Where to live? English proficiency and residential location of UK migrants.*

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ABSTRACT

This study aims to identify the causal effects of English proficiency on residential location choices of immigrants. Based on the ideas that (i) immigrants whose mother tongue is linguistically close to English learn the language more easily, and that (ii) young children learn a new language more easily than older children, we construct an instrument for English proficiency, exploiting linguistic distance from English, and age at arrival in the United Kingdom for childhood migrants. Using a unique dataset, we construct various measures of residential clustering aimed at capturing different types of immigrant enclave, and find a negative impact of better English skills on residency in a language enclave, but a *positive* impact on residency in an ethnic enclave. We also find strong evidence of an impact of poorer English proficiency on living in a neighbourhood of lower quality. *Keywords*: Language skills, residential clustering, enclave, neighbourhood quality. *JEL codes:* J15, R23, Z13.

1. Introduction

The integration of immigrants is becoming an increasingly important policy objective in various developed countries, following an increase in the immigrant population over the past decade (OECD/European Union, 2018). It is widely believed that proficiency in the language spoken in

*Acknowledgments: the permission of the Office for National Statistics to use the Longitudinal Study is gratefully acknowledged, as is the help provided by staff of the Centre for Longitudinal Study Information & User Support (CeLSIUS). CeLSIUS is funded by the ESRC under project ES/V003488/1. The authors alone are responsible for the interpretation of the data. Financial support from the Scottish Institute for Research in Economics and Carnegie Trust for the Universities of Scotland is gratefully acknowledged. We also thank the participants of the conferences of the EALE/SOLE online, the ESPE Barcelona online, the Scottish Economic Society online, and of the seminars at the University of Warwick, University of Curtin Australia, and Institute for Labour Law and Industrial Relations in the European Union.

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the host country is an important factor for promoting integration, and in fact there is vast literature analysing and establishing the relation between host-country language skills and immigrant labour market integration (e.g., Chiswick and Miller, 2014). There is also a growing literature studying the role of language skills in explaining immigrant social outcomes, such as education (e.g., Aoki and Santiago, 2018). However, there is still limited knowledge on the causal impact of language skills on one of the key aspects of integration; namely, residential integration. We aim to fill this gap and contribute to the literature on the impact of language skills on immigrant outcomes by studying a variety of residential outcomes, that measure the extent of residential clustering and the quality of the neighbourhood immigrants reside in. Given that a significant extent of residential segregation is observed in the United Kingdom (UK) and elsewhere,[1] and that residential environments are found to have a significant impact on social, behavioural and labour market outcomes,[2] it is informative to know the role host-country language skills play in explaining immigrant residential environments.

We analyse two sets of residential outcomes. First, we construct measures of the extent of residential clustering of migrants, aimed at capturing the concept of enclave along four dimensions: main language spoken by residents (language enclave), ethnicity (ethnic enclave), country of birth (country-of-birth enclave), and world region of birth (region-of-birth enclave). We then analyse whether language skills of migrants affect location choices of their residence in these different types of enclave. Distinguishing different types of enclave is important, as language skills can have a heterogeneous impact on location choices in different types of enclave. For example, migrants fluent in English may not choose to live in a language enclave, if the reason for living in an enclave is simply for linguistic convenience. However, migrants proficient in English may decide to live in an ethnic enclave if they value other aspects of living in an enclave, such as offering employment networks, cultural amenities, or protection from possible discrimination they might face outside of the enclave. What aspects of living in an enclave migrants value, and thus how English proficiency affects location choices in different types of enclave, is an empirical question.

Second, we study the quality of the neighbourhood migrants live in, where the quality is measured at a small geographical area of an average of 1,500 individuals. We can conduct this analysis by linking a unique dataset from the Office for National Statistics (ONS) Longitudinal Study, which contains individual-level data from the England and Wales 2011 Census, to the

[1] For example, over half of Britain's ethnic minority population lives in only three cities, London, Manchester and Birmingham (Sunak and Rajeswaran, 2014). Immigrant/ethnic minority residential segregation is well documented in other host countries, including United States (US) (Galster and Sharkey, 2017; OECD, 2021).

[2] There is a strand of literature finding 'neighbourhood effects' on individual outcomes (e.g., see Vigdor, 2006 for a review; Damm, 2014; Weinhardt, 2014). There is another strand of literature, focusing on minority groups, that finds positive effects (Edin et al., 2003; Munshi, 2003; Cutler et al., 2008; Damm, 2009), negative effects (Borjas, 2000) and mixed effects (Beaman, 2012) of ethnic/immigrant concentration on their labour market outcomes.

indices measuring neighbourhood quality in England. The various measures of neighbourhood quality we exploit capture different quality dimensions (i.e., the extent of income, employment, and health deprivation of residents), allowing us to analyse residential environments in which migrants with different levels of English proficiency live. It is important to analyse this, since lower language proficiency might have amplifying negative effects, if it not only directly affects migrants'social and labour market outcomes, as shown in the existing literature to be summarised in Section 2, but also indirectly affects their outcomes through neighbourhood effects in their residential areas. We are not aware of any other studies that have provided arguably causal evidence on the impact of language proficiency on the quality of the neighbourhood in which migrants reside.

A major challenge to identify the causal effect is the endogeneity of language skills. First, the residential location of migrants may affect their English skills (reverse causality). Second, there may be unobserved characteristics across individuals, correlated with both English skills and residential outcomes (e.g., ability). Third, the self-reported measure of English skills used in our analysis may contain measurement error. To address these possible endogeneity concerns, the seminal papers, Bleakley and Chin (2004; 2010), rely on an instrumental variable (IV) strategy, where an interaction of age at arrival with a dummy variable for being born in a non-Anglophone country is used as an IV for English skills. The idea underlying the specification of their instrument is as follows: upon arrival in the host country, all migrants are exposed to a new environment, but only those born in a non-Anglophone country encounter a new language. Thus, the difference in the outcomes of early and late arrivers from an Anglophone country would only reflect age-at-arrival effects, while the difference in the outcomes of migrants from a non-Anglophone country would reflect those same age-at-arrival effects and an additional effect, the language effect. Thus, a difference in the outcomes between early and late arrivers born in a non-Anglophone country, in excess of the corresponding difference for Anglophone migrants can be attributed to the effect of language.

Their identification strategy relies on two assumptions, among others, that (i) Anglophone and non-Anglophone migrants are exposed to the same age-at-arrival effects in the host country, and (ii) any changes in cohort quality over time occurred in the same manner between the two sets of migrants. If one or both of these assumptions do not hold, the use of their instrument does not tease out the effects of language. This is an important concern that a large number of papers using this type of identification strategy face (e.g., Bleakley and Chin, 2004, 2010; Akbulut-Yuksel et al., 2011; Miranda and Zhu, 2013; Guven and Islam, 2015; Yao and van Ours, 2015; Clarke and Isphording, 2017). We attempt to address these concerns by using Bleakley and Chin's (2004; 2010) instrument, an interaction of age at arrival with a non-Anglophone dummy, as a control variable to account for possibly different assimilation processes, and for differential changes in cohort quality between the two sets of immigrants. We then instead construct our

instrument, by interacting age at arrival with linguistic distance between the origin-country language and English. Our strategy to identify the causal impact of English skills is therefore based on the comparison of early and late arrivers in the UK among migrants with varying linguistic distances to English language. Our identification strategy, which exploits the variation within non-Anglophone migrants distinguished by linguistic distance to English, is more suitable for the study on residential location choices than Bleakley and Chin's (2004; 2010) strategy, where all non-Anglophone migrants are bundled into a single group, as different immigrant groups have different tendencies to cluster.

Our IV estimates indicate that language skills have a heterogeneous impact on residency in different types of enclave: poorer English skills significantly lead migrants to live in areas with a higher concentration of individuals who speak their native language (i.e., language enclave). In contrast, we find positive effects of better English proficiency on residency in an ethnic enclave and a world-region-of-birth enclave, suggesting that *better* English skills lead migrants to live in those types of enclave. Our results highlight the importance of distinguishing different types of enclave, and suggest different mechanisms of the impact of language skills at play. Turning to the quality of the neighbourhood where migrants live, we find strong evidence that poorer English skills lead migrants to live in a neighbourhood of lower quality. Our supplementary analysis finds that better educational attainment as a result of better English skills is likely to be a key channel through which language impacts neighbourhood quality outcomes, but is not a key channel for residential clustering outcomes.

The rest of the paper is structured as follows: Section 2 starts by reviewing the broad literature on language skills and immigrant outcomes, followed by a review of the specific literature on residential clustering and on neighbourhood quality. Section 3 describes datasets, how our main variables (e.g, residential clustering) are constructed, and our sample specification. Section 4 reviews the empirical framework which has been widely used to analyse the causal impact of language skills, and then presents our identification strategy, highlighting the differences from the past literature. Section 5 presents our empirical results, and compares them to the results obtained from the empirical models used in the existing literature. Section 6 conducts a series of robustness checks, addressing various concerns related to the validity of our identification strategy, and also presents an extension to our main analysis. Finally, Section 7 discusses policy implications and conclusions.

2. Background of literature

The relation between host-country language proficiency and immigrant outcomes is a topic that has attracted attention of economists and other social scientists over the past few decades. To date, the effects of language proficiency on labour market outcomes of immigrants have been

studied extensively.[3] Although not as extensive, there is also a growing literature studying the impact of language skills on immigrant social outcomes, including education and health.[4] Our paper studies one of the social outcomes; namely, residential environments in which immigrants live, captured by the extent of residential clustering and the quality of the neighbourhood immigrants live in. In the following sub-sections, we specifically focus on the literature on residential clustering and neighbourhood quality, and highlight the differences from our paper.

2.1. Language skills and residential clustering

Starting from the studies on migrant's residential clustering, its relation with host-country language proficiency has been extensively studied by researchers in economics and other disciplines. In a seminal paper, Lazear (1999) proposes a model of cultural and language assimilation of migrants that inversely relates an immigrant's language proficiency to the proportion of local population who speak their same native language. This model predicts that an immigrant residing in an area with a large proportion of people who speak their native language has less incentive to learn a new language. On the other hand, the model of spatial assimilation developed by Massey (1985) suggests that ethnic enclaves are a natural first stage for migrants when entering a country, but they leave the enclaves once they have integrated to the new country's culture.

Empirically, a large number of papers have investigated the correlation between host-country language proficiency and ethnic residential clustering (e.g., Logan et al. 2002; Dustmann and Fabbri 2003; Bauer et al. 2005; Iceland and Scopilliti 2008; Beckhusen et al. 2013). Broadly, they find that having lower English language skills is positively correlated with ethnic concentration. For example, Dustmann and Fabbri (2003), in their analysis of the determinants of language skills, find strong negative correlations between ethnic minority concentrations and English language skills of ethnic minority migrants in the UK. Although it is not numerous, there is also some research on residency in language enclaves (e.g., Chiswick and Miller, 1995, 2005). For example, Chiswick and Miller (2005) study the relation between living in a language enclave and English proficiency of migrants in the US, and find that English proficiency is negatively associated with a higher extent of minority language concentration. A limitation of these studies is that it is not clear which direction causality runs: namely, whether poor language skills cause migrants to live in enclaves, or whether they have poor language skills

[3]The studies on earnings include Kossoudji 1988; Dustmann 1994; Chiswick and Miller 1995; Chiswick 1998; Dustmann and van Soest 2001; Shields and Price 2002; Dustmann and Fabbri 2003; Bleakley and Chin 2004; Aldashev et al. 2009; Di Paolo and Raymond 2012; Miranda and Zhu 2013; Budria and Swedberg 2015. The studies on employment include Miller and Neo 1997; Gonzalez 2005; Clausen et al. 2009; Yao and van Ours 2015.

[4]The studies on education include Glick and White 2003; Bleakley and Chin 2010; Akbulut-Yuksel et al. 2011; Aoki and Santiago 2018, while those on health include Miranda et al. 2011; Bauer et al. 2012; Kimbro et al. 2012; Lee et al. 2013; Guven and Islam 2015; Clarke and Isphording 2017; Aoki and Santiago 2018.

because they live in an enclave. In fact, there are studies investigating the opposite relation, i.e., the effect of enclave residency on language skills (e.g., Cutler et al., 2008; Danzer and Yaman, 2016; Laliberte, 2019), indicating the relevance of reverse causality in this context. Bleakley and Chin (2010) is the first paper to address this potential endogeneity issue using an IV for English proficiency, which is an interaction between age at arrival in the US and an indicator for being born in a non-Anglophone country. They find weak evidence of the effects of English proficiency on ethnic and country-of-birth enclave residency, unlike previous studies that found strong correlations between host-country language proficiency and enclave residency.

We are the first UK-based causal study, and add to the existing literature on residential clustering by analysing the causal effects of language skills (i) on four different measures of residential clustering in a comparable manner; (ii) using administrative boundaries to construct the measures of residential clustering; and (iii) using a different identification strategy from the one used in the past literature, requiring weaker identification assumptions, to be discussed in Section 4. First, we distinguish different measures of residential clustering — based on language, ethnicity, country of birth, and world region of birth — as language skills can have heterogeneous effects on those different types of enclave. For example, if the reason for living in an enclave is simply for linguistic convenience, migrants fluent in English would have no incentive to live in a language enclave. Moreover, there is evidence that minority language concentration is negatively correlated with earnings (e.g., Chiswick and Miller 1995; 2005), possibly making a language enclave even less attractive to migrants fluent in English. The effects of language skills on residency in an ethnic enclave are more ambiguous, as some find positive effects (Edin et al., 2003; Munshi, 2003; Cutler et al., 2008; Damm, 2009), while others find negative effects (Borjas, 2000) and mixed effects (Beaman, 2012) of ethnic concentration on their labour market outcomes. Aside from economic aspects, migrants proficient in English may or may not be attracted to live in an ethnic enclave, depending on whether they value other aspects of living in an enclave, such as offering cultural amenities, or protection from possible discrimination they might face outside of the enclave. How English proficiency affects residency in different types of enclave therefore is an empirical question.

Second, we use local authority districts, which are administrative boundaries in the UK, as the geographical unit when constructing our measures of enclave, unlike Bleakley and Chin (2010) who base their analysis on public-use microdata areas (PUMAs), which are census-created geographies that contain no fewer than 100,000 individuals. PUMAs and counties coincide only around five per cent of the times. This is an important distinction when analysing the impact of language skills, because for language skills to affect people's residential locations, we require an assumption that people can interact and meet other people from their same language, ethnicity, country, or world region of origin. In this regard, the use of administrative boundaries is arguably more suitable than census-created boundaries, as transport communi-

cations are likely to exist within an administrative area, allowing individuals to interact more easily, whereas census boundaries would have no relevance to individual's interactions in real life. To this end, Bailey et al. (2020) find evidence that travel time has more of an importance than distance in formulating and maintaining social links across individuals, and suggest public transit infrastructure as an important determinant of social connectedness.

2.2. Literature on neighbourhood quality

In contrast to the relation between language skills and residential clustering which has been studied intensively, we are not aware of any research that has analysed the relation between language proficiency and the quality of the neighbourhood migrants live in. Existing research related to this topic is the studies on neighbourhood effects. There is a strand of literature in this field, which concerns the impact of neighbourhood quality on social and labour market outcomes (e.g., Bertrand et al., 2000; Katz et al., 2001; Edin et al., 2003; Oreopoulos, 2003; Weinberg et al., 2004; Vigdor, 2006; Kling et al., 2007; Sanbonmatsu et al., 2011; Ludwig et al., 2012; Damm, 2014; Weinhardt, 2014).

In our study, instead of looking at the consequences of living in a neighbourhood of a certain quality, we analyse whether language proficiency of migrants has a causal impact on living in a neighbourhood of a certain quality. By doing so, our paper bridges two strands of literature, one on language proficiency of migrants and the other on neighbourhood quality. It is important to analyse residential environments of migrants with different English skills, as lower language proficiency can have amplifying negative effects if it not only directly affects immigrants' social and labour market outcomes (see the top of Section 2), but also indirectly affects their outcomes via neighbourhood effects in their residential environment. For example, using US census tract data, Topa (2001) finds positive spatial correlations of unemployment across neighbouring tracts, and suggests that there are local spillover effects of unemployment due to (absence of) a local exchange of job information. This implies that, if lower language skills lead migrants to live in a high-unemployment neighbourhood, the employment opportunities for these migrants could be reduced due to neighbourhood effects, in addition to the direct effect of poor language proficiency itself on adverse labour market outcomes found in the existing literature (e.g., Gonzalez, 2005; Clausen et al., 2009).

3. Data and sample

3.1. Data sets and variables

To analyse the impact of English language skills on immigrant outcomes, we use an individual-level dataset from the ONS Longitudinal Study of England and Wales, which contains linked

census and life events data for a one-per-cent sample of the population of England and Wales. Unless indicated otherwise, our individual characteristics are collected from the 2011 Census sample within the ONS Longitudinal Study, including information on English proficiency, which is a self-reported ordinal variable that takes values 3, 2, 1, and 0, corresponding to speaks English "very well", "well", "not well", or "not at all", respectively. From this variable, we derive our measure of English skills, which is the indicator variable taking the value of one if the respondent speaks English "very well", and zero otherwise. We also extract our measure of parental education from the ONS Longitudinal Study by tracking the individuals in our dataset through all censuses contained in the Longitudinal Study. Once we have identified their parents, we assign them to the individuals in our sample.

To create our instrument for English proficiency, we exploit two census variables, country of birth and age at arrival in the UK,[5] and a measure of linguistic distance between English and origin-country language. We measure linguistic distance using a variation of the Levenshtein distance computed by Isphording and Otten (2014). They compute the extent of similarity between languages in percentages, using a procedure to evaluate phonetic similarity between different languages, which is developed by the Max Planck Institute for Evolutionary Anthropology. The measure of linguistic distance they construct is a standardised and continuous measure of the distance between languages based on phonetic similarity, where a lower number indicates a smaller linguistic distance. This measure of linguistic distance is highly correlated with other measures of linguistic distance, such as those developed by linguists based on language families, despite its purely descriptive nature which does not rely on any prior knowledge on language relations. We assign linguistic distance based on the official language in the country of birth of migrants. In the case of migrants born in a multilingual country, we assign the predominant native language of the country. For migrants born in a country where English is an official language as well as the predominant language spoken, linguistic distance of zero is assigned. The following sub-sections detail the construction of our outcome variables.

Residential clustering

After linking the ONS Longitudinal Study to the local-authority level data from the 2011 Census obtained from ONS Nomis,[6] we construct the measure of residential clustering using an index of relative clustering following Borjas (2000), defined as:

[5] Age at arrival in the UK is derived from the age of a person, and the date that the person last entered the UK to live in the country. Note that short visits away from the UK are not counted, when determining the date that a person last arrived in the country. The age of arrival is applicable only to usual residents not born in the UK, and does not include usual residents who were born in the UK who have emigrated and then returned.

[6] The 2011 Census data for local authorities can be downloaded from ONS Nomis: `https://www.nomisweb.co.uk/`.

$$Relative\ Clustering\ Index_{lj} = \frac{N_{lj}/N_j}{N_l/N} \tag{1}$$

where $l = 1,....,L$ represents the languages and $j = 1,....,J$ represents the local authorities. N_{lj} is the total number of persons reporting language l as their main language and living in local authority j, N_j is the total number of persons living in local authority j, N_l is the total number of persons reporting language l as their main language in England and Wales, and N is the total population in England and Wales. This relative clustering index is based on the 'exposure index', corresponding to the numerator of equation (1), which gives the fraction of people in a local authority reporting a particular language as their main language. Although the exposure index is widely used in the literature that studies immigrant enclaves (e.g., Borjas 2000; Edin et al. 2003; Bauer et al. 2005), a problem with this index is that it can underweight the available contacts for small ethnic groups. The relative clustering index is a better measure (Bertrand et al., 2000), since it deflates the exposure index by the proportion of people reporting a particular language l in the whole of England and Wales (i.e., the denominator of equation (1)). The relative clustering index in equation (1) captures the share of individuals reporting the same native language in the local authority where an immigrant lives in. It takes value one if the proportion of people speaking language l living in local authority j is the same as the proportion of people speaking that language in England and Wales. If the relative clustering index is greater than one, then the group of individuals speaking that language is overrepresented in that particular local authority, whereas if the index is smaller than one, the group is underrepresented in that particular local authority.

In addition to measuring immigrant clustering based on their main language, we measure it based on their ethnicity, country of birth, and world region of birth. Each of these measures captures residential clustering along different dimensions: an ethnic group includes anyone who reports having a particular ethnic group,[7] irrespective of whether they were born in the UK, whereas a country-of-birth group only includes individuals born in a particular country. A world-region-of-birth group includes not only those born in the same country, but also those born in the same world region of birth,[8] since migrants may congregate not necessarily only with compatriots but also with individuals from surrounding countries of their country of origin.

[7] We distinguish 18 ethnic groups, based on the information available in the Census 2011: British, Irish, Gypsy or Irish traveller, other White, White and Black Caribbean mixed, White and Black African mixed, White and Asian mixed, other mixed, Indian, Pakistani, Bangladeshi, Chinese, other Asian, African, Caribbean, other Black, Arab, and other ethnic group.

[8] Based also on the Census 2011 classifications, we distinguish 18 world regions of birth, belonging to five broad regional groups of Europe, Africa, Middle East and Asia, the Americas and the Caribbean, and Antarctica and Oceania: 'Guernsey, Jersey, Channel Islands, Isle of Man'; Ireland; 'EU countries in March 2001'; 'EU accession countries April 2001 to March 2011'; Rest of Europe; North Africa; Central and Western Africa; South and Eastern Africa; Middle East; Eastern Asia; Southern Asia; South-east Asia; Central Asia; North America; Central America; South America; the Caribbean; and Antarctica and Oceania.

These different measures of clustering allow us to investigate whether and howidelyw much English language skills affect these different dimensions of immigrant residential clustering.

The geographical unit we use for our analysis is the local authority district, which is an administrative division in the UK. There were 348 local authority districts in England and Wales at the 2011 Census, which sum to at least 2,000 population with an average size of approximately 160,000 individuals. Using this geographical unit has some advantages. First, it is large enough: this is important because an individual does not necessarily interact with his immediate neighbours, but may have different networks of people (e.g., family, friends and colleagues) with whom they can interact frequently provided they have easy access to them, which happens if they live within a reasonable distance. In addition, choosing small areas could create measurement error problems in the case of immigrant groups with few observations. The second advantage of using local authorities is that they are not too large, as is the case with regions, which are too large to allow us to make the assumption that individuals could interact and meet other individuals from their same language, country or ethnic group.

The third advantage is that local authority districts are administrative divisions. This is very important as it ensures that transport communications are likely to exist and be easily accessible. This latter motive makes an administrative division better than a census-created division for the purpose of capturing possible interactions with other group members. For example, Bailey et al. (2020) find evidence that travel time has more of an importance than distance in formulating and maintaining social links across individuals, and suggest public transit infrastructure as an important determinant of social connectedness. In this respect, we provide an alternative approach to Bleakley and Chin (2010) who use census-created geographies that contain no fewer than 100,000 individuals called PUMAs, which do not coincide with administrative geographic boundaries, and would have no relevance to interactions of individuals in real life. Using administrative boundaries is arguably better as it makes it more likely that both workplace and residential interactions are taken into account, and both types of interactions can affect the decisions of migrants about where to live.

Neighbourhood quality

We measure neighbourhood quality using data from the English Indices of Deprivation 2015, which are published by Department for Levelling Up, Housing and Communities (DLUHC, 2015). These indices measure relative neighbourhood quality at a small-area level, called the ONS Lower-layer Super Output Areas (LSOAs). LSOAs are small areas designed to be of similar population size with a minimum of 1,000 individuals and a maximum of 3,000 (between 400 and 1,200 households), which have an average of approximately 1,500 residents or 650 households. We have matched our individuals to these indices corresponding to the area in

which they were living at the time of the 2011 Census.

Three domains of the English Indices of Deprivation are exploited: income deprivation, employment deprivation, and health deprivation. Income deprivation is intended to measure the proportion of population experiencing low income in the neighbourhood, while employment deprivation measures the proportion of working-age population who are involuntarily excluded from the labour market. For each of these domains, multiple indicators are used to measure the extent of deprivation,[9] are constructed as non-overlapping counts, and are summed together to pin down the total at-risk-population for the domain.[10] This total at-risk population is then used to calculate the proportion of population experiencing that form of deprivation. Health deprivation is intended to measure age and sex specific premature mortality and the population experiencing the impairment of quality of life due to poor physical or mental health. Unlike income and employment deprivation, a single ordinal measure of deprivation, i.e., the proportion of at-risk population, cannot be calculated. Thus, factor analysis is used to generate appropriate weights for combining the standardised indicators into a single ordinal score of health deprivation.[11]

For each of the deprivation domains, quintiles are calculated by DLUHC, ranking the 32,844 LSOAs in England from least deprived to most deprived and dividing them into five equal groups. We create one variable for each domain, and each of these variables takes values 1 to 5, where 1 corresponds to the least deprived area and 5 corresponds to the most deprived area. Note that, although we would have liked to use a finer level of ranking such as deciles, quintiles are the smallest ranking we could get access to when dealing with data at the LSOA-level due to data confidentiality. For the analysis of neighbourhood quality, we only use a sample of individuals who were living in England at the time of the 2011 Census. This is because, although there are the Welsh Indices of Deprivation, these indices measure relative levels of neighbourhood quality within Wales, and thus the Indices of England and that of Wales are not directly comparable.

[9]The indicators used to measure the extent of income deprivation are adults and children in income support families; in income-based job-seeker's allowance families; in income-based employment and support allowance families; in pension credit families; and in working tax credit or child tax credit families not already counted (i.e., those who are not in receipt of the first four support/allowances); and asylum seekers in England in receipt of subsistence support and/or accommodation support. For employment deprivation, the following indicators are used: women aged 18 to 59 and men aged 18 to 64 who claim job-seeker's allowance, employment and support allowance, incapacity benefit, severe disablement allowance, and carer's allowance.

[10]For detailed definitions of indicators used to construct each measure of deprivation as well as further technical details of calculations, refer to the English Indices of Deprivation 2015 Technical Report (Department for Levelling Up, Housing and Communities, 2015).

[11]For health domain, indicators used to measure deprivation are an age and sex standardised measure of premature death; standardised morbidity-disability ratio; and standardised rate of emergency admission to hospital; and a composite measure on mood and anxiety disorders based on the rate of adult suffering from mood and anxiety disorders, and on the data on hospital episodes, suicide mortality and health benefits.

3.2. Sample specification

Age restriction

Our sample consists of individuals in the ONS Longitudinal Study dataset, who were present in the 2011 Census. We restrict our sample to those aged 20 or older at the time of the 2011 Census, and assume that they chose their current place of residence.[12] Our sample is further restricted to childhood migrants, defined as those born outside of the UK who moved into the UK at age 16 or earlier. We impose this age-at-arrival restriction and assume that these childhood migrants did not make a migration decision on their own, but moved into the country following their parents or guardians.

Country classification

To implement our identification strategy, we include two types of migrants in our sample: (i) individuals born in a non-Anglophone country where English is not an official language (treatment group) and (ii) individuals born in an Anglophone country (control group). We classify a country as Anglophone if English is an official language and the predominant language spoken in the country.[13] Individuals born in countries where English is an official language but not the predominant language spoken are excluded from our sample, as it is not clear to what extent they were exposed to English before arriving in the UK. This rule drops migrants from countries such as India and Pakistan who account for significant proportions of UK migrants.

The Appendix and Table 1 present a list of countries of birth for the migrants in our sample and summary statistics, respectively, for Anglophone and non-Anglophone countries by age-at-arrival group. Table 1 presents summary statistics where mean values and standard deviations are reported in parentheses. Panel A presents individual characteristics. A key observation is that, for Anglophone migrants, the proportions of individuals who speak English "very well" for early and late arrivers are high (97 to 100 per cent) and similar as one would expect. In contrast, for migrants born in non-Anglophone countries, late arrivers show a lower share of people who speak English "very well" (74 per cent) than earlyarrivers (98 per cent). This latter group has a proficiency level similar to migrants born in Anglophone countries. Linguistic distance (from English) is zero for Anglophone countries by construction, and it takes positive values for non-Anglophone countries. Turning to residential outcomes, late arrivers born in non-Anglophone

[12] One might be concerned that some individuals are still living with their parents and did not choose their residence. If this is the case, reverse causality is a serious concern (i.e., living in an enclave hinders an improvement in English proficiency), possibly causing a bias to our OLS estimates. The presence of this reverse causality, however, will not contaminate our IV estimates, as our instrument is unlikely to have a direct impact on residential clustering. We have also conducted our analysis, without those living with their parents, and find that results are not sensitive to this change in sample specification.

[13] The World Almanac and Book of Facts 2011 is used to classify countries.

Table 1
Immigrant characteristics and residential outcomes.

	Born in non-Anglophone country			Born in Anglophone country		
	Arrived aged 0 - 8	Arrived aged 9 - 16	Total	Arrived aged 0 - 8	Arrived aged 9 - 16	Total
A. Individual characteristics						
English proficiency, = 1 if speaks very well	0.977 (0.150)	0.744 (0.437)	0.847 (0.360)	0.995 (0.073)	0.967 (0.178)	0.982 (0.134)
Linguistic distance	0.931 (0.104)	0.962 (0.076)	0.948 (0.091)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Age	38.634 (16.025)	33.907 (15.675)	35.990 (16.002)	44.320 (14.029)	47.050 (16.699)	45.606 (15.404)
Female	0.511 (0.500)	0.509 (0.500)	0.510 (0.500)	0.513 (0.500)	0.540 (0.498)	0.526 (0.499)
White	0.625 (0.484)	0.428 (0.495)	0.515 (0.500)	0.691 (0.462)	0.378 (0.485)	0.544 (0.498)
Black	0.093 (0.291)	0.200 (0.400)	0.153 (0.360)	0.140 (0.347)	0.346 (0.476)	0.237 (0.425)
Asian	0.115 (0.319)	0.209 (0.406)	0.167 (0.373)	0.133 (0.339)	0.233 (0.423)	0.180 (0.384)
Other single race	0.118 (0.322)	0.117 (0.321)	0.117 (0.322)	0.008 (0.087)	0.009 (0.094)	0.008 (0.090)
Multiracial	0.045 (0.208)	0.039 (0.194)	0.042 (0.201)	0.026 (0.160)	0.032 (0.176)	0.029 (0.168)
B. Enclave residency						
Language enclave	2.038 (4.471)	3.781 (6.482)	3.013 (5.749)	1.269 (3.668)	1.810 (3.925)	1.524 (3.800)
Country-of-birth enclave	4.238 (6.765)	5.421 (6.897)	4.900 (6.863)	2.290 (3.421)	3.866 (5.202)	3.033 (4.422)
World-region-of-birth enclave	2.374 (2.616)	2.898 (2.728)	2.667 (2.692)	1.833 (2.124)	2.735 (2.569)	2.258 (2.387)
Ethnic enclave	2.290 (2.434)	2.712 (2.267)	2.525 (2.351)	1.988 (2.211)	3.023 (2.904)	2.476 (2.613)
C. Neighbourhood quality index (in quintiles, 5 = worst)						
Income deprivation index	3.083 (1.454)	3.658 (1.336)	3.404 (1.418)	2.820 (1.384)	3.274 (1.386)	3.034 (1.403)
Employment deprivation index	2.901 (1.402)	3.369 (1.377)	3.162 (1.407)	2.707 (1.372)	3.069 (1.394)	2.878 (1.394)
Health deprivation index	2.779 (1.364)	3.173 (1.367)	2.999 (1.380)	2.670 (1.377)	2.867 (1.369)	2.763 (1.377)

Notes: The sample consists of individuals in the ONS Longitudinal Study dataset aged 20 or over who lived in England and Wales at the time of the 2011 Census, and were born outside the UK who arrived in the UK at age 16 or before. The number of observations varies by panel and column: Panels A and B have 2,005; 2,545; 4,550; 3,158; 2,814 and 5,972 observations in the first to sixth columns, respectively, except for ethnic enclave (1,999; 2,526; 4,525; 3,148; 2,809 and 5,957) due to 40 missing values of ethnicity. Panel B has 1,972; 2,494; 4,466; 3,087; 2,767 and 5,854 observations.
Source: Authors' calculations based on the ONS Longitudinal Study.

countries live in the areas with higher concentrations of people who speak their same native languages and from the same countries of birth (panel B), and in the neighbourhoods of lower quality measured in terms of income, employment and health of residents (panel C).

4. Identification strategy

We begin by presenting the empirical framework used in the seminal papers, Bleakley and Chin (2004; 2010), to analyse a number of immigrant outcomes including residential location choices, and discussing the issues associated with identifying the causal effects of English language skills. We then introduce our empirical framework to estimate the causal impact of English proficiency on location choices of the residence of childhood migrants, highlighting the differences from the empirical model in Bleakley and Chin (2004; 2010) presented below.

$$outcome_{ica} = \alpha_0 + \alpha_1 prof_{ica} + X'_{ica}\xi + \gamma_c + \delta_a + u_{ica} \tag{2}$$

where $outcome_{ica}$ represents the residential location outcome for individual i born in country c who arrived in the UK at age a, and $prof_{ica}$ is a measure of English proficiency. The individual characteristics, X_{ica}, and the parameter ξ are $K \times 1$ vectors, where K is the number of variables capturing individual characteristics such as sex and race. γ_c and δ_a are country-of-birth and age-at-arrival fixed effects, respectively, and u_{ica} is the error term.

The coefficient of interest is α_1, measuring the impact of English proficiency on the residential outcome of the migrant. An econometric challenge to estimate equation (2) is the endogeneity of English proficiency. First, there may be reverse causality. For example, poorer English skills may lead an individual to live in an area with a higher concentration of individuals from their own country, while at the same time living close to compatriots may make it more difficult to improve their English skills. Second, unobserved factors influencing migrant location choices may be correlated with English skills. For example, labour market access is likely to be an important determinant of location choices of migrants. At the same time, labour market access could be correlated with an incentive to learn English, as living in a place with good labour market access may incentivise migrants to improve their English skills. Third, our self-reported measure of language proficiency may contain measurement error. Thus, using the Ordinary Least Squares (OLS) estimator to estimate α_1 is unlikely to produce a causal estimate of the effects of English proficiency. To identify the causal effects, equation (2) can be estimated using the IV estimator, which requires an IV that gives exogenous variation in English skills. To construct an IV for language skills, Bleakley and Chin (2004; 2010) exploit age at arrival in the US. The idea of using age at arrival is based on the "critical period of language acquisition"

hypothesis (Lenneberg, 1967), which states that an individual exposed to a new language during the critical period of language acquisition (i.e., childhood) can learn the language relatively easily.[14] This hypothesis implies that, among migrants from a non-Anglophone country, those who arrive in the host country when they were young would learn English more easily, and have better English skills on average, than migrants who arrived at an older age.

For a variable to serve as an IV for English skills, the following assumptions are required: (i) it does not appear in equation (2) and (ii) it is uncorrelated with any other determinants of the residential outcomes of migrants apart from proficiency in English. However, age at arrival on its own is unlikely to satisfy these assumptions, because it may influence immigrant's residential location outcomes through other channels than language acquisition; for example, through an acquisition of knowledge about living conditions in different neighbourhoods in the host country. To overcome this problem, Bleakley and Chin (2004; 2010) use as an instrument, an interaction of age at arrival with an indicator variable for being born in a non-Anglophone country:

$$\phi_{ica} \equiv max(0, a_i - cutoff) \times I(c\ is\ non - Anglophone) \tag{3}$$

where a_i is age at arrival for individual i; $cutoff$ is the value of a cut-off age;[15] the function $max(0, a_i - cutoff)$ corresponds to the additional years after the cut-off age for the individuals who arrived in the host country after the cut-off age, and zero otherwise; and $I(c\ is\ non - Anglophone)$ is an indicator variable that takes the value of one if the individual is from a non-Anglophone country, and zero otherwise. The idea underlying the use of equation (3) is as follows: upon arrival in the host country, all migrants are exposed to a new environment, but only those born in a non-Anglophone country encounter a new language. Thus, conditional on individual characteristics, the difference in the outcomes of early and late arrivers from an Anglophone country would only reflect age-at-arrival effects, while the difference in the outcomes of migrants from a non-Anglophone country would reflect those same age-at-arrival effects and an additional effect, the language effect. Thus, a difference in the outcomes between early and late arrivers born in a non-Anglophone country, in excess of the corresponding difference for Anglophone migrants can be attributed to the effect of language.

Although the specification of the instrument in equation (3), or slight variants of it, has been widely used in the causal studies on various immigrant outcomes (e.g., Akbulut-Yuksel

[14] Lenneberg (1967) finds that, until early teens, individuals have an innate flexibility for the organisation of brain functions necessary for acquiring a language. If basic language skills have not been acquired by puberty, however, they have a tendency to remain deficient permanently. This is because, due to physiological changes in the brain, the ability to adjust to physiological demands for verbal acquisition deteriorates sharply after puberty.

[15] Bleakley and Chin (2004) use the cut-off age of 11, and Bleakley and Chin (2010) use the age of 9.

et al., 2011; Miranda and Zhu, 2013; Guven and Islam, 2015; Yao and van Ours, 2015), there are potentially important issues with using ϕ_{ica}. The first issue concerns cohort effects: an important assumption implicitly underlying the identification strategy using ϕ_{ica} as an IV is that, any changes in cohort quality over time occurred in the same manner between non-Anglophone and Anglophone migrants. If cohort quality changed in a different manner and if this change coincided with the critical age cut-off, it can create a direct link between ϕ_{ica} and the residential location outcomes, resulting in biased IV estimates. To investigate whether there were such changes in cohort quality, we compare a number of potentially important individual characteristics of Anglophone and non-Anglophone migrants, who arrived in the UK before and after the critical period of language acquisition, in a simple difference-in-differences framework.[16] Our comparison reveals that the difference in late and early arrivers for non-Anglophone migrants is significantly different from the corresponding difference for Anglophone migrants for whether one is active, whether one has ever worked, spouse's English proficiency, and number of dependent children living in the same household (see Table A2). We repeat this exercise for the demographic characteristics reported in Table 1, and find a significant difference in differences for age.[17] Our findings support the possibility of differential changes in cohort quality across the two sets of migrants, threatening the validity of using ϕ_{ica} as an IV for English skills.

For the illustration purpose, let us take age as an example. As equation (2) controls for observable individual characteristics including age, observable differences per se are not an issue. However, if there are any unobservable cohort differences correlated with the observable differences, they could bias resulting IV estimates. For example, the age of a migrant could be correlated with affordability of housing in a high-quality neighbourhood (e.g., younger adults being less able to afford housing in a high-quality neighbourhood). If this is the case, ϕ_{ica} will capture the impact of this differential changes in affordability of housing across the two sets of migrants, on their residential location choices.

The second issue concerns age-at-arrival effects. A crucial assumption underlying the IV strategy using ϕ_{ica} as an instrument is that, non-language related age-at-arrival effects are the same across non-Anglophone and Anglophone migrants. However, one might be concerned that the two sets of migrants face different age-at-arrival effects. In fact, Figure A1 in the Appendix indicates that the two sets of migrants follow different age-at-arrival trends even among

[16] The following equation is used: $outcome_{ica} = \eta_0 + \eta_1 I(a_i > 8) + \eta_2 I(c \text{ is non} - Anglophone) + \eta_3 I(a_i > 8) \times I(c \text{ is non} - Anglophone) + \omega_{ica}$, where $outcome_{ica}$ refers to the outcome of individual i who arrived in the UK from county c at age a; $I(\cdot)$ is an indicator function taking the value of one if the condition specified is satisfied, and zero otherwise; ω is an error term; and ηs are the parameters to be estimated. The outcomes considered are the highest level of education qualification obtained, labour market status, having ever worked, whether in full-time employment, marital status, number of dependent children living in the same household, spouse/partner's English proficiency, and whether they are UK born. We would have also liked to investigate income, but income is not available in ONS Longitudinal Study.

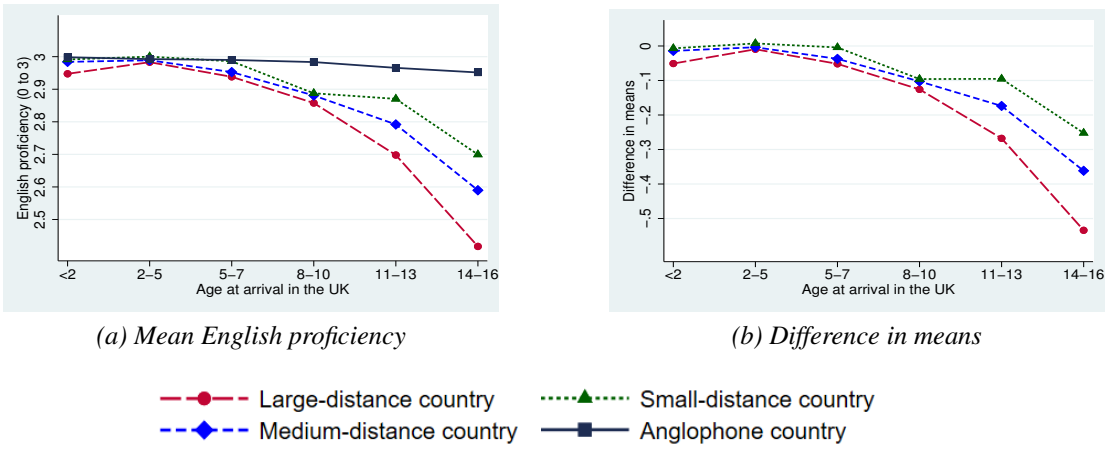
[17] The difference-in-differences estimate of η_3 for age is -7.457 with p-value of 0.003.

early arrivers, implying that the comparison of Anglophone and non-Anglophone migrants who arrived before and after the critical period of language acquisition, is unlikely to tease out the effects of language skills on immigrant outcomes. These are potential issues that a large number of papers using this type of identification strategy face (e.g., Bleakley and Chin, 2004, 2010; Akbulut-Yuksel et al., 2011; Miranda and Zhu, 2013; Guven and Islam, 2015; Yao and van Ours, 2015). In an attempt to mitigate these types of concerns, instead of using ϕ_{ica} as an instrument for English skills, we use it as a control variable in our empirical model. Controlling for ϕ_{ica} addresses these concerns, by (i) absorbing differential changes in cohort quality across the two sets of migrants, which coincided with the critical age cut-off, and (ii) allowing age-at-arrival effects to be different between the two sets of migrants.

We then proceed with constructing our instrument, exploiting the variation in linguistic distance from English within non-Anglophone countries. More specifically, among non-Anglophone migrants, there is heterogeneity in how similar their native languages are to English, and this may affect their capacity to become proficient in English. For example, an immigrant with a language that is more similar to English (e.g., Dutch) may find it easier to learn English than an immigrant with a native language that is very different to English (e.g., Vietnamese). In fact, the pattern observed in our data supports this possibility: Figure 1 shows the relation between age at arrival of migrants, who arrived in the UK during their childhood, and English proficiency when they became adults. The solid line corresponds to migrants from Anglophone countries, and dashed lines correspond to those from non-Anglophone countries by linguistic-distance group.[18] Figure 1 shows that Anglophone migrants score between 2.9 and 3 in the ordinal measure of English skills, where 3 corresponds to "speaks very well", and are generally proficient in English irrespective of their age at arrival. In contrast, for those born in a high linguistic-distance country, the later they arrived, the poorer their English skills are on average, consistent with the critical period hypothesis. The plots for small and medium linguistic-distance countries lie between Anglophone and high linguistic-distance countries, supporting the idea that the linguistic distance from English affects the capacity to become proficient in English. Panel (b) plots the differences in the mean English proficiency scores between Anglophone migrants and non-Anglophone migrants by linguistic-distance group. Panel (b) indicates that the series for non-Anglophone migrants diverge from the series for Anglophone migrants at around ages eight to 10, with the largest gap being observed for the high linguistic-distance group.

Exploiting the heterogeneity in linguistic distance, we construct our instrument, θ_{ica}, by interacting age at arrival with linguistic distance, $ldist_c$, between English and the native language

[18] A non-Anglophone country is classified into a small-distance group and a large-distance group, if the country's linguistic distance is below 33 percentile and at 66 percentile or above, respectively, of the distribution of linguistic distance within non-Anglophone countries. The rest of the countries within non-Anglophone countries are classified as a medium-distance group.



(a) Mean English proficiency *(b) Difference in means*

Fig. 1. English language skills and age at arrival of migrants who arrived in the UK during their childhood.

Notes: Panel (a) plots the average ordinal measure of English proficiency, where 3, 2, 1, and 0 correspond to speak English "very well", "well", "not well", and "not at all", respectively. Non-Anglophone countries are classified into countries with small, medium and large linguistic distance from English. Each series in panel (b) plots the difference in means between Anglophone migrants and each group within non-Anglophone migrants. The sample corresponds to childhood migrants aged 20 or over at the time of the 2011 Census.
Source: ONS Longitudinal Study.

in an origin country, c:

$$\theta_{ica} \equiv max(0, a_i - 8) \times ldist_c \tag{4}$$

Our specification of instrument is different from ϕ_{ica} in equation (3),[19] in that it allows the difficulty of English language acquisition to be different across migrants from different linguistic origins. Yet, our instrument is still arguably exogenous to potentially important omitted variables, such as ability and labour market access. Our specification of instrument, which distinguishes groups that vary by linguistic distance to English, is more suitable for the study on residential location choices than the specification in equation (3), which bundles all non-Anglophone migrants into a single group, as different immigrant groups have different tendencies to cluster. A crucial assumption underlying the use of θ_{ica} as an instrument is that, linguistic distance impacts an English language acquisition process only, conditional on various observable characteristics, which we will revisit in Section 6.

It is important to note that Clarke and Isphording (2017) is the first paper to exploit this variation in linguistic distance to construct an IV for English skills, by interacting it with age at arrival, in their study of immigrant health in Australia. One of the major differences from our approach is that they do not account for ϕ_{ica} in their model, implying that any changes in cohort quality, and any differences in age-at-arrival effects between these two sets of migrants will at least partly be absorbed by their instrument. Not surprisingly, the cost we must pay for using ϕ_{ica} as a control and θ_{ica} as an instrument, is that part of the variation in our instrument, θ_{ica}, will be absorbed by ϕ_{ica}, since θ_{ica} and ϕ_{ica} are highly correlated. We will see in Section 5, however, that there is still enough variation left in our data to allow us to estimate our empirical model.

Next, we implement a further change to the specification used in Bleakley and Chin (2004; 2010), and add to our model, year-of-arrival fixed effects that vary by individual, which are possibly important omitted variables. Recent literature has documented changes in immigrant characteristics over time, with more recent waves of migrants to the countries in the Organisation for Economic Cooperation and Development (OECD) being more educated, and especially so in the UK (Arslan et al., 2014).[20] This is an important concern if migrants of varying linguistic origins arrived in the UK in systematically different years, as different background characteristics associated with different years of arrival may lead the migrants of varying linguistic origins to achieve different English proficiency and residential outcomes in the UK.

[19] Age eight is chosen as the cut-off value because Figure 1 indicates that the series start diverging at ages five to seven, and the gaps become more salient at ages eight to 10 in our dataset.

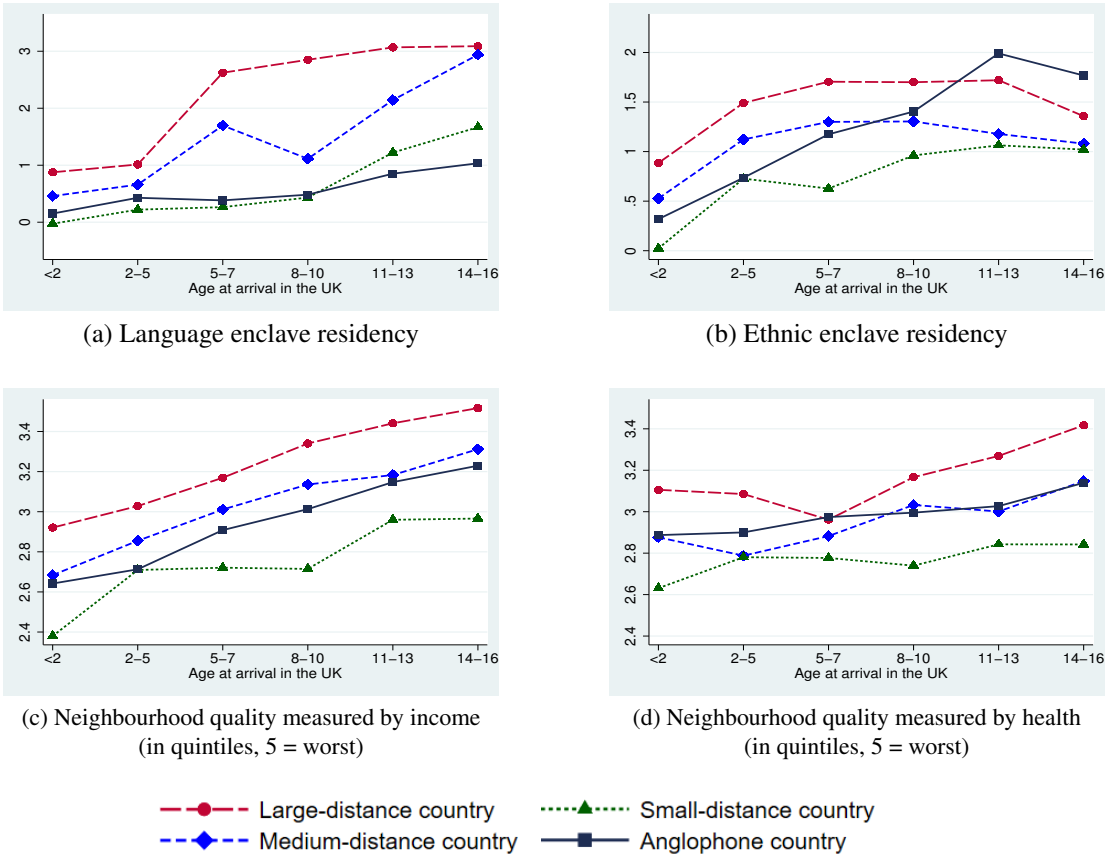
[20] For example, in 1995 roughly 15 per cent of UK migrants held a university degree, whereas this figure had more than doubled to roughly 40 per cent by 2011 (Dustmann and Frattini, 2014).

Additionally, different conditions migrants faced throughout their stay, stemming from different years of arrival, can also lead migrants to achieve different outcomes. Our data indicate that the average years of arrival for Anglophone and non-Anglophone migrants are 1973 and 1984, respectively, implying that the concern is relevant in our context and it is important to account for year-of-arrival fixed effects.

Before presenting our final empirical specification, we report the plots of mean immigrant residential outcomes by age at arrival, and discuss implications of the patterns observed to our final model specification. The outcomes plotted in Figure 2 are extent of linguistic residential clustering (panel (a)) and of ethnic residential clustering (panel (b)), and quality of the neighbourhood migrants live in, measured by income of residents (panel (c)) and by health of residents (panel (d)).[21] The solid line corresponds to Anglophone migrants, and dashed lines correspond to non-Anglophone migrants by linguistic-distance group. Figure 2 indicates that, early arrivers from a large linguistic-distance country and an Anglophone country appear to follow different trends. This difference in trends, which is indicative of the difference in age-at-arrival effects between migrants from a large linguistic-distance country and an Anglophone country is not an issue in our empirical approach, as we allow for different age-at-arrival effects in our model. Among late arrivers, the two series tend to diverge, and relative to Anglophone migrants, those from a large linguistic-distance country appear to live in an area with a higher concentration of individuals who speak their same native language, but not necessarily from the same ethnic group, and in a more deprived neighbourhood. Migrants from a medium-distance country appear to follow a similar pattern to those from a large-distance country, with late arrivers living in an area with a higher (lower) concentration of individuals who speak their same native language, and in a more (less) deprived neighbourhood, relative to migrants from an Anglophone country (a large-distance country).

An interesting observation from Figure 2 is that Anglophone migrants also exhibit age-at-arrival effects (i.e., early and late arrivers achieving different outcomes). This observation implies that, apart from the effect of language, age at arrival is likely to have direct effects on migrants' residential outcomes, confirming that age at arrival per se is not a valid instrument and it is important to control for age-at-arrival fixed effects. Another observation from Figure 2 is that there are systematic differences across series in each panel, which should be accounted for by using country-of-origin fixed effects.

[21] As there are a number of outcome variables, instead of reporting a graph for each outcome, we report, in Table 2, the relation between each outcome and age at arrival (i.e., reduced-form estimates).



(a) Language enclave residency

(b) Ethnic enclave residency

(c) Neighbourhood quality measured by income (in quintiles, 5 = worst)

(d) Neighbourhood quality measured by health (in quintiles, 5 = worst)

Fig. 2. Immigrant outcomes by linguistic distance and age at arrival.

Notes: Means of immigrant outcomes are plotted by age at arrival where the outcomes are extent of residential clustering in terms of the main language spoken by residents (panel (a)) and of ethnicity of residents (panel (b)); and quality of the neighbourhood in which migrants live, measured by income of residents (panel (c)) and health of residents (panel (d)). Non-Anglophone countries are classified into countries with small, medium and large linguistic distance from English. Each outcome is regression adjusted for age and sex. The sample corresponds to childhood migrants aged 20 or over at the time of the 2011 Census.

Source: ONS Longitudinal Study.

All in all, our main equation of interest is specified as follows:

$$outcome_{ica} = \beta_0 + \beta_1 prof_{ica} + \beta_2 \phi_{ica} + X'_{ica}\zeta + \iota_i + \chi_c + \alpha_a + \varepsilon_{ica} \tag{5}$$

where $outcome_{ica}$ represents the residential outcome for individual i born in country c who arrived in the UK at age a; $prof_{ica}$ is a measure of English language skills; and ϕ_{ica} is as defined in equation (3). βs are parameters to be estimated, and in particular $\beta_1$is our parameter of in-

terest. The individual characteristics X_{ica}, including age, race and sex, and the parameter ζ are $K \times 1$ vectors, where K is the number of variables capturing individual characteristics. In Section 6, we will expand our set of individual characteristics to include other possibly important controls, such as parental education, to see the sensitivity of our results to the inclusion of those additional variables. ι_i, χ_c, and α_a are year-of-arrival, country-of-birth, and age-at-arrival fixed effects, respectively, and ε_{ica} is the error term. Country-of-birth fixed effects account for any effects specific to a country of origin which do not vary by age at arrival; year of-arrival fixed effects absorb any systematic differences in cohort characteristics of those who arrived in the UK in different years; and age-at-arrival fixed effects absorb the corresponding differences of those who arrived in the UK at different ages. If migrants with different linguistic distances from English arrived in the UK at systematically different ages (e.g., linguistically distant migrants arriving at an early age), this last fixed effects will capture the effects on outcomes stemming from this difference.

Our first-stage equation, which relates English proficiency and age at arrival, using our instrument θ_{ica} in equation (4), can be specified as follows:

$$prof_{ica} = \beta_{f0} + \beta_{f1}\theta_{ica} + \beta_{f2}\phi_{ica} + X'_{ica}\zeta_f + \iota_{fi} + \chi_{fc} + \alpha_{fa} + \varepsilon_{fica} \tag{6}$$

where the additional letter f in subscripts refer to 'first stage'.

5. Results

We start by estimating equation (5) using the OLS estimator.[22] Column (1) of Table 2 reports the OLS estimates of the impact of English skills on the residential outcomes of childhood migrants in England and Wales, after controlling for individual characteristics, an interaction of age at arrival with the dummy for coming from a non-Anglophone country as defined in equation (3), and year-of-arrival, country-of-birth, and age-at-arrival fixed effects. The results for enclave residency in panel A, and for neighbourhood quality in panel B all indicate that poorer English skills are significantly associated with living in an enclave, irrespective of the types of enclave, and in a neighbourhood of lower quality measured in terms of income, employment and health

[22] Our measure of English language skills is an indicator variable for speaking English "very well" as described in Section 3. We also try using an indicator for speaking English "very well" or "well". When the indicator is constructed in such a way, the variation of this variable is not as large since the majority of individuals in our sample reported to speak English either "very well" or "well". First-stage and IV estimates become smaller and larger, respectively, in absolute terms, although we do not observe any qualitative changes in the results. In addition, we try using the original Census ordinal measure of English skills ranging from zero to three, where three corresponds to speaks English "very well". The results using this alternative English proficiency measure, presented in the online Appendix, are again qualitatively similar to our main results.

Table 2
Relations between residential outcomes, English skills, and the instrumental variable.

Dependent variable:	Enclave, neighbourhood quality			Dummy for English skills
	OLS	IV	Reduced-form	First-stage
	(1)	(2)	(3)	(4)
A. Enclave residency				
Language enclave	-4.420***	-3.574*	0.528*	-0.148***
	(0.873)	(2.016)	(0.290)	(0.015)
Country-of-birth enclave	-1.330***	0.807	-0.119	-0.148***
	(0.437)	(1.908)	(0.290)	(0.015)
World-region-of-birth enclave	-0.278**	2.762***	-0.408***	-0.148***
	(0.128)	(0.943)	(0.129)	(0.015)
Ethnic enclave	-0.335*	2.987***	-0.444***	-0.148***
	(0.173)	(1.010)	(0.087)	(0.015)
B. Neighbourhood quality index (in quintiles, 5 = worst)				
Income deprivation	-0.416***	-0.914*	0.134*	-0.147***
	(0.075)	(0.538)	(0.075)	(0.015)
Employment deprivation	-0.372***	-1.376*	0.202**	-0.147***
	(0.072)	(0.717)	(0.093)	(0.015)
Health deprivation	-0.263***	-1.502**	0.221***	-0.147***
	(0.069)	(0.596)	(0.076)	(0.015)

Notes: OLS and IV are the estimates of β_1 in eq.(5). Reduced-form and first-stage are the estimates of the coefficient on our instrument specified in eq.(4). Each row corresponds to regressions for different outcomes. Every regression controls for dummies for age, gender and race; an indicator for coming from a non-Anglophone country interacted with age at arrival; and year-of-arrival, country-of-birth, and age-at-arrival fixed effects. Sample sizes for panels A and B are 10,522 and 10,320, respectively, except for ethnic enclave (10,482 observations due to 40 missing values). The F-statistics on the excluded instrument in column 4 range from 97 to 103. Standard errors are clustered by country of birth. *** $p < .01$, ** $p < .05$, and * $p < .10$.
Source: Authors' calculations based on the ONS Longitudinal Study.

of residents.

A problem with the OLS estimates of the effects of English proficiency is that they are biased if English proficiency is endogenous. To address this potential issue of endogeneity, equation (5) is estimated using the IV estimator, where we use as an instrument for English proficiency, an interaction of the excess age at arrival from age eight with linguistic distance between the origin-country language and English (see equation (4)). The first-stage estimates indicate that, for migrants born in a linguistically distant country, each year past age eight at arrival significantly reduces their likelihood of speaking English "very well" by about 0.148 on average (column (4), Table 2). The magnitude of this estimate implies that a person's likelihood of speaking English very well would be lowered by approximately one if a non-Anglophone migrant arrived in the UK at age 15 instead of at age eight. For the identification, it is crucial that our instrument is not weak, since a weak instrument is known to bias the IV estimator toward the probability limit of the corresponding OLS estimator. Stock et al. (2002) calculate the critical value for the test of weak instruments based on the first-stage F-statistic, and suggest that an F-statistic of approximately above 10 makes IV inferences reliable. Our instrument is not weak according to their test for weak instruments, as the first-stage F-statistics on the excluded instrument range between 97 and 103.

Column (3) of Table 2 presents the reduced-form estimates of the effects of the instrument on residential outcomes. The results for residential clustering, reported in panel A, indicate that, for those born in a linguistically distant country who arrived in the UK after age eight, each additional year that passes before they arrive in the UK is correlated with living in an area with a higher concentration of people who speak same native language. In line with this reduced-form estimate, the causal estimate in column (2) shows that a poorer English proficiency significantly leads migrants to live in an area with a higher concentration of people who speak their native language. In contrast, we find a positive and significant impact on residency in world-region-of-birth and ethnic enclaves.

To understand our findings, let us take Spanish as an example. Our findings suggest that a white Spanish person who speaks English well clusters with white people (their ethnicity) or people from Europe (their world region of birth), but not necessarily with other Spanish speakers. Our results are in contrast to the majority of correlation studies which find negative associations between better language skills and ethnic residential clustering (e.g., Logan et al. 2002; Dustmann and Fabbri 2003; Bauer et al. 2005; Iceland and Scopilliti 2008; Beckhusen et al. 2013), and to that of Bleakley and Chin (2010) who find an insignificant impact of English proficiency on ethnic enclave residency. Both our study and that of Bleakley and Chin (2010) find an insignificant impact on residency in a country-of-birth enclave. This could be due to the fact that, for the group of individuals whose number of compatriots is small, there may not be enough fellow citizens to cluster with (e.g., Koreans). In this regard, world-region-of birth

enclaves may be a better measure to capture concentrations of individuals who were born in geographically close proximity.

Regarding the magnitude of the effect, to facilitate an interpretation of our estimate for the effect on language residential clustering -3.574, consider the following hypothetical situation: suppose that there is an immigrant born in a Spanish-speaking country who does not speak English very well and lives in the local authority with the relative language clustering index of 3.6 (meaning that there are roughly 3.6 times as many Spanish-speaking migrants in the local authority as one would have expected if the Spanish-speaking population had distributed itself randomly across England and Wales). If this immigrant had spoken English "very well", they would have lived in a local authority where Spanish-speaking migrants are neither over- nor under-represented (i.e., local authority with the relative clustering index of one).

Panel B reports neighbourhood quality outcomes. IV estimates in column (2) indicate that poor English proficiency leads migrants to live in a neighbourhood of lower quality, where residents are more deprived in terms of income, employment and health. The magnitudes of the effects are non-negligible: a one-standard-deviation increase in English skills of late arrivers from a non-Anglophone country lowers the quality of neighbourhood they live in, measured by quintiles, by roughly 0.4 to 0.7. There appears to be strong evidence of the effects of language skills on neighbourhood quality.

When comparing OLS and IV estimates, there is no clear pattern for the residential clustering outcomes,[23] whereas IV estimates are larger in absolute terms (more negative) for neighbourhood quality outcomes. It is possible that an omitted variable, such as ability, biases the OLS estimator downward (making the negative effect more negative), but at the same time measurement error possibly correlated with our measure of English skills biases the OLS estimator upward (making the negative effect less negative). For example, migrants surrounded by non-Anglophone migrants may report their proficiency being fluent, while those surrounded by native English speakers may report their proficiency being poor irrespective of their true English proficiency. In fact, Dustmann and van Soest (2001) find that self-reported categorical language measures contain substantial measurement error. Bearing in mind that the estimated effects have negative signs, if the upward bias caused by measurement error, known as attenuation bias, outweighs the downward bias caused by unobserved characteristics, IV estimates will be larger in absolute terms (more negative) than OLS estimates, which can help explain the relatively larger IV effects, in absolute terms, for neighbourhood quality outcomes.

[23] The previous study using the US census self-reported measure of English proficiency to analyse the impact of English proficiency on country-of-birth and ethnic clustering outcomes does not find any clear pattern in the relative sizes of IV and OLS estimates either (Bleakley and Chin, 2010).

5.1. Model comparison

Having estimated the impact of English skills based on our empirical model, it would be informative to investigate whether different model specifications, based on different identification strategies, has any impact on results. To this end, we compare results using the same dataset but with different models. We have seen, in Section 4, that Bleakley and Chin (2004; 2010) attempt to tease out the effects of English proficiency on immigrant outcomes, by comparing Anglophone and non-Anglophone migrants who arrived before and after the critical period of language acquisition. Clarke and Isphording (2017), in their study of the impact of English skills on immigrant health, use a related approach, where they compare immigrants with varying linguistic distance from English, arriving to the host country before and after the critical period of language acquisition.

To replicate results based on Bleakley and Chin's model, we run IV regressions using equation (2), and use ϕ_{ica} in equation (3) as an instrument for English proficiency. To obtain results based on the model in the spirit of Clarke and Isphording (2017), we run IV regressions using our base model in equation (5) but *without* controlling for ϕ_{ica}, with θ_{ica} in equation (4) as an instrument for English proficiency. There are two important notes associated with this exercise. First, we keep the set of individual characteristics, X_{ica}, in equation (5) as they are, instead of changing them to match the controls in Bleakley and Chin (2010) and Clarke and Isphording (2017), in order to keep changes from our base model minimum to make results comparable.[24] Second, we report results with and without controlling for year-of-arrival fixed effects, to investigate whether adding them has any impact on results.

Columns (2) and (3) of Table 3 present results based on Bleakely and Chin's model without and with year-of-arrival fixed effects, respectively. The corresponding estimates based on the model in the spirit of Clarke and Isphording (2017) are reported in columns (4) and (5). Column (1) reports our base results for comparison. Starting from residential clustering outcomes in panel A, we find that the magnitudes of the effects of English skills vary by model, although the directions of the impact are broadly the same as our base results. The largest impact appears to stem from whether to control for an interaction of a non-Anglophone dummy and age at arrival, ϕ_{ica}, although whether to add year-of-arrival fixed effects also causes non-trivial changes in effect sizes. Turning to neighbourhood quality outcomes in panel B, signs are maintained across models, suggesting that poorer English skills lead migrants to live in a neighbourhood of lower quality. However, the magnitudes of the coefficients do vary by model, and IV estimates are substantially smaller in the absolute term in columns (2) to (5). Whether to add year-of-arrival fixed effects seem to not change the magnitudes drastically for the neighbourhood

[24] In addition, Bleakley and Chin (2010) and Clarke and Isphording (2017) use data from different countries from the UK, making some of their controls irrelevant in our context (e.g., Hispanic dummy).

Table 3
IV effects of English proficiency using alternative model specifications.

	Base (1)	(2)	(3)	(4)	(5)
A. Enclave residency					
Language enclave	-3.574*	-4.718**	-5.381***	-4.638**	-5.279***
	(2.016)	(1.843)	(2.003)	(1.803)	(1.958)
Country-of-birth enclave	0.807	0.531	-0.652	0.574	-0.569
	(1.908)	(2.065)	(2.314)	(2.024)	(2.259)
World-region-of-birth enclave	2.762***	0.840	0.102	0.954	0.253
	(0.943)	(0.653)	(0.631)	(0.633)	(0.616)
Ethnic enclave	2.987***	1.388*	0.694	1.479**	0.826
	(1.010)	(0.733)	(0.702)	(0.717)	(0.685)
B. Neighbourhood quality index (in quintiles, 5 = worst)					
Income deprivation	-0.914*	-0.217	-0.246	-0.249	-0.283
	(0.538)	(0.331)	(0.357)	(0.315)	(0.337)
Employment deprivation	-1.376*	-0.202	-0.113	-0.260	-0.184
	(0.717)	(0.329)	(0.367)	(0.310)	(0.344)
Health deprivation	-1.502**	-0.262	-0.089	-0.325	-0.168
	(0.596)	(0.353)	(0.391)	(0.334)	(0.368)
Instrument for English skills	θ_{ica}	ϕ_{ica}	ϕ_{ica}	θ_{ica}	θ_{ica}
I(non-Anglophone)× arrival age	Yes	No	No	No	No
Year-of-arrival fixed effects	Yes	No	Yes	No	Yes

Notes: $\theta_{ica} \equiv max(0, a_i - 8) \times ldist_c$ and $\phi_{ica} \equiv max(0, a_i - 8) \times I(non - Anglophone)$. The estimates shown are the IV estimates of β_1 in eq.(5), except for columns 2 and 3 where the IV estimates of α_1 in eq.(2) are reported. Every regression controls for dummies for age, sex, race, and country-of-birth and age-at-arrival fixed effects. Odd-numbered columns further control for year-of-arrival fixed effects, and column 1 additionally controls for ϕ_{ica}. Each row corresponds to regressions for different outcomes. Sample sizes for panels A and B are 10,522 and 10,320, respectively, except for ethnic enclave (10,482 observations due to 40 missing values). Standard errors are clustered by country of birth. *** $p < .01$, ** $p < .05$, and * $p < .10$.
Source: Authors' calculations based on the ONS Longitudinal Study.

quality outcomes, implying that the differences in results are stemming from adding ϕ_{ica} as a control. This is not surprising given the differential changes in cohort quality observed in Table A2, and differences in age-at-arrival profiles, even among early arrivers, between Anglophone and non-Anglophone migrants observed in Figure A1, both of which can bias IV estimates if ϕ_{ica} is not controlled for.

6. Robustness checks and extensions

We now address various concerns that can threaten the validity of our identification strategy. The first concern to be addressed is that our main results are driven by differences in the background characteristics associated with linguistic distance, which are different from language. Two strategies are employed to deal with this issue: first, we explicitly account for various factors possibly associated with linguistic distance, including cultural distance between the UK and origin country (interacted with age at arrival); and second, we drop a set of countries that have special ties to the UK, in an attempt to make our sample less heterogeneous. The second concern to be addressed is that our main results are driven by differences in parental characteristics. Third, we explore the possibility that migrants from linguistically distant countries from the UK in which English is commonly used, find it easy to acquire English skills, irrespective of linguistic distances between their mother tongues and English. Next, recalling that our strategy to identify the causal impact of language relies on the variation within non-Anglophone migrants, we examine the robustness of our results to dropping Anglophone migrants. Finally, as an extension of our analysis, we investigate the role education qualifications play in explaining the impact of English skills on residential outcomes.

For our IV strategy to identify the causal impact of English proficiency, we require an assumption that, linguistic distance impacts an English language acquisition process only, conditional on various fixed effects and other controls. One might be concerned, however, that linguistic distance may not only capture a different English language acquisition process, but also other aspects of assimilation process that might differently affect residential outcomes of migrants. So far, in addition to controlling for individual characteristics, we have controlled for country-of-birth, year-of-arrival, and age-at-arrival fixed effects which absorb various confounding factors, possibly correlated with linguistic distance. To further address the concern of differences in the background characteristics associated with linguistic distance, we now start adding potentially important controls. The first control to be added is the measure of cultural distance between the UK and origin country (interacted with age at arrival). It is possible that linguistic distance is associated with other aspects of cultural differences between the UK and origin country, and that migrants born in a country that is culturally more distant to the UK find it more difficult to adapt to the new UK environment, resulting in different residential outcomes

to be achieved. Importantly, this adverse effect could become more severe as age at arrival gets older, which may create a direct link between our instrument and residential outcomes. To account for this possibility, we use, as a summary measure of cultural distance, genetic distance between the origin-country population and UK population, obtained from Spolaore and Wacziarg (2009). They argue that genetic distance, which measures the proximity of populations in terms of genes, reflects time since the populations shared the same ancestors. Over time, the ancestors pass on their descendants their biological traits (i.e., genes) as well as their cultural traits, including habits and values, and this transmission occurs with variation. Populations genetically far from each other had more time to diverge in terms of cultural traits, and this divergence can subsequently produce barriers for human interactions. In fact, Spolaore and Wacziarg (2009) document that genetic distance of populations has positive and significant correlations with a wide range of measures of cultural differences. Column (2) of Table 4 indicates that, qualitatively, the results are not sensitive to the inclusion of this additional control. Note that column (1) reports the base results from Table 2 for comparison.

In a similar vein, we add a further control, a measure of religious distance between the UK and origin country (interacted with age at arrival).[25] It is possible that linguistic distance is correlated with religious distance from the UK. The differences in norms associated with different religions, such as those related to educational attainment and marriage, could affect residential location choices of migrants. Importantly, this effects of religious distance may vary by age at arrival. If this is the case, our instrument could capture the compound effects of English proficiency and religious heterogeneity (or its associated heterogeneity in norms). The results (not reported) are also robust to the inclusion of this additional variable.

We now take a different approach to deal with the concern that the main results are driven by different background characteristics associated with linguistic distance (that vary by age at arrival). Namely, we restrict our sample to a set of countries that may be less heterogeneous from each other than the original sample. To this end, we drop countries that have special ties with the UK. Inevitably, we must pay the cost of reducing sample size, although the more we restrict our sample, the less heterogeneous the sample becomes. First, migrants from Europe might find it easier to adapt to the UK environment because European countries share commonality with the UK in culture and institutions, due to a long history of interactions across European countries. Similarly, migrants from Commonwealth countries might find it easier to adapt to the UK because of, for example, a similarity in their legal systems. The special ties these countries have with the UK might affect assimilation process, which could subsequently affect their residential outcomes.

[25] Religious distance is obtained from Spolaore and Wacziarg (2009), which was calculated following a similar approach to that used for linguistic distance, based on the classification obtained from the World Christian Database. Refer to Spolaore and Wacziarg (2009) for details.

Table 4
IV effects of English proficiency using additional controls and alternative samples.

	Base (1)	Control for cultural distance (2)	Drop Europe (3)	Drop Common -wealth (4)	Control for parental education (5)	Control for proficiency index (6)	Drop Anglophone migrants (7)
A. Enclave residency							
Language enclave	-3.574*	-3.045	-4.878*	-4.398**	-1.146	-1.041	-4.161*
	(2.016)	(1.938)	(2.601)	(2.067)	(3.352)	(1.714)	(2.120)
Country-of-birth enclave	0.807	1.729	0.909	-1.048	0.159	3.758*	-0.717
	(1.908)	(2.011)	(2.715)	(1.899)	(3.836)	(1.960)	(2.069)
Region-of-birth enclave	2.762***	2.577***	2.160	2.002**	2.658**	3.171***	2.062**
	(0.943)	(0.926)	(1.537)	(0.791)	(1.270)	(1.037)	(0.909)
Ethnic enclave	2.987***	2.415***	1.196	2.454***	3.058**	2.861***	2.749***
	(1.010)	(0.848)	(1.187)	(0.818)	(1.346)	(1.055)	(1.012)
B. Neighbourhood quality index (in quintiles, 5 = worst)							
Income deprivation	-0.914*	-1.073*	-0.689	-0.912*	0.501	-0.795	-0.993*
	(0.538)	(0.575)	(0.786)	(0.499)	(0.680)	(0.510)	(0.530)
Employment deprivation	-1.376*	-1.415*	-0.363	-1.343**	-0.411	-1.247*	-1.393**
	(0.717)	(0.729)	(0.675)	(0.645)	(0.987)	(0.673)	(0.698)
Health deprivation	-1.502**	-1.499**	0.111	-1.430***	0.311	-1.553**	-1.512**
	(0.596)	(0.610)	(0.790)	(0.530)	(0.788)	(0.610)	(0.599)

Notes: The estimates shown are the IV estimates of β_1 in eq.(5), including all controls described in Table 2 notes. Additionally, columns 2, 5 and 6 control for an additional variable each, which is an interaction of age at arrival with cultural distance from the UK (column 2), parental education (column 5), and English proficiency index (column 6), respecitvely. Columns 3, 4 and 7 correspond to different sample specifications: Sample excluding European migrants (column 3); excluding Commonwealth migrants (column 4); and excluding Anglophone migrants (column 7). Standard errors are clustered by country of birth. *** $p < .01$, ** $p < .05$, and * $p < .10$.
Source: Authors' calculations based on the ONS Longitudinal Study.

The results that exclude European and Commonwealth migrants are reported in columns (3) and (4) of Table 4, respectively. The results are broadly similar to our main results when Commonwealth countries are omitted. Interestingly, when migrants from European countries are omitted, the estimates of English proficiency become insignificant for residency in an ethnic enclave and for the neighbourhood quality outcomes. Considering the fact that non-European migrants in our dataset are generally from low-income countries, it might be that better English skills do not necessarily make them live in a neighbourhood of better quality, due possibly to their better tolerance towards living in a relatively lower quality neighbourhood within the UK, which could still be better conditions than those in their origin countries. As a result, these migrants might be more willing to live in a lower quality neighbourhood, and this tendency may magnify as age at arrival increases, because late arrivers are likely to be more affected by their origin-country standard of living. Non-European migrants might also enjoy relatively inexpensive rents in those neighbourhoods. Another possible explanation is that non-European migrants might be more financially constrained, such that whether they speak English very well or not has less of an impact on their residential outcomes.

We turn to considering another important factor, which can give an alternative explanation to our findings in the previous section, namely, parental background. Precisely, parental characteristics of migrants from the two sets of countries might be different, and parents with different characteristics might have made different decisions regarding the timing of migration to the UK. For example, parents from linguistically distant countries might have recognised a possible barrier that their children would face if they migrate when their children are older, and may have chosen to migrate when their children were younger. At the same time, these parents might be different from the parents of migrants from linguistically close countries, in a way that can affect the future residential outcomes of childhood migrants.

To address this type of concerns, we control for parental education, measured by the dummy variable that takes the value of one if any of the two parents of the migrants has college education or above, and zero otherwise.[26] A limitation of this exercise is that, due to missing information on parental education, sample sizes decrease by roughly 40 per cent. Despite this limitation, we control for this possibly important confounding factor in column (5) of Table 4. We are not aware of any other studies on the causal effects on residential outcomes that explicitly account for parental education, which is a potentially very important confounding factor. The results are broadly similar to our main results for enclave residency in panel A, but for neighbourhood quality in panel B, the results become insignificant. To investigate whether this change in estimation results are driven by a change in sample sizes or the inclusion of parental education, we estimate the model with the smaller samples used in column (5) *without* con-

[26] Ideally, we would have liked to control for more detailed measures of parental education, but the indicator for college education or above is the only measure that we can construct from our dataset.

trolling for parental education. Results (not reported) are very similar to those in column (5), implying that differences in the results are likely driven by a change in sample size.

We now address a concern that migrants from a linguistically distant country, where English plays an important role, may find it easy to acquire English skills, irrespective of linguistic distance between their mother tongue and English, potentially biasing our IV estimates. This is a valid concern, since there is variation in the commonality of English within non-Anglophone countries due to, for example, the extent and quality of English language education. To address this concern, we control for English Proficiency Index 2018 as the measure of average English skills in source countries.[27] A limitation of this exercise is that, because the English Proficiency Index is not available for all non-Anglophone countries in our sample, the sample sizes of non-Anglophone migrants are reduced by roughly 35 per cent. Nevertheless, we conduct this exercise using the best available data to explore this potential issue which can bias our estimates. The results reported in column (6) indicate that the results are broadly similar to the main results.

Next, recall that our strategy to identify the causal impact of English proficiency exploits the variation within non-Anglophone migrants distinguished by linguistic distance to English, after conditioning on Bleakley and Chin's (2004; 2010) instrument, ϕ_{ica} in equation (3). We now investigate robustness of our results to retaining only non-Anglophone migrants in our sample, and utilising the variation stemming only from these migrants. The results reported in column (7) confirm that our results are robust to the omission of Anglophone migrants.

Finally, as an extension of our analysis, we investigate a possible important channel through which English proficiency affects residential location choices; namely, education. Apart from the direct effects of English proficiency by facilitating communication with native residents, English proficiency may also have indirect effects by improving their educational attainments (Aoki and Santiago, 2018). We investigate this channel by adding the measures of education in equation (5).[28] We find that, after controlling for education, the point estimates of the impact of English proficiency on various types of residential clustering do not change much. We also find that holding an academic degree has no significant impact on residential clustering outcomes. In contrast, education, in particular, holding an academic degree, has a non-negligible impact on the neighbourhood quality outcomes, and the effects of English skills on these outcomes have been greatly diminished (e.g., roughly between three quarter to half of the original magnitudes). Taken together, our analysis supports the possibility that a better educational attainment resulting from better English skills is a key channel through which better language skills lead

[27] The English Proficiency Index 2018 is calculated by the international education company, EF Education First, based on the data on the scores of their English test collected from 1.3 million test takers across the world in 2017.

[28] Education is measured by a set of dummy variables that take the value of one if the person has a compulsory qualification, a post-compulsory qualification, and an academic degree, respectively, as the highest level of education qualification obtained, and zero otherwise. The dummy variable for no qualifications is omitted as a reference point.

migrants to live in a neighbourhood of higher quality, but other channels are likely at play for residential clustering.

7. Conclusion

We study the causal effects of English skills on residential location choices in four different types of immigrant enclave — language, country-of-birth, world-region-of-birth, and ethnic enclaves — and on the quality of the neighbourhood migrants live in, which to our knowledge has not been studied before. Our analysis is conducted using a unique dataset from the ONS Longitudinal Study that we link to the measures of neighbourhood quality in England, allowing us to gain insight into the residential environments which migrants with different English skills live in. To overcome a possible endogeneity issue of English skills, we rely on an IV strategy, where linguistic distance between English and the origin-country language, interacted with age at arrival, is used as an instrument for English skills. To account for (i) different assimilation processes between Anglophone and non-Anglophone migrants, and (ii) any changes in cohort quality that occurred in a different manner between the two sets of migrants, we control for an interaction of age at arrival with an indicator for being born in a non-Anglophone country. This interaction term is used as an instrument for English skills in Bleakley and Chin (2004; 2010), and other papers that follow their identification strategy (e.g., Akbulut-Yuksel et al., 2011; Miranda and Zhu, 2013; Guven and Islam, 2015; Yao and van Ours, 2015).

Our results suggest that better English skills have a negative impact on the residency in a language enclave. In contrast, we have found *positive* effects of better English skills on the residency in region-of-birth and ethnic enclaves. This last effect is in contrast to the majority of the findings of previous correlation studies, showing the negative associations between better language skills and residency in an ethnic enclave. Our result is also different from that of Bleakley and Chin (2010), who find, using US data, insignificant causal relations between English proficiency and residency in an ethnic enclave. Our findings imply that, for example, a Spanish-speaking white immigrant born in Spain who speaks English very well tend to live in an area with a low concentration of Spanish speakers, but in an area with a high concentration of individuals from Europe (their world region of birth) and of other white people (their ethnicity).

The results based on our IV strategy suggest that the impact of English skills on residential clustering varies depending on the type of enclave, suggesting different mechanisms are at play for different types of enclave. Helping migrants improve their English skills, via for example providing English language courses, could be effective in reducing residential clustering, by promoting migrants to live in linguistically less segregated areas with lower concentrations of people speaking their own native language. However, better language proficiency leads migrants to cluster in areas with higher concentrations of individuals from the same world

region of birth and ethnicity, suggesting that other aspects than linguistic convenience, such as the availability of cultural amenities or good job opportunities, are likely to play an important role in determining migrant residential locations.

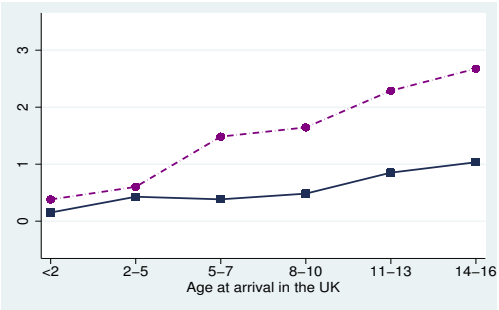
Turning to neighbourhood quality outcomes, we find that poor English skills lead migrants to live in a lower-quality neighbourhood, in which residents are deprived of employment, among others. This could imply that poor language skills can have amplifying negative effects on migrant's employment status through neighbourhood effects (e.g., Topa, 2001), in addition to through its direct effects on unemployment as found in a number of existing studies (e.g., Miller and Neo, 1997; Gonzalez, 2005; Clausen et al., 2009; Yao and van Ours, 2015). An extension of our analysis finds that lower educational attainment, resulting from poor English proficiency, is likely the key channel through which language skills affect neighbourhood quality outcomes. In this regard, helping migrants improve their English skills could be an effective policy to improve their residential environments, by improving their educational outcomes (Aoki and Santiago, 2018).

When considering a design of language support, it would be beneficial to target those who arrived in the UK after age eight, because individuals who arrived in the UK at age eight or before appear to catch up with the level of proficiency of Anglophone migrants by the time they become adults. It is also likely to be an efficient use of resources to target younger migrants, among those who arrived after age eight, because the earlier migrants are exposed to English, the easier it is for them to learn the language.

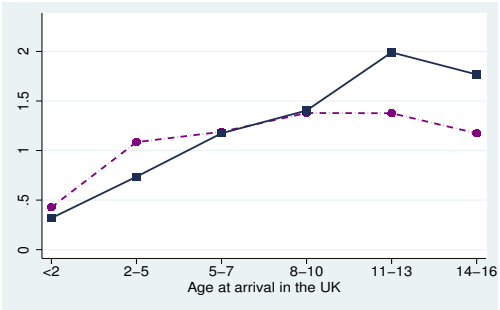
Declaration of Competing Interest

None.

Appendix



(a) Language enclave residency



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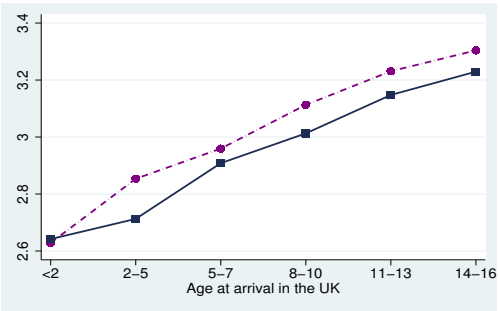
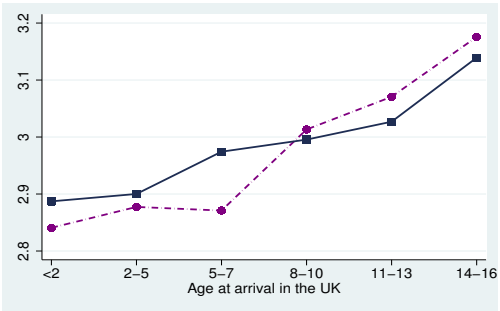


(c) Neighbourhood quality measured by income (in quintiles, 5 = worst)



(d) Neighbourhood quality measured by health (in quintiles, 5 = worst)

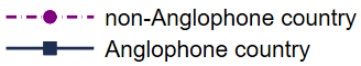


Figure A1

Immigrant outcomes by linguistic origin and age at arrival.

Notes: Mean immigrant outcomes are plotted by age at arrival where the outcomes are extent of residential clustering in terms of the main language spoken by residents (panel (a)) and of ethnicity of residents (panel (b)); and quality of the neighbourhood in which migrants live, measured by income of residents (panel (c)) and health of residents (panel (d)). Each outcome is regression adjusted for age and sex. The sample corresponds to childhood migrants aged 20 or over at the time of the 2011 Census.

Source: ONS Longitudinal Study.

Table A1
Immigrants by country of birth.

A. Anglophone countries			*B. Non-Anglophone countries*		
A1. Arrived aged 0 - 8	*N*	*%*	*B1. Arrived aged 0 - 8*	*N*	*%*
Ireland	555	17.6	Cyprus	238	11.9
Kenya	346	11.0	Somalia	122	6.1
United States	239	7.6	Italy	121	6.0
South Africa	233	7.4	Turkey	110	5.5
Canada	223	7.1	France	79	3.9
Australia	204	6.5	Malaysia	77	3.8
Singapore	186	5.9	Germany	61	3.0
Jamaica	165	5.2	Iran	58	2.9
Malta	150	4.7	Egypt	55	2.7
Uganda	149	4.7	Iraq	52	2.6
Nigeria	117	3.7	Netherlands	51	2.5
Zambia	76	2.4	Vietnam	48	2.4
Zimbabwe	67	2.1	Spain	44	2.2
New Zealand	60	1.9	Portugal	43	2.1
Gibraltar	51	1.6	Belgium	41	2.0
Ghana	47	1.5	Yemen	40	2.0
Guyana	36	1.1	Saudi Arabia	39	1.9
Isle of Man	30	0.9	Malawi	33	1.6
Trinidad and Tobago	27	0.9	Aafghanistan	32	1.6
Mauritius	25	0.8	Libya	32	1.6
Total top 20	2,986	94.6	Total top 20	1,376	68.6
A2. Arrived aged 9 - 16	*N*	*%*	*B2. Arrived aged 9 - 16*	*N*	*%*
Ireland	536	19.0	Somalia	359	14.1
Kenya	496	17.6	Turkey	195	7.7
Jamaica	347	12.3	Cyprus	175	6.9
Uganda	217	7.7	Afghanistan	122	4.8
Nigeria	193	6.9	Poland	119	4.7
South Africa	156	5.5	Vietnam	90	3.5
Zimbabwe	119	4.2	China	89	3.5
Ghana	107	3.8	Portugal	77	3.0
United States	66	2.3	Iraq	71	2.8
Guyana	57	2.0	Yemen	67	2.6
Canada	44	1.6	Italy	66	2.6
Australia	41	1.5	Iran	61	2.4
Singapore	39	1.4	Kosovo	58	2.3
Sierra Leone	39	1.4	Germany	55	2.2
Zambia	31	1.1	France	47	1.8
Trinidad and Tobago	29	1.0	Malaysia	44	1.7
St Lucia	26	0.9	Malawi	39	1.5
Mauritius	24	0.9	Ethiopia	28	1.1
New Zealand	23	0.8	Rrussia	28	1.1
Barbados	22	0.8	Lithuania	28	1.1
			Congo (Democratic Republic)	28	1.1
Total top 20	2,612	92.8	Total top 20	1,846	72.5

Notes: Panels A and B present Anglophone and non-Anglophone countries, respectively. *N* refers to the number of individuals by country of birth for the top 20 countries present in our sample for those who arrived in the UK between age 0 and 8 (upper panels) and between 9 and 16 (lower panels).
Source: Authors' calculations based on the ONS Longitudinal Study.

Table A2
Comparison of immigrant and spouse characteristics by group distinguished by age at arrival and linguistic origin.

	Non-Anglophone country of birth		Anglophone country of birth		Difference in differences
	Arrived aged 0 - 8	Arrived aged 9 - 16	Arrived aged 0 - 8	Arrived aged 9 - 16	{(2)-(1)} –{(4)-(3)}
	(1)	(2)	(3)	(4)	(5)
A. Education					
No qualifications	0.093	0.194	0.100	0.173	0.028
	(0.290)	(0.396)	(0.300)	(0.379)	(0.035)
Compulsory	0.371	0.459	0.379	0.461	0.006
	(0.483)	(0.498)	(0.485)	(0.499)	(0.029)
Post-compulsory	0.626	0.534	0.618	0.537	-0.012
	(0.484)	(0.499)	(0.486)	(0.499)	(0.029)
Academic degree	0.422	0.277	0.428	0.323	-0.040
	(0.494)	(0.447)	(0.495)	(0.468)	(0.029)
B. Labour market					
Ever worked	0.944	0.847	0.979	0.963	-0.080***
	(0.231)	(0.360)	(0.142)	(0.190)	(0.018)
Active	0.856	0.774	0.885	0.862	-0.059***
	(0.352)	(0.418)	(0.319)	(0.345)	(0.021)
Full-time	0.636	0.541	0.720	0.665	-0.040
	(0.481)	(0.499)	(0.449)	(0.472)	(0.029)
Unemployed	0.111	0.160	0.053	0.100	0.003
	(0.314)	(0.367)	(0.225)	(0.300)	(0.024)
C. Marriage, spouse and fertility					
Married	0.476	0.450	0.621	0.616	-0.022
	(0.500)	(0.498)	(0.485)	(0.486)	(0.044)
Spouse's English skills	2.893	2.563	2.979	2.936	-0.287***
	(0.387)	(0.713)	(0.156)	(0.281)	(0.047)
Spouse UK born	0.688	0.292	0.743	0.412	-0.064
	(0.464)	(0.455)	(0.437)	(0.492)	(0.054)
Number of dependent children in same household	0.869	1.204	0.872	0.744	0.464***
	(1.117)	(1.433)	(1.063)	(1.024)	(0.121)

Notes: See Table 1 notes for sample specification. The sample size, N, is 10,522 unless otherwise specified. The sample in panel B is further restricted to those aged between 20 - 60 and not in full-time education (N=7,876). The characteristics related to children (N=9,125) and spouse/partner (N=6,194) can be observed only for those with children and spouse/partner present in the same household, respectively. Column 5 presents the estimates of η_3 and their standard errors obtained from the following equation: $outcome_{ica} = \eta_0 + \eta_1 I(a_i > 8) + \eta_2 I(non - Anglophone) + \eta_3 I(a_i > 8) \times I(non - Anglophone) + \omega_{ica}$. $***p < .01$.
Source: Authors' calculations based on the ONS Longitudinal Study.

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Online Appendix

Table OA1
IV effects of English proficiency using an alternative measure of English skills.

Dependent variable:	Enclave, neighbourhood quality			English skills ordinal measure
	OLS	IV	Reduced-form	First-stage
	(1)	(2)	(3)	(4)
A. Enclave residency				
Language enclave	-2.953***	-2.519*	0.528*	-0.209***
	(0.682)	(1.457)	(0.290)	(0.020)
Country-of-birth enclave	-0.944***	0.569	-0.119	-0.209***
	(0.333)	(1.349)	(0.290)	(0.020)
World-region-of-birth enclave	-0.219*	1.947***	-0.408***	-0.209***
	(0.111)	(0.687)	(0.129)	(0.020)
Ethnic enclave	-0.235*	2.112***	-0.444***	-0.210***
	(0.124)	(0.736)	(0.087)	(0.020)
B. Neighbourhood quality index (in quintiles, 5 = worst)				
Income deprivation	-0.300***	-0.638	0.134*	-0.211***
	(0.056)	(0.387)	(0.075)	(0.021)
Employment deprivation	-0.273***	-0.960*	0.202**	-0.211***
	(0.056)	(0.520)	(0.093)	(0.021)
Health deprivation	-0.180***	-1.048**	0.221***	-0.211***
	(0.051)	(0.429)	(0.076)	(0.021)

Notes: OLS and IV are the estimates of β_1 in eq.(5), where the ordinal measure for English skills, ranging between 0 and 3, is used as the measure of English proficiency. First-stage and reduced-form are the estimates of the coefficients on the instrument specified in eq.(4). Refer to Table 2 for controls included. Sample sizes for panels A and B are 10,522 and 10,320, respectively, except for ethnic enclave (10,482 observations due to 40 missing values). The first-stage F-statistics on the excluded instrument range between 104 and 107. Standard errors are clustered by country of birth. *** $p < .01$, ** $p < .05$, and * $p < .10$.
Source: Authors' calculations based on the ONS Longitudinal Study.