of the political agenda nowadays. There is growing concern that as societies become more diverse, new tensions may arise. Moreover, in recent years the re-emergence of far-right parties, whose political discourses are often permeated by anti-immigrant rhetoric, has called for a renewed focus on the topic. In addition to that, attitudes towards ethnic out-groups have been found to represent a key driver of important political decisions. Under this perspective, the United Kingdom represents an interesting and focal case to focus on. Research has shown that attitudes towards immigration and national identity, alongside authoritarian values, played a key role in shaping the outcome of the Brexit referendum (Curtice 2017; Goodwin and Milazzo, 2017), a political event whose consequences have critically affected global inter-country relations and dynamics.

Previous research has focused on how either levels of ethnic diversity (i.e., the proportion of an ethnic out-group population in a given context), or rate of change of ethnic diversity (i.e., the rate of recent increase in the local ethnic out-group population) at the local level are associated with intergroup attitudes and prejudice. However, to date, the evidence-base remains generally mixed. For example, Schmid et al. (2014) and Wagner et al. (2006) found that proportional levels of ethnic diversity can improve intergroup relations, whereas Kros and Hewstone (2020), Kawalerowicz (2021), and Weber (2019) found that the rate of change of ethnic diversity can lead to a deterioration of intergroup relations. Additionally, Pottie-Sherman & Wilkes (2017) found no effect of either proportional levels or rate of change of ethnic diversity on intergroup relations.

One possible explanation for such mixed evidence is that community diversity exerts heterogeneous effects for different individuals. Previous evidence has shown that individual characteristics such as education, authoritarianism and individual political predispositions can affect the relationship between ethnic out-group size at the local level and residents' prejudice (Hello et al., 2006; Van Assche et al., 2014; Meleady et al., 2017). We focus on an additional potential driver of heterogeneity that may explain when and for whom absolute levels of diversity as well as changes in diversity may lead to more or less prejudicial attitudes: an individual's personality characteristics. More precisely, we explore whether individual differences in five key personality traits affect the relationship between both levels of, and changes in, ethnic diversity in their immediate residential area and their prejudicial attitudes. An extensive body of psychological research has found that an individual's personality can be described in terms of five key dimensions, commonly referred to as the 'Big 5' personality traits, namely extraversion, openness to experience, agreeableness, conscientiousness and emotional stability (McCrae and Costa, 1985; see e.g., Jackson and Poulsen, 2005; Matic et al., 2019, Crawford and Brandt., 2019; Strauss et al., 2003). Considering the involvement of these traits in diversity research, prior studies have shown that traits such as openness to experience or conscientiousness are associated with more positive views towards ethnic differences (Sibley and Duckitt, 2008; Hodson and Dhont, 2015). Particularly strong evidence has been found for agreeableness, with research showing a reliable relationship between high levels of agreeableness and lower prejudice towards immigrants and ethnic minorities (e.g., Crawford and Brandt, 2019). Furthermore, some personality traits, such as openness to experience, have also been shown to shape individuals' probability of engaging in intergroup social relationships or shaping individual perceptions of intergroup threat (Crawford and Brandt, 2019; Jackson and Poulsen, 2005; Danckert et al., 2017; Dinesen et al., 2016). Accordingly, we argue that an individuals' personality traits can *condition* (that is, moderate) how people respond to experiences of ethnic diversity in their local areas, with consequences for their intergroup attitudes. In other words, we predict that depending on their personality traits on the five dimensions, individuals will show a distinct pattern of relationships between both the absolute levels of diversity on prejudicial attitudes as well as changes in diversity on these attitudes.

To test these questions, we use data from the National Child Development Study, which is a cohort study in the UK that started in 1958 and that entailed regular follow up surveys every 5–10 years. Information on prejudice was collected in 2000 (when respondents were 42 years old) and 2008 (when they were 50 years old) consecutively, just before and after the EU enlargement took place. The data also contain information on respondents' personality characteristics. We combine this dataset with information on the ethnic diversity of respondents' residential areas in 2001 and 2011 (along with other community characteristics), available through the UK Censuses.

Overall, a first contribution of our analysis is to shed additional light on the role of contextual ethnic diversity on the development of prejudicial attitudes. Second, we build on previous works and integrate micro, or individual, and macro, or contextual, pathways of explanation concerning the relationship between ethnic diversity in the residential area and prejudice. Finally, most of the existing non-experimental literature on the relationship between ethnic out-group size and prejudice relies on cross-sectional surveys. In contrast, we exploit the longitudinal element of the NCDS and apply a fixed-effects panel data modelling approach, which allows us to generate more robust, though not causal, estimates.

The remainder of the article continues as follows. The next section outlines the theoretical background for our analysis. The third section elaborates on our data and methods. In the fourth and fifth sections, we first present our results, before we conclude with a discussion on our findings.

2. Literature review

2.1. Theoretical perspective on the relationship between out-group size and prejudice

In the debate concerning contextual-level drivers of prejudice, ethnic out-group size has played a central role, identified as a crucial

determinant of individuals' intergroup attitudes.

Studies have typically drawn on two divergent theories, the "contact" and "threat" hypotheses, respectively. The former posits that the greater the out-group size within one's local area, the greater one's opportunities are for face-to-face interaction and for the development of social ties and friendships between different ethnic groups. Since a vast body of research has established that having positive contact with out-group members can improve attitudes toward a minority group (Allport, 1954; Pettigrew, 1998; Pettigrew and Tropp, 2006), it follows that greater opportunities for such contact in diverse areas should lead the majority group to develop less hostile attitudes towards those ethnic groups perceived as "different" due to their increased potential to engage in intergroup contact. However, more recent research has shown that increases in the local out-group size can also result in increased opportunities for any type of intergroup contact, including negative intergroup encounters, which can fuel prejudice sentiment (Laurence and Bentley, 2018).

On the other hand, the "threat" hypothesis predicts that higher shares of ethnic out-group in one's local area increase majority-group residents' perceptions that minority groups are a threat to their social and economic status. This leads to a deterioration of attitudes toward the minority group, and to greater levels of prejudice (Blalock, 1967). Such actual or perceived threat among the majority-group may be related to increased competition for material resources, such as jobs, housing, and welfare benefits (Blalock, 1967; Quillian, 1995). Threats can however also be related to immaterial (e.g., cultural or symbolic) resources. Individuals or groups might perceive that their values or beliefs are being undermined by an out-group's culture (Kinder and Sears, 1981), fostering sentiments of social disintegration and societal disaffection (Van der Brug et al., 2000).

Studies on the effect of out-group size on the formation of prejudicial attitudes have found evidence supporting both the contact and threat hypotheses. Studies across Europe (Wagner et al., 2006; Schlueter and Scheepers, 2010), the UK (Schmid et al., 2014; Kaufmann, 2017) and the US (Oliver and Wong, 2003) found larger concentrations of ethnic out-groups to be associated with more positive intergroup attitudes toward ethnic minorities. At the same time, some authors also found a negative relationship, whereby out-group size was associated with less positive intergroup attitudes (Schlueter and Scheepers, 2010; Kros and Hewstone, 2020; Kawalerowicz, 2021). Disagreement exists even between large-scale meta-analysis studies. For example, a meta-analysis of 55 studies testing the association between out-group size and prejudice found no evidence of a relationship in either direction (Pottie-Sherman and Wilkes, 2017). However, a more recent meta-analysis, which looks at various forms of social trust and takes into account 87 studies, finds evidence for a significant negative relationship between neighbourhood-level ethnic diversity and trust, particularly in neighbours (Dinesen et al., 2020).

Given the inconclusiveness of the evidence-base to date for how diversity at the local level affects prejudice attitudes, attention has shifted from the size of the ethnic out-group population in an area to its rate of change over time (Weber, 2019; Borkowska and Laurence, forthcoming). Thus, researchers have focused on disentangling the effect of absolute levels of ethnic diversity, i.e., the proportion of an ethnic out-group population in a given context, from the effect of change, i.e., the rate of recent increase in the local ethnic out-group population, such as the change in the proportion of ethnic outgroup in an area in the last ten years. From a theoretical perspective, considering the effect of levels of ethnic diversity and changes in ethnic diversity in an area in a joint analysis may help reconcile competing predictions (and findings) on contact and threat hypotheses. This, we argue, is because a majority group individual may react adversely to large changes in the size of the out-group that happen over a shorter timeframe. Yet, over time, when living together alongside minority members, i.e., when there are higher levels of ethnic outgroup members in a context, may mean that majority group members come to increasingly see ethnic minority residents as part of their wider in-group, rather than as the out-group, which may modify their initial assessment (Kawalerowicz, 2021). Examples of the effect of absolute levels of ethnic diversity include a study in the US (Hopkins, 2010) which found that living in areas with higher levels of ethnic diversity was associated with greater positive intergroup contact. In the UK, Kaufmann (2017) and Kaufmann and Goodwin (2018) also found that living in areas with higher levels of diversity was associated with greater positive intergroup contact. Furthermore, evidence from a joint analysis of levels of ethnic diversity and changes in ethnic diversity in an area demonstrate that larger recent increases in ethnic out-group proportions in the local area are associated with more negative intergroup attitudes, while levels are not (Van Heerden and Ruedin, 2019). This suggests that threat effects of ethnic change may fade over time, while threat-reducing characteristics of minority levels can increase with time (Kaufmann, 2017). For example, a study by Weber (2019) found that the rate of recent increase in the local ethnic minority population was associated with more negative intergroup attitudes. Nonetheless, it is imperative to provide further evidence on this relationship, taking into consideration potential moderator (conditional) factors that may explain divergent effects, such as an individual's personality traits.

2.2. The role of personality

Since the work of Adorno et al. (1950), scholars have tried to provide a comprehensive account of why some people, in comparison to others, tend to be more hostile towards out-groups, highlighting various relevant traits that may play a role therein. Most prior work which has since tried to investigate predictors of prejudice residing in individual differences has focused on political personality traits (Duckitt and Sibley, 2010), such as social dominance orientation (Pratto et al., 1994) or right-wing authoritarianism (Altemeyer, 1988). However, a growing portion of the literature (see, for example, Jackson and Poulsen, 2005; Matic et al., 2019; Crawford and Brandt, 2019; Strauss et al., 2003), which our study is in line with, has examined the Big 5 Personality model to measure individuals' personality traits (McCrae and Costa, 1985). This model seeks to capture variation in individual differences along five core dimensions which have been found to underlie much of the variation in human personality. Specifically, the five core traits are defined as extraversion (i.e., the degree to which individuals are more or less sociable, have larger social networks and more likely to engage in social activities), agreeableness (i.e., the degree to which individuals are more or less good-natured, cooperative and trusting),

conscientiousness (i.e., the degree to which individuals are more or less reliable and organized, but also traditionalistic and protective of the status quo), emotional stability (i.e., the degree to which individuals are more or less calm, self-confident and secure) and openness to experience (i.e., the degree to which individuals are more or less imaginative, curious and creative).

Of these characteristics, the two traits that have been found to be most reliably related with prejudice are agreeableness and openness to experience, with those friendlier and more pleasant (i.e., high agreeableness), or more open to new experiences and feelings (i.e., high openness to experience) typically scoring lower in prejudice (Hodson and Dhont, 2015; Turner et al., 2020). Several authors have thus consistently found low agreeableness and low openness to experience to predict higher prejudice (e.g., Akrami et al., 2011; Ekehammar et al., 2004; Graziano et al., 2007; Sibley and Duckitt, 2008; Gallego and Pardos-Prado, 2014). Research on the relationship between the remaining personality factors and prejudice is, in contrast, much less consistent. For instance, Ackermann and Ackermann (2015) found that conscientiousness was related with less favourable attitudes towards immigrants. Additionally, Sibley & Duckitt (2008) found that extraversion and emotional stability were not clearly correlated with prejudicial attitudes.

2.3. Personality traits as moderators of the relationship between out-group size and prejudice

Individual differences in personality are not only directly associated with prejudicial attitudes but they have also been found to significantly shape people's perception of the characteristics, and changes in, their environments. In other words, some aspects of individuals' personality can moderate how people respond to situational and contextual triggers (Dinesen et al., 2016). Regarding the effect of ethnic diversity in people's locales, we posit that this matters not only when considering levels of out-group size in the neighbourhood area, but that it matters especially in the context of rapid changes in diversity, since these changes are particularly likely to be noticed (Hopkins, 2010). Building on the "acculturation" hypothesis (Newman, 2013), theories in political psychology stress how rapid influxes of members of ethnic out-groups triggers large-scale change (Johnston et al., 2015). For example, in the Netherlands, ethnic diversity is negatively correlated with attitudes towards immigrants specifically among people experiencing their immediate environment as threatening as well as among highly authoritarian individuals (Van Assche et al., 2014). Depending on one's personality profile, such changes could be viewed either positively, as opportunity enhancing, or negatively, as a threat to existing cultural institutions and norms.

In the context of explaining how contextual factors of diversity are differentially perceived depending on individual differences in personality, we can draw upon contact and threat theoretical hypotheses to explain how personality traits, and in particular openness to experience and agreeableness, contribute to positive or negative perceptions of levels and changes in local ethnic diversity on inter-group attitudes. Drawing on the contact hypothesis, research has found that individuals scoring higher on openness to experience and agreeableness are more likely to initiate interethnic group contact and interpret such contact experiences favourably (Jackson and Poulsen, 2005). In particular, it is assumed that individuals scoring higher on openness to experience are more likely to develop cross-race friendships and, when moving to a more diverse environment, are able to take advantage of new environmental affordances, adding more different-race members to their networks (Antonoplis and John, 2022). Moreover, individuals who score higher on the openness trait tend to express more pro-immigration attitudes when experiencing both greater personal inter-ethnic contact as well as self-reported exposure to ethnic diversity in the neighbourhood (Danckert et al., 2017). Accordingly, individual high in openness to experience seem to also experience higher life satisfaction when living in diverse cosmopolitan environments (Jokela et al., 2015). With respect to agreeableness, Ackermann et al. (2018) find evidence for a moderating role of neighbourhood ethnic diversity in Switzerland, to the extent that individuals who score high on agreeableness express preferences for their country to be both economically as well as culturally open. A similar effect occurred for conscientiousness. The authors argue that greater inter-ethnic contact, driven by higher levels of local ethnic diversity, encourages agreeable people in their preference for an open country and, at the same time, reduces the traditionalist attitudes of conscientious individuals by forcing them to get in contact in an out-group (Ackermann et al., 2018).

Drawing on the threat hypothesis, authors have suggested that individuals scoring low in agreeableness and high in conscientiousness tend to react negatively to economic threats deriving from greater ethnic out-group size (Hodson et al., 2009; Dinesen et al., 2016). Moreover, for individuals with higher agreeableness the effect of threat on out-group attitudes was mitigated (Dinesen et al., 2016). According to the *differential-adaptation hypothesis* (Johnston et al., 2015) individuals might thus interpret rapid ethnic change differently depending on their levels of agreeableness and openness, respectively. Mondak (2010) further found that low levels of agreeableness, as well as high levels of conscientiousness, were associated with risk-aversion and a less favourable propensity towards diversity and social change in general (Mondak, 2010). This, in turn, might influence the extent to which individuals feel threatened or not by increased exposure to ethnic out-groups.

Overall, in the field of political psychology, scholars have stressed how individual personality traits and characteristics of the social context jointly matter for shaping political attitudes and behaviours (Gerber et al., 2010; Mondak et al., 2010). Studies that investigate a similar question in the context of intergroup attitudes and attitudes towards immigration (see Ackermann et al., 2018; Danckert et al., 2017; Van Assche et al., 2014), have also highlighted a significant moderating role of personality traits, particularly openness to experience and agreeableness. For instance, Ackermann et al. (2018) found that openness to experience was associated with more positive attitudes towards immigration and that perceived ethnic diversity in the neighbourhood affects the relationship between personality and attitudes toward the degree of openness of Switzerland. Danckert et al. (2017) demonstrated that agreeableness was linked to a greater acceptance of immigrants and that openness moderates the effect of interethnic encounters on immigration attitudes. Moreover, Van Assche et al. (2014) showed that for low-authoritarian individuals, local ethnic diversity was associated with a greater acceptance of out-groups.

3. Aims of the paper and research questions

The above literature informs our understanding of how the ethnic structure of communities (i.e., the size of outgroups presents in a community and its experiences of ethnic change) might relate to the development of prejudice attitudes, and the role of personality in this relationship. Prior research has examined on the one hand, the relationship between ethnic out-groups in the surrounding environment and prejudice and, on the other hand, the relationship between different personality traits and prejudice. We draw on this literature but extend it by examining the potential moderating role played by different personality traits on the effects of absolute levels of ethnic out-group size and changes in ethnic out-group size, respectively, on prejudice. Based on previous literature, we expect that openness to experience and agreeableness can positively moderate the relationship between both levels and changes of ethnic diversity and prejudice. These traits are associated with a higher propensity to engage in intergroup contact and a lower threat perception. Given the mixed evidence base on extraversion, conscientiousness and emotional stability, we make no predictions on the nature of the relationships for these traits but test them empirically in an exploratory manner in our analyses.

The majority of prior work, both testing moderating effects but also looking at contextual effects of diversity in general, have largely drawn on cross-sectional data (Danckert et al., 2017; Van Assche et al., 2014). However, results obtained through this approach may be limited since they do not consider time-invariant unobserved heterogeneity, such as prior exposure to ethnic diversity or parental prejudice, which could lead to biased estimates. Furthermore, such studies create complexities in disentangling the role of selection effects. For instance, an individual's intergroup attitudes might determine their choice of living in a community with a particular level of ethnic diversity. In contrast, our study does not intend to argue for any causal relationship. Nonetheless, a significant advantage of our research is that we utilize longitudinal data to enhance our comprehension of how personality traits moderate the association between out-group size and prejudice.

4. Data and methods

To explore the role of personality in conditioning how increasing ethnic diversity affects individuals' prejudice we draw on data from the National Child Development Study (NCDS), a cohort study which follows the same sample of individuals (born in 1958) over their lives (University of London Institute of Education, 2021a; 2021b). More specifically, we use two waves of the data: the 2000 wave (when respondents were 42 years old) and the 2008 wave (when they were 50 years old). Data on the demographic composition of respondents' local areas (Lower Super Output Areas – LSOAs) are retrieved from the 2001 and 2011 census and linked to NCDS respondents, with 2001 UK census data linked to the 2000 wave and 2011 UK census data linked to the 2008 wave. All models are restricted to the white British population only, given the fact that the NCDS sample only contains a small number of minority individuals, as well as the proposed processes of contact/threat which are much more salient for the majority-group.

The first stage of analysis applies a mixed-effects multilevel pooled regression approach, with observations nested within individuals nested within LSOAs. We also allow the coefficients for individual-level personality traits to vary across LSOAs (Heisig and Schaeffer, 2019).

This pooled cross-sectional approach allows us to first explore how levels of prejudice differ across levels of diversity and one's level of personality traits. Our main outcome of interest is individuals' intergroup attitudes. Our main independent variables of interest are neighbourhood ethnic diversity and the five personality traits, while controlling for individual and contextual characteristics. We also add an interaction term between each personality trait and the ethnic diversity variable to explicitly test the proposed moderating role of personality. Our model is therefore the following:

$$Y_{(i,n)} = \beta_0 + \beta_1(N_n) + \beta_2(P_{i,n}) + \beta_3(N_n * P_{i,n}) + \beta_4(X_{i,n}) + e$$

where Y is the attitudinal outcome we investigate for person i, living in neighbourhood n. We have the constant effect $\beta(0)$, the neighbourhood ethnic diversity variable, the set of five personality traits P, the interaction terms between the neighbourhood ethnic diversity variable and the five personality traits (N*P) and, finally, individual and contextual controls, X (i,n).

In a second step, we utilize the longitudinal element of the NCDS and we apply fixed-effects panel data modelling approaches. This approach will essentially test how a change in the percentage of non-white British residents over time in the local area affects a change in prejudice, and whether any effect is conditional on the level of one's different personality traits. By modelling how changes in ethnic diversity impact changes in attitudes helps us adjust for selection-effects, such as the tendency for people to move to areas with similar ethnic backgrounds, and, thus, to generate more robust estimates. Through a process of time-demeaning the data, such methods adjust for all unmeasured time-invariant unobserved heterogeneity. In fixed-effects approaches, all time-invariant variables drop out of the estimation, given they do not change over time (and thus there is no within-individual variance). This applies to our personality-traits as well as to some individual and contextual controls. Personality traits are only measured in 2008, but we did not expect that respondents' personality traits would have changed (significantly) over time (especially considering that we were dealing a timespan of 8 years and a sample of over 40 years olds). Accordingly, in a fixed-effects approach we can no longer test the direct effect of personality traits on out-group attitudes (given they do not change); thus, their coefficients drop out of the model. However, we can test for an interaction-term between one's stable personality trait (at the 2008-level) and a change in the percentage of non-white British residents; thus, the interaction-term remains in the model and is still valid. Specifically, we clarify here our basic specification and describe it as follows:

$$Y_{i,n,t} - \bar{Y} = \beta_1(N_{i,n,t} - \bar{N}_i) + \beta_2((N_{i,n,t} - \bar{N}_i) * P_i) + \beta_3(X_{i,n,t} - \bar{X}_i) + (\delta_t - \bar{\delta}_t) + \theta_{i,n} + u_{i,n,t}$$

where the dependent variable, $Y_{i,n,t}$ is the level of intergroup prejudice reported by individual i in neighbourhood n at time t , β_1 is the effect of the change in local ethnic diversity between the two waves and β_2 represents the interaction terms between local ethnic diversity and the five personality traits. Then, a set of time-varying controls are included ($X_{i,n,t}$) as are wave fixed effects ($\theta_{i,n}$).

To strengthen such analysis, we also restrict our sample to individuals who stayed in the same neighbourhood between the two waves (2000 and 2008) i.e., residential stayers. In doing so, we can isolate the impact of changes in diversity stemming solely from shifting demographics which occur around an individual who remained in the same community; for example, by controlling for changes in the socio-economic characteristics/demographics of a neighbourhood (Laurence and Bentley, 2016).

This approach not only strengthens arguments against selection-effects but also further adjusts models for unobserved time-invariant contextual-level heterogeneity.

5. Measures

5.1. Outcome

To measure intergroup prejudice we draw on three social distance measures within the NCDS, each measured using a 5-option Likert scale of ‘Strongly Agree’ to ‘Strongly Disagree’. Respondents are asked how far they agree/disagree with the following statements: ‘I don’t want other races as a boss’, ‘I wouldn’t mind working with other races’ (reverse coded), and ‘I wouldn’t mind if a different race moved next door’ (reverse coded). We sum respondents’ scores across all measures and then generate an average score of attitudes towards the outgroup or prejudice. Higher values correspond to lower prejudicial attitudes.

5.2. Neighbourhood ethnic diversity

To capture the level ethnic diversity within a respondent’s local area we use the proportion of non-white British in their neighbourhood. This information is retrieved from the UK Census in 2001 and 2011. The population census takes place every 10 years in the United Kingdom and is run by the Office for National Statistics. We define the neighbourhood at the level of Lower Layer Super Output Areas (LSOAs). Each LSOA contains between 1000 and 3000 people.

5.3. Personality traits

Personality traits are measured in the 2008 wave. We draw on composite measures aimed to capture the ‘big-five’ personality-traits, based on the validated 50-item IPIP scales (Goldberg, et al., 2006).² The ‘big-five’ personality traits are: extraversion, agreeableness, conscientiousness, emotional stability, and openness to experience³ (measured on 9–55 point scales).

6. Covariates

At the individual-level, we adjust all our models for: sex, tenure, marital status, whether there are child in household, employment status, socio-economic group, and qualifications. We include a regional control variable. At the LSOA-level, we also adjust our models for percent aged 65+, the level of resource-disadvantage in a community (% female headed lone-parent households, % unemployed, % in social housing) and level of urbanisation (population density, % in agriculture). We also tested models adjusting for crime rates, but these did little to affect the substantive findings and given this data was limited to England only our full models omit this variable. Table 1 presents descriptive statistics for the outcome and percent of ethnic diversity across the sample. The first column presents pooled results, while the latter two show, respectively, statistics for the first (2000) and second (2008) wave of the analysis. Mean values of the out-group attitudes measure are higher in 2008 than in 2000, which means that out-group attitudes have slightly improved over time. The average percentage of non-white British also increases over time, passing from 0.08% to 0.12%.

Table 1 in the Supplementary material includes descriptive statistics for all variables.

7. Results

Table 2 report results of the mixed-effects multilevel pooled regression on our variables of interests, including individual, contextual and time controls. Table 2 in the Supplementary material includes full results.

Overall, we first observe that levels of ethnic diversity, that is the percent non-white British in the neighbourhood, is positively correlated with out-group attitudes across all models without interaction terms (Model 1, Model 3, Model 5, Model 7, Model 9). We next turn to findings on personality characteristics and observe that individuals reporting higher scores on the agreeableness scale

² Each personality trait is built on 10 indicators, for example “I don’t have a good imagination” (reverse-coded, openness to experience), “I feel little concern for others” (agreeableness), “I am the life of the party” (extraversion), “I am always prepared” (conscientiousness), “I get stressed out easily” (emotional stability).

³ The NCDS documentation refers to this dimension of personality as “Intellect”, although this construct is equivalent to the concept of openness to experience as built upon 10 indicators aimed at capturing the extent to which individuals are imaginative and creative.

Table 1
Descriptive statistics.

	NCDS Pooled Sample		NCDS 2000 Sample		NCDS 2008 Sample	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
	Out-group Attitudes	4.09	0.72	4.02	0.69	4.17
% non-white British	0.1	0.13	0.08	0.1	0.12	0.15
N	9953		4808		5145	

Note: author's computation based on Waves 6–8 of NCDS.

report significantly less prejudice (Model 1). In Model 2, we perform the core test of the analysis: that individuals' personality traits might moderate the association between the level of diversity of one's community and their out-group attitudes. We include an interaction term between percent non-white British and agreeableness. First, we notice that the direct relationship between percent non-white British and out-group attitudes becomes negative (although statistically non-significant), suggesting that higher levels of diversity are associated with higher prejudice when levels of agreeableness are low. The interaction-term is positive and significant, suggesting percent non-white British has a more positive relationship with prejudicial attitudes among those scoring higher on agreeableness. To explore how this moderating relationship plays out for people's attitudes, we calculate predicted attitudes scores across 7-levels of neighbourhood percent non-white British (from 0% to 70% non-white British). However, we subdivide this relationship by whether an individual reported the lowest score or highest score on the agreeableness scale (Fig. 1, based on Model 2, Table 2).

This reveals two key points. Firstly, across every level of percent non-white British, individuals that are more agreeable report less prejudicial attitudes. For example, in Fig. 1, we observe that the predicted prejudicial attitude score for a high-agreeableness individual is consistently lower than that of a low-agreeableness individual, regardless of the level of diversity.

Secondly, among high-agreeable individuals, increasing neighbourhood diversity is associated with an *improvement* in prejudicial attitudes (and this positive association is significant: the average marginal effect (AME) of percent non-white British on attitudes among those with high-agreeableness is: 0.28*). However, among low-agreeable individuals, increasing diversity is associated with a significant deterioration in prejudice (AME of % non-white British: -0.53^*).

In Model 3 we repeat this process for exploring the direct-effect and moderating-effect of openness to experience. We observe that individuals with a higher openness to experience report more positive prejudicial attitudes. However, openness to experience does not appear to moderate the relationship between percent non-white British and prejudicial attitudes: the interaction-term between an individual's openness to experience score and their neighbourhood percent non-white British is non-significant (Model 4). These dual findings can be observed in Fig. 2, generating predicted scores of out-group attitudes across levels of percent non-white British for high- and low-openness to experience individuals (based on Model 4, Table 2).

Model 5 tests the direct effect of extraversion, demonstrating that individuals scoring higher on extraversion report less prejudice. In Model 6 we then test whether one's extraversion moderates the effect of percent non-white British on prejudice attitudes. The interaction significant and positive, suggesting that a higher percent non-white British has a more positive impact on individuals' out-group attitudes if they have higher-levels of extraversion. We again plot predicted scores of out-group attitudes across levels of percent non-white British for high- and low-extraverted individuals (Fig. 3, based on Model 6, Table 2).

As with agreeableness, we again see two key takeaways. More extraverted individuals report much more positive out-group attitudes across all levels of non-white British. Moreover, increasing diversity has a significant positive-effect on attitudes among those with higher extraversion (AME of % non-white British: 0.35*) but a negative-effect on attitudes among those characterised by low extraversion (although this negative association is not significant: the AME of percent non-white British on attitudes among those with low-extraversion is: -0.26 n/s).

We turn next to exploring the role of Conscientiousness. In Model 7 we observe that an individual's conscientiousness score has no association with their out-group attitudes. In Model 8, we test whether conscientiousness moderates the impact of percent non-white British; however, the interaction-term is not statistically significant. This can be visually demonstrated by generating predicted scores of out-group attitudes across levels of non-white British for high- and low-conscientiousness individuals (Fig. 4, based on Model 8, Table 2).

Finally, we explore the role of Emotional Stability. In Model 9 we observe that individuals scoring higher on the emotional stability scale report more positive out-group attitudes (akin to the strength of extraversion, and similarly much weaker than agreeableness). In Model 10, we test whether one's emotional stability moderates the impact of percent non-white British. We observe a positive and significant interaction term, suggesting diversity has a more positive impact on out-group attitudes among individuals reporting higher emotional stability. We again plot predicted scores of out-group attitudes across levels of percent non-white British, but for high- and low-emotional stability individuals (Fig. 5, based on Model 10, Table 2).

Similar key takeaways emerge, as for the results for extraversion and agreeableness. Individuals reporting higher emotional stability at all levels of percent non-white British evince more positive out-group attitudes. We also appear to see a similar process of polarisation occurring between high-/low-emotional stability individuals in response to increasing diversity. Increasing diversity has a positive-effect on attitudes among those with higher emotional stability (AME of % non-white British: 0.42**) and a negative-effect on attitudes among those with low emotional stability (AME of % non-white British: -0.29^+).

Collectively, these findings suggest that individuals' personality traits are important for individuals' out-group attitudes. When

Table 2

Pooled cross-sectional modelling of the impact of % non-White British on out-group attitudes by Big 5 personality inventory.

Outcome	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes
Personality Trait	Agr	Agr	Open	Open	Extr	Extr	Conscientious	Conscientious	Emotional Stab	Emotional Stab	All traits
% non-white British	0.203* (0.085)	-0.723 (0.408)	0.170* (0.086)	0.075 (0.353)	0.196* (0.087)	-0.313 (0.273)	0.199* (0.087)	-0.236 (0.360)	0.198* (0.087)	-0.375 (0.240)	-1.436* (0.438)
Agreeableness	0.034*** (0.002)	0.031*** (0.002)									0.029*** (0.002)
Agreeableness * % non-white British		0.025* (0.011)									0.022* (0.011)
Openness to Experience			0.022*** (0.002)	0.021*** (0.002)							0.015*** (0.002)
Openness to Experience * % non-white British				0.003 (0.010)							
Extraversion					0.008*** (0.001)	0.007*** (0.002)					-0.006*** (0.002)
Extraversion * % non-white British						0.018* (0.009)					0.011 (0.009)
Conscientiousness							0.003 (0.002)	0.001 (0.002)			-0.010*** (0.002)
Conscientiousness * % non-white British								0.013 (0.011)			
Emotional Stability									0.010*** (0.001)	0.008*** (0.001)	0.008*** (0.001)
Emotional Stability * % non-white British										0.021* (0.008)	0.018* (0.008)
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Contextual Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	2.777*** (0.081)	2.872*** (0.091)	3.216*** (0.079)	3.226*** (0.087)	3.653*** (0.070)	3.706*** (0.075)	3.803*** (0.080)	3.850*** (0.089)	3.597*** (0.069)	3.656*** (0.073)	2.732*** (0.105)
BIC	21,706	21,712	21,732	21,741	22,106	22,113	21,866	21,874	21,987	21,988	20,341
N	9953	9953	9953	9953	9953	9953	9953	9953	9953	9953	9953

Notes: ***p < 0.001, **p < 0.01, *p < 0.05. Authors' computation on Wave 6 and 8 of NCDS dataset.

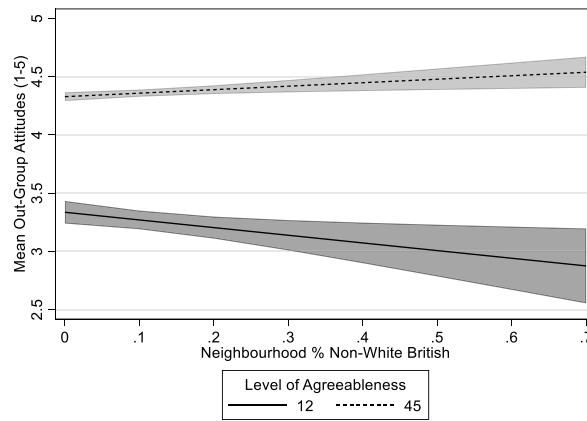


Fig. 1. Predicted Out-group attitudes across percent non-White British by level of Agreeableness.

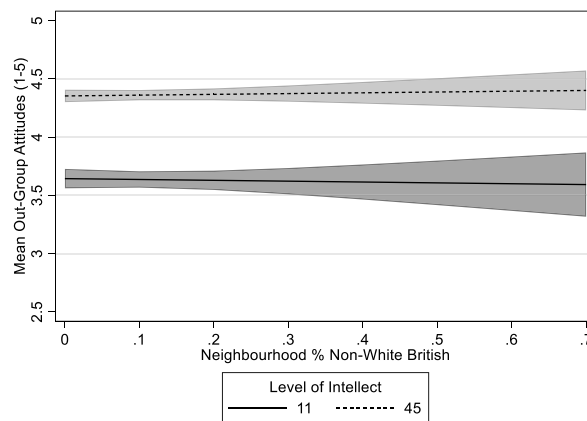


Fig. 2. Predicted Out-group attitudes across percent non-White British by level of Openness to Experience.

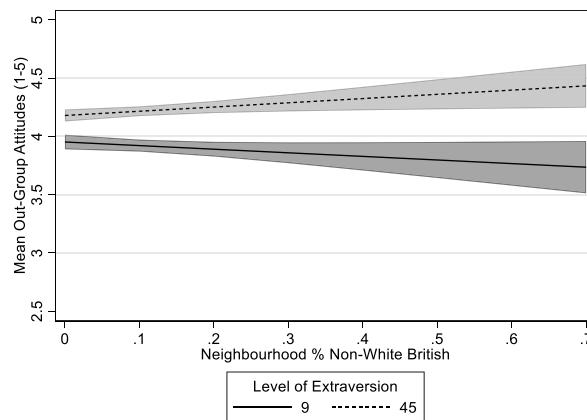


Fig. 3. Predicted Out-group attitudes across percent non-White British by level of Extraversion.

tested separately at least, it appears that people’s extraversion, emotional stability, openness to experience, and especially their agreeableness, all predict more positive out-group attitudes. In addition, we also observe that people’s agreeableness, extraversion and emotional stability moderate how they react to higher levels of neighbourhood diversity. Those with high scores on these trait scales actually see their attitudes improve at higher levels of neighbourhood ethnic diversity. Those scoring low on these trait scales generally see their attitudes worsen at lower levels of diversity.

However, thus far, we have been exploring each personality dimension separately. Yet, personality traits are mainly correlated. In Table 3, which shows the bivariate correlations between the five traits, we can see that there exists low to medium strength correlations between many of the personality-traits.

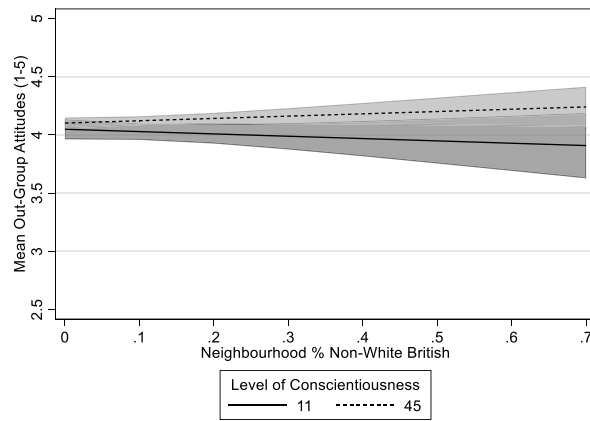


Fig. 4. Predicted Out-group attitudes across percent non-White British by level of Conscientiousness.

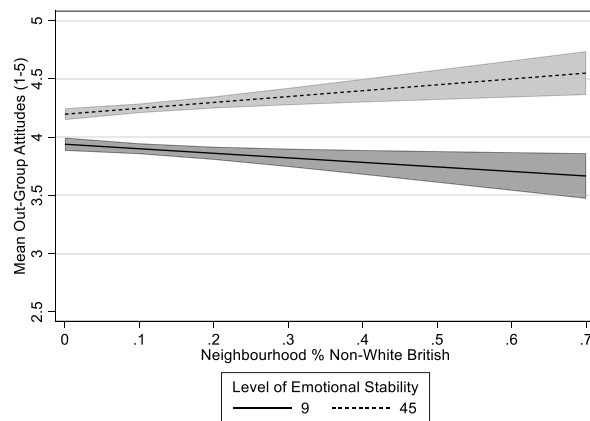


Fig. 5. Predicted Out-group attitudes across percent non-White British by level of Emotional Stability.

Accordingly, some of the findings we observed earlier for each personality trait (when testing the role of each trait separately) could be driven by shared variance with other personality traits. In order to ascertain whether the effects obtained remain robust when we consider potential shared variance and interrelations between the different personality traits we therefore decided in a next step to consider jointly all relevant personality-traits in a unique model. In this model we included the three interaction-terms we had previously observed to be significant: between percent non-white British and (a) Agreeableness; (b) Extraversion and (c) Emotional Stability (omitting the two interaction terms that were not significant). Model 11 in Table 2 therefore tests the moderating role of agreeableness, extraversion and emotional stability together in a single model. First, we observe that percent non-white British becomes negatively and significantly correlated with the outcome, suggesting that including personality characteristics may affect the relationship between the level of ethnic diversity and prejudice. Second, the moderating role of emotional stability and agreeableness remains strong and significant, while the moderating role of extraversion becomes non-significant. In sum, these two traits appear to be the key personality traits that moderate the impact of percent non-white British on out-group attitudes in our sample.

Up to this point, we have been treating personality-traits as exerting linear effects on out-group prejudice. However, the direct-effect of personality traits may be non-linear. Furthermore, the moderating effects of personality-traits may also be non-linear. In Table 4, we explore any non-linearity in the associations thus far observed (again, pursuing a pooled cross-sectional approach).

Table 3

Correlations between Big-5 personality traits.

Pairwise correlations (NCDS)					
Variables	Extraversion	Agreeableness	Emotional Stability	Openness to Experience	Conscientiousness
Extraversion	1				
Agreeableness	0.34	1			
Emotional Stability	0.21	0.04	1		
Openness to Experience	0.39	0.33	0.08	1	
Conscientiousness	0.15	0.28	0.2	0.24	1

Notes: correlation coefficient matrix restricted to analytic sample (n = 9953).

Table 4

Pooled cross-sectional modelling of the impact of % non-White British on out-group attitudes by Big 5 personality inventory (quadratic-effects).

Outcome	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes
	Agr	Agr	Open	Open	Extr	Extr	Conscientious	Conscientious	Emotional Stab	Emotional Stab	All traits
% non-white British	0.168* (0.081)	-5.179* (1.760)	0.167 (0.086)	2.298 (1.438)	0.196* (0.087)	-1.664* (0.746)	0.200* (0.087)	0.358 (1.173)	0.193* (0.087)	-0.892 (0.606)	-5.753* (1.792)
PERSONALITY											
Agreeableness	0.004 (0.014)	-0.024 (0.017)									-0.023 (0.017)
Agreeableness * Agreeableness	0.000* (0.000)	0.001* (0.000)									0.001* (0.000)
Agreeableness * % non-white British		0.278* (0.100)									0.273* (0.102)
Agreeableness * Agreeableness * % non-white British		-0.004* (0.001)									-0.004* (0.001)
Openness			-0.021 (0.014)	-0.016 (0.016)							0.015*** (0.002)
Openness * Openness			0.001* (0.000)	0.001* (0.000)							0.001 (0.000)
Openness * % non-white British				-0.130 (0.088)							
Openness * Openness * % non-white British				0.002 (0.001)							
Extraversion					0.007 (0.008)	-0.007 (0.010)					-0.006*** (0.002)
Extraversion * Extraversion					0.000 (0.000)	0.000 (0.000)					
Extraversion * % non-white British						0.116* (0.053)					0.012 (0.009)
Extraversion * Extraversion * % non-white British						-0.002 (0.001)					
Conscientiousness							0.009 (0.014)	0.005 (0.017)			-0.010*** (0.002)
Conscientiousness * Conscientiousness							-0.000 (0.000)	-0.000 (0.000)			
Conscientiousness * % non-white British								-0.028 (0.074)			-0.013 (0.011)
Conscientiousness * Conscientiousness * % non-white British								0.001 (0.001)			
Emotional Stability									-0.020* (0.007)	-0.028*** (0.008)	0.008*** (0.001)
Emotional Stability * Emotional Stability									0.001*** (0.000)	0.001*** (0.000)	0.001 (0.000)
Emotional Stability * % non-white British										0.053 (0.045)	0.017* (0.008)

(continued on next page)

Table 4 (continued)

Outcome	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes
	Agr	Agr	Open	Open	Extr	Extr	Conscientious	Conscientious	Emotional Stab	Emotional Stab	All traits
Emotional Stability *										-0.000 (0.001)	
Emotional Stability * % non-white British											
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Contextual Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	3.305*** (0.246)	3.843*** (0.303)	3.878*** (0.225)	3.779*** (0.264)	3.677*** (0.131)	3.902*** (0.148)	3.708*** (0.239)	3.778*** (0.282)	3.992*** (0.117)	4.138*** (0.129)	3.632*** (0.317)
BIC	21,704	21,720	21,727	21,743	22,114	22,129	21,875	21,892	21,978	23,981	20,372
N	9953	9953	9953	9953	9953	9953	9953	9953	9953	9953	9953

Notes: ***p < 0.001, **p < 0.01, *p < 0.05. Authors' computation on Wave 6 and 8 of NCDS dataset.

Models 1–2 (Table 4) examines non-linearity for agreeableness (including both a quadratic-term for agreeableness – Model 1, Table 4 and then adding an interaction between the quadratic personality measure and percent non-white British – Model 2, Table 4). From the previous analysis, we observed that agreeableness was the strongest and most consistent predictor of lower prejudice, and also that it was an important trait for moderating the impact of percent non-white British. Here, we first observe a positive non-linear association with prejudice attitudes i.e., as agreeableness increases, its positive effect on improving prejudicial attitudes also becomes stronger (Model 1). However, what is particularly striking is its non-linear moderating relationship with percent non-white British, which is statistically significant (Model 2). This is best understood by plotting the predicted levels of out-group attitudes across levels of percent non-white British for high-, medium- and low-agreeableness individuals but where the model includes the quadratic agreeableness term (Fig. 6, based on Table 4, Model 2).

What we see is that amongst high agreeableness individuals, out-group attitudes are again more positive across all levels of percent non-white British; however, we no longer see a positive impact of percent non-white British among this group (AME of % non-white British: 0.084 n/s). For medium-agreeableness individuals, we see that a higher percent non-white British has a small *negative* impact on their out-group attitudes (AME of % non-white British: -0.18 , although this is non-significant at conventional statistical levels). However, for low-agreeableness individuals we see a strong negative effect of percent non-white British on their out-group attitudes (AME of % non-white British: -2.38^{**}). For openness to experience, but also for emotional stability, we do observe a small non-linear direct-effects on prejudice. However, we also observe no non-linearity in their moderating relationship with percent non-white British (Models 3–4 and Models 9–10). We observe no non-linearity in the direct association between extraversion and prejudice nor a moderating association with percent non-white British (Models 5–6). This is also true of the impact of conscientiousness on prejudice (Models 7–8). In Model 11, we include all the significant measures together in a single model, which continues to demonstrate the strong quadratic-effect of agreeableness.

In sum, our examination of potential non-linearity does not radically change our understanding of most of the previous findings on personality traits and their conditioning role for percent non-white British. The exception is agreeableness. We now observe its conditioning role is even stronger; in particular, percent non-white British has a negative impact on individuals with medium- and low-agreeableness. As scores on agreeableness decrease, this negative effect gets stronger and stronger, with a strikingly negative impact on prejudicial attitudes among those with low-agreeableness.

We next turn to evaluate the effect of change in ethnic diversity over time, and more robustly testing whether personality traits moderates the effect on prejudicial attitudes through the use of fixed-effect panel data modelling (Table 5).

Models 1 through 5 set out to test the moderating role of each personality trait in the association between percent non-white British and out-group attitudes, via an interaction-term between each personality trait and the percentage of non-white British residents in one's neighbourhood. First, we observe that across models that include an interaction term with agreeableness, extraversion and conscientiousness respectively, the relationship between percent non-white British and the outcome is negative and significant. We then observe that agreeableness (Model 1) and continues to moderate the effect of percent non-white British, even under more robust modelling. Fig. 7 show graphically the effect of the moderation, and the increase in the gap in terms of prejudice between those characterised by high/low levels of agreeableness at higher levels of change in diversity.

In Model 2, openness to experience does not have any significant moderating effect. Extraversion, on the other hand, positively and significantly moderates the effect of the percentage of non-white British residents (Model 3). Fig. 8 showcases the effect of the moderation graphically for high/low extraverted individuals.

Conscientiousness also positively and significantly moderates the impact of percent non-white British (Model 4), as illustrated in Fig. 9, which displays a similar pattern to that of agreeableness and extraversion.

Finally, emotional stability has no significant moderating effect (Model 5).

Again though, as discussed above, we need to model all these significant interaction-terms together to explore whether one may be driving the association of another. Thus, in Model 6, we include the three key interaction-terms between percent non-white British and agreeableness, extraversion and conscientiousness. Here we find that it is only one's agreeableness score that significantly moderates

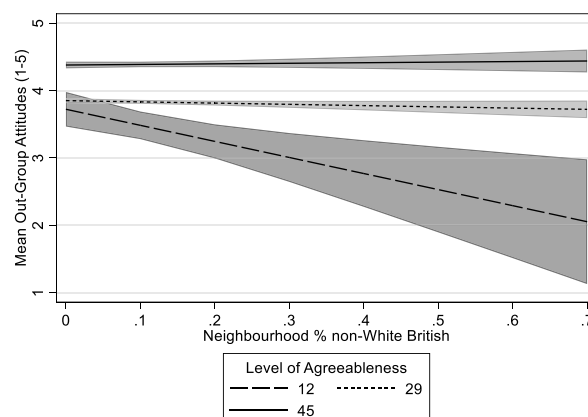


Fig. 6. Predicted Out-group attitudes across percent non-White British by level of Agreeableness (Quadratic).

Table 5
Fixed-effects modelling of the impact of % non-White British on out-group attitudes by Big 5 personality inventory.

Outcome	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes	Out-group Attitudes
Personality Trait	Agr	Open	Extr	Conscientious	Emotional Stab	All traits
% non-white British	-2.894*** (0.802)	0.278 (0.760)	-1.595* (0.636)	-2.069* (0.805)	-0.904 (0.654)	-4.745*** (1.111)
Agreeableness	-	-	-	-	-	-
Agreeableness * % non-white British	0.080*** (0.022)	-	-	-	-	0.058* (0.024)
Openness to Experience	-	-	-	-	-	-
Openness to Experience * % non-white British	-	-0.009 (0.023)	-	-	-	-
Extraversion	-	-	-	-	-	-
Extraversion * % non-white British	-	-	0.056* (0.021)	-	-	0.030 (0.022)
Conscientiousness	-	-	-	-	-	-
Conscientiousness * % non-white British	-	-	-	0.062* (0.024)	-	0.022 (0.022)
Emotional Stability	-	-	-	-	-	-
Emotional Stability * % non-white British	-	-	-	-	0.032 (0.021)	-
Individual (Time-varying) Controls	Yes	Yes	Yes	Yes	Yes	Yes
Contextual (Time-varying) Controls	Yes	Yes	Yes	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	4.062*** (0.091)	4.063*** (0.091)	4.064*** (0.091)	4.059*** (0.091)	4.065*** (0.091)	4.061*** (0.091)
N	9953	9953	9953	9953	9953	9953

Notes: ***p < 0.001, **p < 0.01, *p < 0.05. Authors' computation on Wave 6 and 8 of NCDS dataset.

the effect of changes in local ethnic diversity on their prejudicial attitudes; extraversion, emotional stability and conscientiousness are all rendered non-significant when included together in a model.

Lastly, to further explore the moderating effects of personality traits, we turn to test for the presence of any non-linearity in the moderating effects of personality traits (as observed in the pooled cross-sectional analysis) but now within the fixed-effects framework (Table 6, available in Supplementary Material). However, we do not detect any non-linearity effects, not even for agreeableness.

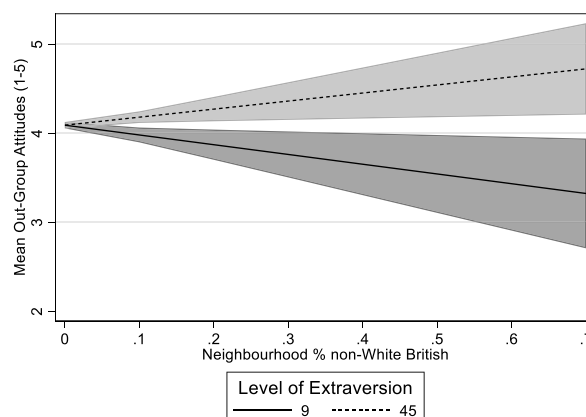


Fig. 7. Predicted Out-group attitudes across percent non-White British by level of Extraversion (Fixed-Effects Analysis).

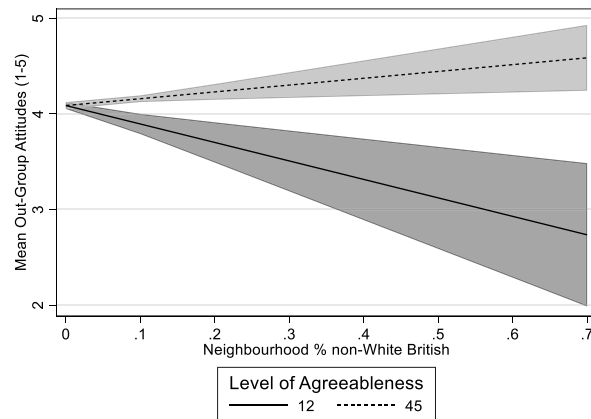


Fig. 8. Predicted Out-group attitudes across percent non-White British by level of Agreeableness (Fixed-Effects Analysis).

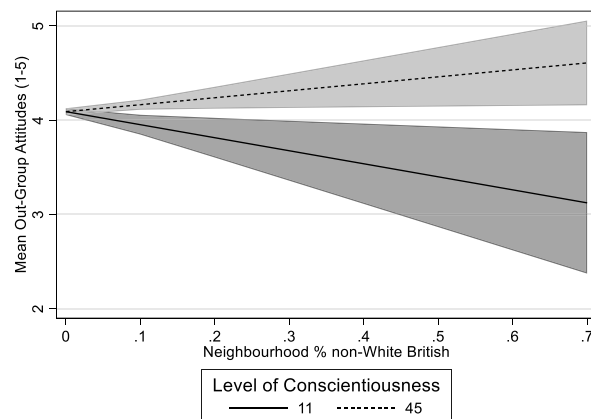


Fig. 9. Predicted Out-group attitudes across percent non-White British by level of Conscientiousness (Fixed-Effects Analysis).

8. Discussion and conclusion

The aim of this paper was to explore what role (if any) personality traits might play in conditioning how white British individuals respond to both absolute levels and changes in ethnic diversity in their neighbourhoods, respectively. Taken together our results reveal several key findings. Firstly, both an individual's personality traits and the level of neighbourhood diversity matter for their intergroup attitudes. Secondly, personality traits, and in particular, one's levels of agreeableness, do appear important for conditioning how the proportion of non-white British in one's neighbourhood affects their prejudicial attitudes. Given this is demonstrated in both pooled cross-sectional and fixed-effects modelling among residential stayers strengthens the robustness of this finding, and confirms our theoretical predictions. The central role played by agreeableness in our sample thus corresponds to earlier studies showing this trait to be associated with reduced intergroup hostility (Crawford and Brandt, 2019). Individuals with high agreeableness tend to be more tolerant of outgroup members and less likely to hold negative stereotypes.

Among individuals with high agreeableness, increasing exposure to both higher levels of, and positive changes in, ethnic diversity appears to be associated with improved prejudicial attitudes. Among individuals with low agreeableness on the contrary, higher levels of, and positive changes in, diversity appears to harm their outgroup attitudes, to a significant extent. In other words, one's level of agreeableness appears to determine how one reacts to neighbourhood diversity, potentially leading to an even greater polarisation in outgroup attitudes between low-/high agreeableness residents as neighbourhoods become more diverse.

Contrary to our predictions and prior research, we were unable to find robust evidence for the effect of openness to experience. One potential explanation for this unexpected result could be that the type of indicators used within the NCDS to investigate the concept of openness to experience tend to reflect more the imaginative and idealistic, rather than curious, type of personality. Each overarching personality trait encompasses multiple facets, and it might be that some facets might be more, or in this case less, relevant to different outcomes, such as prejudicial attitudes. Instead, but only for higher levels of diversity and not for changing levels diversity, we find a moderating role of emotional stability which persists, as for agreeableness, even in the empirical model that includes all relevant personality traits. We did not have a specific prediction concerning emotional stability, due to the mixed findings characterising the literature. However, results seem to point to the fact that the more/less emotionally stable are individuals, the less/more likely they are to express prejudice. Here, it seems characteristics like security and self-confidence might affect how individuals perceive the fact of

living in a neighbourhood characterised by a high level of diversity.

Overall, our findings on the robust effect of agreeableness appear consistent with theories on inter-group contact and perceived threat perceptions, to the extent that it might be people who score high in agreeableness who are more likely to engage in intergroup contact as diversity increases, while people who score low in agreeableness do not. Prior research has shown that contact moderates the effect of diversity on intergroup attitudes: diversity has either no effects or positive effects for people who have positive contact, but a negative effect for people without contact (Stein et al., 2000; Laurence, 2014). Therefore, individuals who are more agreeable might gain more benefits from contact as diversity increases and thus experience no negative effect. Less agreeable people, instead, might experience contact less favourably, with greater diversity thus triggering threat perceptions and adversely affecting intergroup attitudes. This may be especially the case at extremely high levels of ethnic diversity, as shown in the pooled cross-sectional model with quadratic effects, and in the areas where the pace of change is greater, as shown by the fixed effect model. Thus, although our findings seem to be aligned with the literature on contact and threat theory, we cannot go beyond this theoretical conjecture here, since unfortunately, due to data constraints and missing measures, we were unable to test the extent to which these mechanisms of contact or threat apply. It thus remains for future research to investigate this potential mechanism of contact.

A number of additional limitations apply to this research. First, it might be the case that, due to social desirability bias, individuals scoring high in agreeableness have a much higher tendency to answer questions on their attitudes toward ethnic minorities in a manner that will be viewed favourably by others (i.e., higher social desirability bias) than those scoring low on agreeableness, regardless of the level of diversity. Nonetheless, research does not suggest that higher levels of agreeableness tend to be associated with self-favouring bias (Graziano and Tobin, 2002). Furthermore, we looked at the correlation between agreeableness and two different items that may be particularly prone to social desirability bias (self-reported life satisfaction and agreement on the extent to which women should have the right to abortion), which amounted to respectively 0.08 and 0, being basically null. All of this thus supports the idea that the significant interaction effect we observe is not necessarily driven by social desirability bias. Second, we need to acknowledge that our results do refer to a specific group of individuals, that is mid-aged adults in the UK, whereas we are not able to investigate the extent to which the effects we observe may vary depending on age and generational features. Nonetheless, the fact that we observe this moderating effect of agreeableness within a more robust framework (adjusting for all individual- and contextual-level time invariant unobserved heterogeneity) significantly strengthens our confidence that certain personality traits, and in particular agreeableness, matter for how people respond to increasing ethnic diversity.

The information that supports the conclusions of this study are available from the UK Data Service. Restrictions on the use of these data, which were used under license for this study, include the requirement of a signed agreement and the need to register with the service. Data are available at <https://beta.ukdataservice.ac.uk/datacatalogue/studies/study?id=8085> with the permission of Centre for Longitudinal Studies.

All research methods were approved by the Ethics Committee of the Centre for Longitudinal Study, which ensured the safety and privacy of participants.

No specific funding was awarded for this project.

Declaration of interest

The authors report there are no competing interests to declare.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ssresearch.2023.102919>.

References

- Ackermann, K., Ackermann, M., 2015. The big five in context: personality, diversity and attitudes toward equal opportunities for immigrants in Switzerland. *Swiss Polit. Sci. Rev.* 21 (3), 396–418.
- Ackermann, K., Ackermann, M., Freitag, M., 2018. Opting for an open society? Personality traits and attitudes toward the openness of Switzerland. *Comp. Eur. Polit.* 16 (3), 413–433.
- Adorno, T., Frenkel-Brenswik, E., Levinson, D.J., Sanford, R.N., 1950. *The Authoritarian Personality*. Harper, New York.
- Akrami, N., Ekehammar, B., Bergh, R., 2011. Generalized prejudice: common and specific components. *Psychol. Sci.* 22 (1), 57–59.
- Allport, G., 1954. *The Nature of Prejudice*. Basic Books, New York, NY.
- Altemeyer, B., 1988. *Enemies of Freedom: Understanding Right-Wing Authoritarianism*. Jossey-Bass.
- Antonoplis, S., John, O.P., 2022. Who has different-race friends, and does it depend on context? Openness (to other), but not agreeableness, predicts lower racial homophily in friendship networks. *J. Pers. Soc. Psychol.* 122 (5), 894.
- Blalock, H.M., 1967. Status inconsistency, social mobility, status integration and structural effects. *Am. Socio. Rev.* 790–801.
- Borkowska, M. & Laurence, J. (forthcoming) *the Role of Ethnic Diversity and Residential Segregation in Shaping Anti-immigrant Sentiment and Support for Brexit*.
- Crawford, J.T., Brandt, M.J., 2019. Who is prejudiced, and toward whom? The big five traits and generalized prejudice. *Pers. Soc. Psychol. Bull.* 45 (10), 1455–1467.
- Curtice, J., 2017. Why leave won the UK's EU referendum. *J. Common Mkt. Stud.* 55, 19.
- Danckert, B., Dinesen, P.T., Klemmensen, R., Nørgaard, A.S., Stolle, D., Sønderkov, K.M., 2017. With an open mind: openness to experience moderates the effect of interethnic encounters on support for immigration. *Eur. Socio Rev.* 33 (5), 721–733.
- Dinesen, P.T., Klemmensen, R., Nørgaard, A.S., 2016. Attitudes toward immigration: the role of personal predispositions. *Polit. Psychol.* 37 (1), 55–72.
- Dinesen, P.T., Schaeffer, M., Sønderkov, K.M., 2020. Ethnic diversity and social trust: a narrative and meta-analytical review. *Annu. Rev. Polit. Sci.* 23, 441–465.

- Duckitt, J., Sibley, C.G., 2010. Right-wing authoritarianism and social dominance orientation differentially moderate intergroup effects on prejudice. *Eur. J. Pers.* 24 (7), 583–601.
- Dustmann, C., Casanova, M., Fertig, M., Preston, I., Schmidt, C.M., 2003. The Impact of EU Enlargement on Migration Flows (No. 25/03. Research Development and Statistics Directorate, Home Office).
- Ekehammar, B., Akrami, N., Gylje, M., Zakrisson, I., 2004. What matters most to prejudice: big five personality, social dominance orientation, or right-wing authoritarianism? *Eur. J. Pers.* 18, 463–482.
- Gallego, A., Pardos-Prado, S., 2014. The big five personality traits and attitudes towards immigrants. *J. Ethnic Migrat. Stud.* 40 (1), 79–99.
- Gerber, A.S., Huber, G.A., Doherty, D., Dowling, C.M., Ha, S.E., 2010. Personality and political attitudes: relationships across issue domains and political contexts. *Am. Polit. Sci. Rev.* 104 (1), 111–133.
- Goldberg, L.R., Johnson, J.A., Eber, H.W., Hogan, R., Ashton, M.C., Cloninger, C.R., Gough, H.G., 2006. The international personality item pool and the future of public-domain personality measures. *J. Res. Pers.* 40 (1), 84–96.
- Goodwin, M., Milazzo, C., 2017. Taking back control? Investigating the role of immigration in the 2016 vote for Brexit. *Br. J. Polit. Int. Relat.* 19 (3), 450–464.
- Graziano, W.G., Bruce, J., Sheese, B.E., Tobin, R.M., 2007. Attraction, personality, and prejudice: liking none of the people most of the time. *J. Pers. Soc. Psychol.* 93 (4), 565.
- Graziano, W.G., Tobin, R.M., 2002. Agreeableness: dimension of personality or social desirability artifact? *J. Pers.* 70 (5), 695–728.
- Heisig, J.P., Schaeffer, M., 2019. Why you should always include a random slope for the lower-level variable involved in a cross-level interaction. *Eur. Socio Rev.* 35 (2), 258–279.
- Hello, E., Scheepers, P., Slegers, P., 2006. Why the more educated are less inclined to keep ethnic distance: an empirical test of four explanations. *Ethn. Racial Stud.* 29 (5), 959–985.
- Hodson, G., Hogg, S.M., MacInnis, C.C., 2009. The role of “dark personalities” (narcissism, Machiavellianism, psychopathy), Big Five personality factors, and ideology in explaining prejudice. *J. Res. Pers.* 43 (4), 686–690.
- Hodson, G., Dhont, K., 2015. The person-based nature of prejudice: individual difference predictors of intergroup negativity. *Eur. Rev. Soc. Psychol.* 26 (1), 1–42.
- Hopkins, D.J., 2010. Politicized places: explaining where and when immigrants provoke local opposition. *Am. Polit. Sci. Rev.* 104 (1), 40–60.
- Jackson, J.W., Poulsen, J.R., 2005. Contact experiences mediate the relationship between five-factor model personality traits and ethnic prejudice. *J. Appl. Soc. Psychol.* 35 (4), 667–685.
- Jivraj, S., 2012. How Has Ethnic Diversity Grown 1991-2001-2011? the Dynamics of Diversity: Evidence from the 2011 Census. Centre on Dynamics of Ethnicity (CoDE), University of Manchester retrieved at: <http://hummedia.manchester.ac.uk/institutes/code/briefings/dynamicsofdiversity/how-has-ethnic-diversity-grown-1991-2001-2011.pdf>.
- Johnston, C.D., Newman, B.J., Velez, Y., 2015. Ethnic change, personality, and polarization over immigration in the American public. *Publ. Opin. Q.* 79 (3), 662–686.
- Jokela, M., Bleidorn, W., Lamb, M.E., Gosling, S.D., Rentfrow, P.J., 2015. Geographically varying associations between personality and life satisfaction in the London metropolitan area. *Proc. Natl. Acad. Sci. USA* 112 (3), 725–730.
- Kaufmann, E., 2017. Levels or changes?: ethnic context, immigration and the UK Independence Party vote. *Elect. Stud.* 48, 57–69.
- Kaufmann, E., Goodwin, M., 2018. The diversity wave: a meta-analysis of the native-born white response to ethnic diversity. *Soc. Sci. Res.* 76, 120–131.
- Kinder, D.R., Sears, D.O., 1981. Prejudice and politics: symbolic racism versus racial threats to the good life. *Journal of personality and social psychology* 40 (3), 414.
- Kros, M., Hewstone, M., 2020. Negative and positive interethnic contact and the association of ethnic neighbourhood composition with trust, cohesion, and prejudice. *Eur. Socio Rev.* 36 (6), 937–956.
- Kawalerowicz, J., 2021. Too many immigrants: how does local diversity contribute to attitudes toward immigration? *Acta Sociol.* 64 (2), 144–165.
- Laurence, J., 2014. Reconciling the contact and threat hypotheses: does ethnic diversity strengthen or weaken community inter-ethnic relations? *Ethn. Racial Stud.* 37 (8), 1328–1349.
- Laurence, J., Bentley, L., 2016. Does ethnic diversity have a negative effect on attitudes towards the community? A longitudinal analysis of the causal claims within the ethnic diversity and social cohesion debate. *Eur. Socio Rev.* 32 (1), 54–67.
- Laurence, J., Bentley, L., 2018. Countervailing contact: community ethnic diversity, anti-immigrant attitudes and mediating pathways of positive and negative inter-ethnic contact in European societies. *Soc. Sci. Res.* 69, 83–110.
- Matić, J., Löw, A., Bratko, D., 2019. Personality and ideological bases of anti-immigrant prejudice among Croatian youth. *J. Ethnic Migrat. Stud.* 45 (13), 2387–2406.
- Meleady, R., Seger, C.R., Vermue, M., 2017. Examining the role of positive and negative intergroup contact and anti-immigrant prejudice in Brexit. *Br. J. Soc. Psychol.* 56 (4), 799–808.
- McCrae, R.R., Costa, P.T., 1985. Updating Norman's "adequacy taxonomy": intelligence and personality dimensions in natural language and in questionnaires. *Journal of personality and social psychology* 49 (3), 710.
- Mondak, J.J., 2010. Personality and the Foundations of Political Behavior. Cambridge University Press, Cambridge.
- Mondak, J.J., Hibbing, M.V., Canache, D., Seligson, M.A., Anderson, M.R., 2010. Personality and civic engagement: an integrative framework for the study of trait effects on political behavior. *Am. Polit. Sci. Rev.* 104 (1), 85–110.
- Newman, B.J., 2013. “Acculturating contexts and anglo opposition to immigration in the United States” *American J. Polit. Sci.* 57 (2), 374–390.
- Oliver, E.J., Wong, J., 2003. Intergroup prejudice in multiethnic settings. *Am. J. Polit. Sci.* 47 (4), 567–582.
- Pettigrew, T.F., 1998. Intergroup contact theory. *Annu. Rev. Psychol.* 49 (1), 65–85.
- Pettigrew, T.F., Tropp, L.R., 2006. A meta-analytic test of intergroup contact theory. *Journal of personality and social psychology* 90 (5), 751.
- Pottie-Sherman, Y., Wilkes, R., 2017. Does size really matter? On the relationship between immigrant group size and anti-immigrant prejudice. *Int. Migrat. Rev.* 51 (1), 218–250.
- Pratto, F., Sidanius, J., Stallworth, L.M., Malle, B.F., 1994. Social dominance orientation: a personality variable predicting social and political attitudes. *J. Pers. Soc. Psychol.* 67, 741–763.
- Quillian, L., 1995. Prejudice as a response to perceived group threat: population composition and anti-immigrant and racial prejudice in Europe. *Am. Socio. Rev.* 586–611.
- Schmid, K., Al Ramiah, A., Hewstone, M., 2014. Neighborhood ethnic diversity and trust: the role of intergroup contact and perceived threat. *Psychol. Sci.* 25 (3), 665–674.
- Schlueter, E., Scheepers, P., 2010. The relationship between outgroup size and anti-outgroup attitudes: a theoretical synthesis and empirical test of group threat-and intergroup contact theory. *Soc. Sci. Res.* 39 (2), 285–295.
- Sibley, C.G., Duckitt, J., 2008. Personality and prejudice: a meta-analysis and theoretical review. *Pers. Soc. Psychol. Rev.* 12 (3), 248–279.
- Simpson, L., 2014. How Has Ethnic Diversity Changed in Scotland? the Dynamics of Diversity: Evidence from the 2011 Census. Centre on Dynamics of Ethnicity (CoDE), University of Manchester retrieved at: http://hummedia.manchester.ac.uk/institutes/code/briefings/dynamicsofdiversity/code-census-briefing-scotland_v2.pdf.
- Stein, R.M., Post, S.S., Rinden, A.L., 2000. Reconciling context and contact effects on racial attitudes. *Polit. Res. Q.* 53 (2), 285–303. Laurence 2015.
- Strauss, J.P., Connerley, M.L., Ammermann, P.A., 2003. The “threat hypothesis,” personality, and attitudes toward diversity. *J. Appl. Behav. Sci.* 39 (1), 32–52.
- The Migration Observatory, 2016. Emigration, Immigration and Net Migration in the UK, 1991-2015. Retrieved at: <https://migrationobservatory.ox.ac.uk/resources/charts/emigration-immigration-net-migration-uk-1991-2014/>.
- Turner, R.N., Hodson, G., Dhont, K., 2020. The role of individual differences in understanding and enhancing intergroup contact. *Social and Pers. Psychol. Compass* 14 (6), e12533.
- University of London, Institute of Education, 2021a. Centre for longitudinal studies. In: National Child Development Study: Age 42, Sweep 6 (And Sweep 6 Geographical Identifiers (1999-2000 Secure Access)) [data collection]. Joint Centre for Longitudinal Research, [original Data Producer(s)]. Joint Centre for Longitudinal Research. <https://doi.org/10.5255/UKDA-SN-5578-1>. SN: 5578 (SN: 7846).

- University of London, Institute of Education, 2021b. Centre for longitudinal studies. In: National Child Development Study: Age 50, Sweep 8 (And Sweep 8 Geographical Identifiers (2008-2009 Secure Access)) [data collection]. Joint Centre for Longitudinal Research, [original Data Producer(s)]. Joint Centre for Longitudinal Research. <https://doi.org/10.5255/UKDA-SN-7867-1>. SN: 6137 (SN: 7867).
- Van Assche, J., Roets, A., Dhont, K., Van Hiel, A., 2014. Diversity and out-group attitudes in The Netherlands: the role of authoritarianism and social threat in the neighbourhood. *J. Ethnic Migrat. Stud.* 40 (9), 1414–1430.
- Van der Brug, W., Fennema, M., Tillie, J., 2000. Anti-immigrant parties in Europe: ideological or protest vote? *Eur. J. Polit. Res.* 37 (1), 77–102.
- Van Heerden, S., Ruedin, D., 2019. How attitudes towards immigrants are shaped by residential context: the role of ethnic diversity dynamics and immigrant visibility. *Urban Stud.* 56 (2), 317–334.
- Wagner, U., Christ, O., Pettigrew, T.F., Stellmacher, J., Wolf, C., 2006. Prejudice and minority proportion: contact instead of threat effects. *Soc. Psychol. Q.* 69 (4), 380–390.
- Watt, N., Wintour, P., 2015. How Immigration Came to Haunt Labour: the inside Story. Published on March 24th, The Guardian. Available at: <https://www.theguardian.com/news/2015/mar/24/how-immigration-came-to-haunt-labour-inside-story>.
- Weber, H., 2019. Attitudes towards minorities in times of high immigration: a panel study among young adults in Germany. *Eur. Socio Rev.* 35 (2), 239–257.