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FULL ARTICLE

"The grass is greener on the other side": The relationship between the Brexit referendum results and spatial inequalities at the local level

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Abstract

Despite seven decades of development of the European Union project, on 23 June 2016, the United Kingdom, Europe and the rest of the world were surprised when the Leave campaign won the Brexit referendum, offering an extraordinary case study for researchers. We spatially disaggregate the vote share data, which allows us to explore where anti-European sentiment took root in the UK and why. In this paper, a spatial dependence model is applied to clarify and quantify the relevance of the different dimensions—demographic, cultural/educational and economic—that play a role in explaining the rise of support for the Leave campaign. The analysis is conducted at the local level, using local authorities (LAs) as the spatial unit of analysis due to the combination of official datasets with newly generated data in the context of an EU H2020 project. A new indicator capturing the affluence of each local area relative to its close neighbours is proposed and included in the model. In general, we observe that most of the main conclusions obtained by large regions or at the national level also hold at the local scale. However, it is particularly interesting that inequalities by LAs are clearly significant, indicating a marked influence on voters' decisions that have thus far been unaccounted for. This result

provides further support for the existence of, to use Andrés Rodriguez-Pose's terminology, an even more intense "revenge of the places that do not matter" at the local scale.

KEYWORDS
Brexit referendum, geography of discontent and Euroscepticism, spatial inequalities

1 | INTRODUCTION

The success of the campaign for the exit of the United Kingdom from the European Union in the referendum of 23 June 2016, generated a shockwave not only in the United Kingdom but also throughout Europe and the world. After seven decades of European Union construction focused on economic and social improvements, the citizens of the United Kingdom and the rest of the world witnessed the surprising triumph of Brexit, opening the door to an uncertain and complex future. However, seen in perspective, Brexit can be considered a *chronicle of an event foretold*: after the outbreak of the severe international economic crisis of 2007–2008, the insufficient response of European Union institutions generated a climate of rapidly spreading general dissatisfaction with the political system. This displeasure has not stopped growing since, with Brexit being a clear materialization of this wave of discontent, albeit neither the only nor the last one.

To prevent similar situations from occurring in other EU countries in the imminent future, it is crucial to understand the elements that came together to generate the discomfort and disaffection with European Union institutions in the UK. From the UK's perspective, it is important to understand all the factors that led to such a dramatic decision affecting its future social and economic developments, especially in the local domain (Billing et al., 2019). Additionally, the Brexit referendum gives social science researchers valuable data on the location of anti-EU sentiment-data that can be combined with other location-specific information to test hypotheses on the determinants of vote outcomes. Consequently, a large and ever-growing number of studies have used this UK case to understand the general phenomenon of political discontent, leaving behind a much clearer knowledge of how, where and why anti-immigration, anti-globalization and anti-Europe narratives succeed. This literature reviews how the emergence of discontent channelled into anti-European voting has been driven by multidimensional factors, with demographic, cultural/educational and socio-economic characteristics all coming together to play a part. Several works also point to the existence of a clear geographical element insofar as there was a spatial concentration of the pro-Leave vote.

Among the studies focusing on the geographical dimension, two in particular draw attention to the role of regional inequality in shaping voting outcomes. Rodríguez-Pose (2018) contributes the very provocative idea that gives the title to his paper: *the revenge of the places that do not matter*. This phenomenon describes how deprived areas, as the main enclaves of support for populist political alternatives and the usual bearers of anti-Europe, anti-immigration or anti-globalization sentiment, vote against institutions that are considered to have forgotten about an areas' needs and failed to provide solutions to their concerns. McCann (2016) highlights the common misconception that the metropolitan elites of London are the only ones who have benefited and that other regions have not received anything from the EU. As McCann points out, although many of these weaker regions have certainly seen the downside of internationalization, belonging to the European Union actually mitigated those perverse effects, although this fact did not reach the population as the disparities between wealthier and poorer regions grew steadily larger. Both Rodríguez-Pose (2018) and McCann (2016) agree that territorial inequality is what matters, which is not to say that interpersonal inequality is not important but rather that the challenge to the system has come from this neglected source of inequality.

Previous literature has developed analyses on a regional scale; individual decisions are aggregated by areal units at the spatial level of large regions. When insufficient spatial disaggregation is used, the local heterogeneity that may exist within areal units may be cancelled out in the aggregation, losing nuances in the analysis or reaching biased conclusions. In this paper, our main goal is to contribute to the previous literature and, in particular, to the ideas of Rodríguez-Pose (2018), Los et al. (2017) and McCann (2016), reproducing the analysis of the spatial behaviour of the pro-Leave vote in the Brexit referendum but using a more disaggregated unit of spatial analysis: local authorities (LAs hereinafter). Working at a local scale, we can observe whether the spatial patterns of discontent remain and identify the nuances derived from more spatially detailed data. In addition, our study contributes to the wide existing literature in the following ways: first, by generating local income data that are consistent with the more aggregated spatial scales (as part of the deliverables for the EU H2020 IMAJINE Project); second, by using these new data as a key element to analyse the spatial pattern of the Leave vote; and third, by creating a novel indicator reflecting an area's average income difference with its neighbours to test how local inequalities influenced Brexit. Finally, high spatial disaggregation requires the use of sophisticated spatial econometric techniques. In this paper, the econometric specification carefully takes into account the spatial dimension of the data.

Our results indicate that local spatial inequality matters for the Leave vote. The relative income position of each locality within a group of neighbours matters in the sense that after controlling for a host of location characteristics, local authorities that are poorer than their neighbours tend to have a higher Leave vote share, and vice versa. In light of the existing literature on the Brexit vote, we interpret the results as supporting the argument of the discontent of "left-behind" places channelling into a punishment vote against the status quo of UK membership in the EU (McCann, 2016; Rodríguez-Pose, 2018).

The paper is organized as follows. In the next section (Section 2), we include a brief review of the extensive literature on the geography of anti-European sentiment. This review helps identify the dimensions that we must consider in our analysis. Section 3 introduces the empirical setting of the study: the spatial unit used (local authority) (subsection 3.1), our response variable (subsection 3.2), and the set of explanatory factors we intend to use to quantify the dimensions of the phenomenon (subsection 3.4), with special attention to our measure of local inequalities (subsection 3.3). Section 4 gathers all the information provided previously into the chosen specification of spatial dependence. The results are presented and discussed in Section 5. The paper concludes with a final summary and policy recommendations (Section 6).

2 | WHERE DID THE ANTI-EUROPEAN VOTE TAKE ROOT? THE RELEVANCE OF WORKING WITH HIGHLY DISAGGREGATED SPATIAL UNITS

Throughout the last decade, we have witnessed a general feeling of disaffection with the system and institutions, a climate of *political discontent*. This idea of *discontent* expresses different types of reactions that can be grouped into categories such as: (i) the rise of populist parties and movements with an anti-European stance in many EU countries (Algan et al., 2017; Vasilopoulou, 2018); (ii) reduced trust in the European Union and national institutions, which has been referred to as a trust crisis (European Commission, 2015); (iii) reduced support for the European project in general, as well as reduced levels of identification with the European Union (Flesher, 2017); and (iv) a reduction in social engagement and participation among the citizens of EU countries (Magni, 2017). Furthermore, as noted in the literature, these dimensions are *localized* in the sense that they are more prevalent in some places than in others. More boldly speaking, there is a *geography of discontent* (Los et al., 2017) such that the rise of populist movements, Euroscepticism, the loss of trust in the European Union and national institutions and the reduction of social engagement exhibit particular spatial patterns (Georgiadou et al., 2018; Oesch, 2008).

In the context of this growing literature concerned with understanding the drivers of the *discontent* in general and the patterns across space in particular, Brexit has been a case study of enormous relevance, attracting

substantial academic attention and extensive analysis from the social sciences. Thanks to this literature, we are starting to understand what the drivers of Brexit were, why it happened, who Leave voters are and where the Brexit campaign was most successful. Through this particular case, we can better understand the phenomena of institutional disaffection, anti-Europeanism or general political discontent.

The percentage of votes in favour of Brexit increased monotonically with age, going from only 27% of the group aged 18–24 to 60% of those aged 65+, while conversely, it decreased monotonically with education (Crescenzi et al., 2017). Academic studies have rapidly confirmed the effects of age and education on the probability of voting to leave the EU (see Arnorrsson & Zoega, 2016; Clarke, Whiteley, et al., 2016; Harris & Charlton, 2017; and Manley et al., 2017, among others). However, in addition, there was a clear relationship between voting Leave, concern over immigration and the slippery concept of identity. With different approaches and techniques, authors such as Hobolt and Wratil (2016), Hobolt (2016), Arnorrsson and Zoega (2016), Clarke et al. (2016), Langella and Manning (2016) and Goodwin and Heath (2016) coincide in finding that voters who express concerns about immigration and multiculturalism voted Leave.

What about economic variables such as income, deprivation or unemployment? Kaufmann (2016, p. 1) summarizes the main conclusion of most of the previous studies: "Age, education, national identity and ethnicity are more important than income and occupation," However, as noted by Los et al. (2017), conceptual perspectives motivating Brexit exclusively based on cultural issues (identity, national sovereignty, etc.) have been regarded by some as inadequate to thoroughly describe the geography of the Brexit vote. This alternative perspective claims that variables accounting for the economic conditions of citizens and the economic geography of UK regions are at least as important as culture and identity in determining individual attitudes towards the EU and voting patterns in the 2016 referendum (Crescenzi et al., 2017). Indeed, empirical analyses performing comprehensive investigations of the Brexit vote and considering not only demographic and political variables but also proxy variables for local economic structure and "economic exposure" to the rest of the European Union all seem to suggest that economic factors played a significant role (see Arnorrsson & Zoega, 2016; Becker et al., 2017; or Hobolt, 2016). Additionally, Darvas (2016) claims that wage inequality and poverty were two crucial drivers of Brexit. Clarke et al. (2017) demonstrate that economic cost–benefit evaluations are at least as influential as any sense of identity. Indeed, Curtice (2017) claims that the perceived impact of leaving the EU on the economy is the variable most strongly related to how people voted. Clarke et al. (2016) show how labour market conditions are crucial in conditioning voters' choices. Higher employment levels are associated with a lower propensity to vote Leave, suggesting that unemployed people were more prone to support Brexit than those with safe salaries and jobs (see Becker et al., 2017 or Alabrese et al., 2019; Clarke et al., 2017; Goodwin & Heath, 2016; Goodwin & Milazzo, 2017). Los et al. (2017, p. 788) summarize the conclusions of the empirical work to date, stating that econometric studies "all suggest that local economic conditions were the single most important factor driving the pattern of voting, interacting with the characteristics of the individuals making up that locality." Harris and Charlton (2017, p. 2127) read the general context very well: "Ultimately, the story is perhaps less about the EU itself but one of industrial decline and growing social and economic inequality, overlapping with nationalism and political beliefs."

Focusing on the geographical perspective, it is clear that within England, there were marked geographical differences in voting patterns. Remain votes dominated in London and many parts of the home counties—the western arc around London from Cambridge to Oxford and down to Surrey—along with some of Britain's major cities such as Leeds, Manchester, Cardiff, Leicester, Bristol, Liverpool, Edinburgh and Glasgow. In addition, Remain voter preferences in both Scotland and Northern Ireland displayed markedly different patterns from those in localities that were perceived to have benefited most from globalization (Coyle, 2016). As noted by Goodwin and Heath (2016), the geography of deprivation and prosperity both interacted with and overlaid each of the individual-specific explanatory variables. In the context of this previous literature on the spatial patterns of support for Leave, Rodríguez-Pose (2018) pitches a stirring idea: *the revenge of the places that do not matter*, whereby those areas specialized in declining activities and located on the periphery voted down a system that they perceived to have quelled their potential and driven them down a road in which the future offers no opportunities, no jobs and no hope.

In line with this idea of the generation of a *feeling of spatial revenge*, Los et al. (2017) highlight that people in less prosperous regions who sensed that they had suffered under modern globalization were much more likely to vote Leave; this holds even after personal characteristics are controlled for. Ironically, the regions that voted Leave also tended to be more dependent on Europe than their counterparts that voted Remain (Los et al., 2017). These Leave-voting regions tended to be more dependent on EU markets for their trade and prosperity, and many of them had benefited significantly from regional development funding from the EU Cohesion Policy over many years. Additionally, as McCann (2016) emphasizes, while many of these weaker regions have suffered under globalization, they actually benefited from trade integration under the EU, with the latter process partially mitigating the effects of the former. However, the public did not understand this. According to McCann (2018, p. 4), "In the UK, an important pro-Leave narrative was that the 'metropolitan elites' of London were the only real beneficiaries of EU membership, while other regions had not enjoyed the benefits of European economic integration. In contrast, empirically, it is now clear that this *metropolitan elite* argument was completely incorrect and that the regions that most benefited from the EU markets for their viability were largely the non-core weaker regions of the UK."

In terms of research design, the studies can be divided along the lines of the type of unit of analysis they are using, individuals or area units. Individual responses form the variable of interest in individual-level studies; in the latter case, responses are aggregated by areal units, such as local authorities or regions. Most of the previous literature on the geography of discontent developed analyses on a regional scale. When using regions as units of analysis, one must refrain from the ecological fallacy of assuming that conclusions about individuals based on population-level or "ecological" data will hold. In this case, the analysis becomes about places and their characteristics, and the research question becomes, "What is it about places that resulted in certain vote outcomes?"

In addition, there are many studies on the determinants of the Brexit vote using individual-level data on voting intention. The Understanding Society Survey includes questions about the Brexit referendum such as "Should the United Kingdom remain a member of the European Union or leave the European Union?" In a study using voting intent as a dependent variable, Lee, Morris, and Kemeny (2018) place individual mobility as the central indicator of the social division that delivered Brexit. The argument is based on Goodhart's (2017) book on Brexit distinguishing between "Anywheres2 and "Somewheres." Goodhart's Anywheres are educated elites whose identities are not tied to any particular local community, or even Britain. These elites are said to have overwhelmingly voted to remain in the European Union, while Somewheres, with strongly place-bound identities and associations, voted to leave it. "The immobile are, by definition, more tied to their local area and thus more exposed to external change, so local change may have influenced them more than other groups, with the Brexit vote being a way of protesting against changes to their local environment" (Lee, Morris, & Kemeny, 2018, p. 155). The main explanatory variable here is whether a respondent was living in the same local area in which they were born. The authors suggest that immobility increased Leave votes in counties experiencing growth in their non-white population. Growth in the average local wage lessens the effect of immobility. Similar to other individual-level studies, this study uses regional controls and area-aggregated variables to account for spatial effects. Despite the interest it arouses, this widely used approach may not reflect the complexity of spatial effects. There are notable exceptions, such as the contribution made by Harris and Charlton (2017), who use a multilevel model with local authorities nested in regions to account for spatial effects in voting outcomes, or Abreu and Öner (2020), who explore the influence of the interaction between individual features and geographical context on voting behaviour (Table 1).

Analysis at the individual level and the large spatial scale of NUTS regions may miss important determinants acting at the intermediate, smaller (spatial) scale. A perusal of the area-as-unit-of-analysis literature shows that analysis at different, particularly finer, spatial scales may yield different results; taking the politically contentious issue of in-migration, Colantone and Stanig cited in Lee et al. (2018, p. 145) find that stocks and flows of immigrants in NUTS 3 regions are unrelated to voting intention, "a finding that stands in direct contrast to that found by Goodwin and Milazzo (2017), who use more disaggregated parliamentary constituencies."

TABLE 1 Variables used as predictors—EU-SILC and census microdata (2011)

Head of household age and age squared
Head of household gender
Head of household is a foreigner from an EU country/foreigner from non-EU country
Head of household marital status: married/separated/widow/divorced
Head of household education: post-mandatory/non-college education/college education
Head of household activity status: worker/retired or disable/other activity
Head of household is in a part-time employment
Head of household occupation: manager/technician or professional/support worker or sales/craft, machine operators or skilled agricultural worker
Head of household economic sector: CNAE (1 digit)
Tenure of the dwelling
Number of rooms in the dwelling
Number of workers in the dwelling
Number of members (by age) in the household
Household structure: single parent/couple with children/couple without children/other with family/other without family

Additionally, the contrast between the voting outcomes of large cities and rural areas or between the centre and periphery within regions suggests that the analysis should be carried out using smaller spatial units, such as local authorities. There is a dearth of studies on voting outcomes using meso or local area units that could potentially add to our understanding of the geographical determinants of votes filling the middle ground between studies using highly aggregated regional-scale and individual-level studies.

A major obstacle to performing analysis at the local or medium scale is the absence of data on income or poverty at levels of disaggregation lower than the regional level. Supported by the European Union H2020 IMAJINE project's development of a database of socio-economic variables at a local scale, in this paper, we propose to analyse how socio-economic variables and spatial disparities can contribute to explaining the Brexit vote, and we test the Rodríguez-Pose (2018) idea of *the revenge of places that do not matter* at this level of disaggregation.

3 | EMPIRICAL SETTING: SPATIAL UNIT OF ANALYSIS, ESTIMATION OF LOCAL INCOME AND DATASET

3.1 | Spatial unit of analysis: Local authorities

The objective of this work is to study the drivers of Brexit success with a local-level analysis, placing special emphasis on understanding the role of local spatial inequalities. We should therefore use a highly disaggregated spatial unit. In this study, we propose to perform the analysis at the level of local administrative units, LAU level 1 in the EU classification. This is formerly the NUTS 4 level of municipalities or equivalent. These units closely align with the level of local government in the UK, providing local public services in the area. A wide range of socio-economic data from the 2011 Census is available at the LAU 1 level for the UK, making it possible to create variables that have been used in previous studies on determinants of the Brexit vote, namely, demographics, education, labour market condition variables. Therefore, we consider this to be the most appropriate local spatial unit to carry out our research. We refer to these units as local authorities (LAs).

However, at the same time, we are strongly limited by the existence of official statistical information. In this study, we resort to several sources of data, particularly the 2011 census safeguarded microdata (a sample of 5% of the local population), containing individual data coded at the LA level. The original count of LAU 1 areas (excluding Northern Ireland) was 406. However, the census microdata aggregate localities with less than 120,000 inhabitants to a neighbouring area, making the number of units used in this study 265.

3.2 | Independent variable: Leave votes share by local authorities in the Brexit referendum

Our dependent variable is the Leave vote share by LAs recorded by the Electoral Commission of the UK. The spatial distribution of Leave vote support by LAs is plotted in Figure 1, which shows a heterogeneous landscape where some areas, such as London and its neighbouring areas in the west (Oxfordshire and Hampshire) and the south (Surrey, West Sussex and East Sussex), exhibit a share of Leave votes below 45%. On the other hand, some LAs in western Britain, namely, the coasts of Lincolnshire and Norfolk, show higher support for the Leave option, which garnered approximately 60% to 75% of the local votes.

3.3 | Our main explanatory variable: A measure of relative local spatial inequality

Apart from using information at the local level, by LAs, of demographic or educational characteristics and the economic circumstances and expectations that have been considered in previous studies, in this research we are particularly interested in the role of spatial economic inequality at the local scale (by LA). This objective, however, is also affected by the absence of income or production data at a local level (by LA).

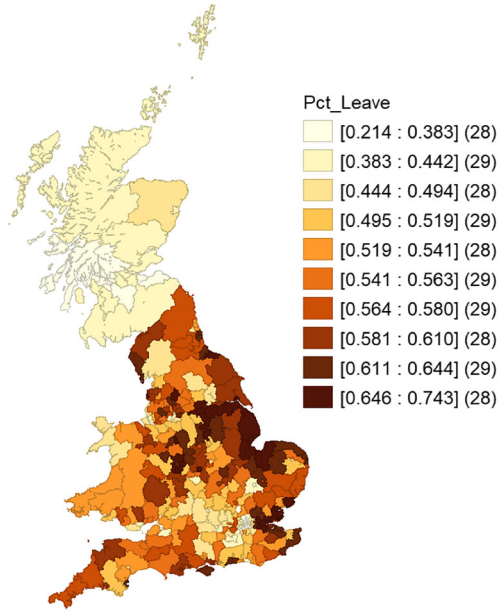

FIGURE 1 Leave-vote share in the Brexit referendum by Local Authority. *Source*: Own elaboration using data from the Electoral Commission of the UK

Estimation of this type of information has been one of the objectives of the European Union H2020 IMAJINE project, an attempt to generate reliable information at the local level that is coherent with official sources at more aggregated (regional and national) levels. This project aims to study spatial differences of various natures across EU territories using several socio-economic indicators and explicitly considering the role played by the spatial scale. More specifically, one part of the project consists of disaggregating the income and wellbeing indicators that are available for several EU countries at an aggregated regional level (NUTS 1 or NUTS 2 regions) to produce analogous measures at the subregional or local scale (NUTS 3 or lower). The result of this disaggregation will enable the quantification of potential inequalities between territories that could be masked as a consequence of data aggregation (e.g., urban–rural gaps within regions).[1]

As further explained below, the main advantage of the estimated data used in this analysis is its coherence with regional and national aggregates. As in any analysis relying on estimated variables, this one is critically affected by the existing gap between the estimated and the actual value of the variable in question. The lack of information is the fundamental reason behind the use of an estimated variable, but we believe that the procedure summarized next (especially the second stage) makes the estimation more reliable, as it allows for the imputation of a value under high uncertainty that can satisfy conditions derived from observable data.

The procedure followed to produce these spatially disaggregated data has two stages, as explained in Fernández-Vázquez et al. (2018). In the first stage, the imputation technique proposed in Elbers et al. (2003) and Tarozzi and Deaton (2009) is applied. Although extensive explanations can be found in the mentioned paper, in summary, the procedure combines information from the European Union Social Indicators and Living Conditions (EU-SILC) survey and the population census (PC) for a given economy. The EU-SILC contains detailed socio-economic information about the households surveyed but no details about their geographical location beneath the NUTS 1 level. Consequently, estimates based on the EU-SILC typically do not allow the inference of income figures for subregional units such as municipalities or cities. On the other hand, microdata from the PCs contain geographical information on the individuals surveyed at a disaggregated scale, but economic indicators, and more specifically income figures, are not generally available. The strategy suggested in Elbers et al. (2003) and in Tarozzi and Deaton (2009) consists of estimating regression models of the indicator of interest (y) on a set of regressors (Z) that are observable in both the EU-SILC and the PC. Once these models are estimated at an aggregated spatial scale, the results for the parameters are projected over the households surveyed in the PC. Since the PC has the detailed geographical location of the households, this technique enables the estimation of y at the same disaggregated spatial scale presented in the PC.

The second stage seeks to guarantee consistency between the estimates for the subregional units and the regional aggregates from the official dataset (i.e., the EU-SILC), since the sum of the estimates $\widehat{y}_i$ for the households ($i = 1,\ldots,D$) in a region may be larger or smaller than the regional figure. Fernández-Vázquez et al. (2018) propose a solution to this inconsistency based on generalized maximum entropy (GME) to adjust the estimates and make them consistent with the official aggregates. Using GME, the authors turn the estimations from the first stage into an optimization problem, constrained by the linear relationships to be satisfied (higher-level aggregates). The final value responds to the idea that each possible value that the variable of interest may take has an associated probability and that such a probability can be estimated using an optimization criterion. In this way, the final prediction is built from consistent socio-economic information at different levels (first stage), constrained by known aggregates so that the distance to the actual value is minimized. To test the validity of the imputation, Fernández-Vázquez et al. (2018) included a comparison to actual data and made a numerical simulation for the case of Spain. The results showed that the error of the estimation was relatively small and that the constrained method performed better than the unconstrained method. See the enclosed supporting information for a more comprehensive explanation of how this process of adjusting estimates using GME is applied.

In the case of the UK, the EU-SILC contains approximately 8,058 households, for which information on a set of demographic characteristics (age, labour status, education level, occupation, etc.) is gathered in matrix *Z*. The variables on this matrix were selected following two criteria:

1. They should be appropriate explanatory factors used in regression models that predict household income levels.
2. They should be observable in the 2011 UK census.

Once the variables in *Z* are chosen, regression models that predict household income for each household *i* in the EU-SILC are estimated. These regression equations are estimated individually for each of the areas to allow for regional heterogeneity in the parameters. The vector with the estimates of each equation $(\widehat{\beta})$ is then assigned to the households in the sample of the PC, which consists of approximately 1.5 million observations, and the income predicted for each household *i* is calculated as $\widehat{y}_i = \widehat{\beta} z_i$. Afterwards, the GME adjustment described in supporting information is applied to make these estimates consistent with the regional figure available in the EU-SILC for the UK in 2011 (NUTS 2 level).

Thanks to the estimation process described, we can have income information at the local level (by LA units), making it possible to map the spatial distribution of the median income (euros per year) in the UK, as depicted in Figure 2.

Once we have the income level by LAs, we use it to calculate a new measure of spatial inequality. For this study, we considered it appropriate to build an indicator representing the relative average difference in the local median income between an LA and its 15 nearest neighbours (closer LAs). This spatial definition allows us to link the spatial pattern of the Leave vote (Figure 3) with the relative income differences that may exist within the limits of a vicinity.[2] Particularly, this indicator ($Diff_i$) is defined as:

$$Diff_i = 1/n \sum_{i,j}^{n} \left(\frac{Minc_i - Minc_j}{Minc_i} \right), \quad i \neq j;\ n = 15 \tag{1}$$

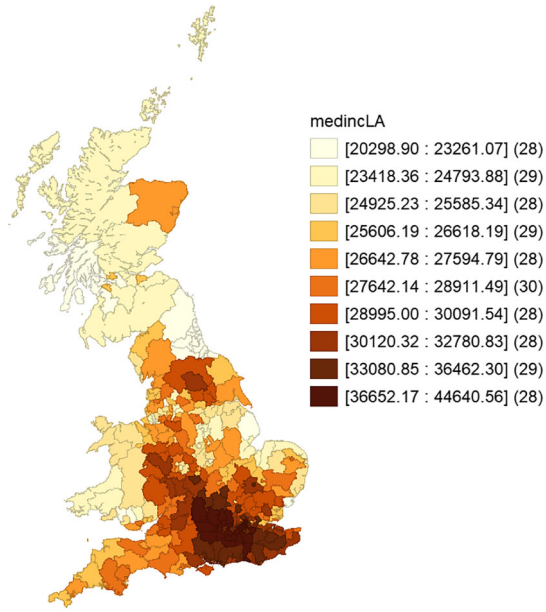

FIGURE 2 Median income by local authority (2011). *Source*: Own elaboration using data from IMAJINE (Fernández-Vázquez et al., 2018)

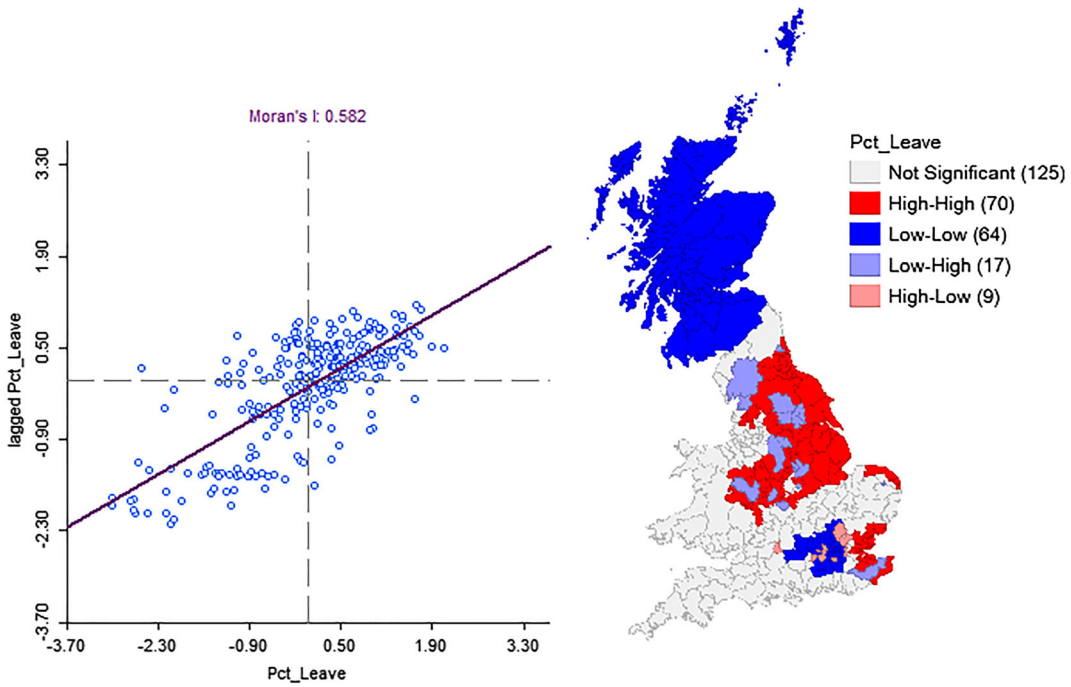

FIGURE 3 ESDA: Moran's scatterplot and cluster map of the Leave-vote share. *Source*: Own elaboration

where $Minc_i$ is the median income in LA *i*, and $Minc_j$ is the median income in LA *j*. The absolute value of this index shows how near or far an LA is with respect to its neighbours in terms of median income, being positive if the region is above the average within its defined vicinity and negative if it is below. The duality of the index (positive/negative) makes it a very strong tool despite its simplicity, as it differentiates two types of inequalities, namely, a better or a worse situation relative to that of the neighbouring localities (closer LAs). The latter case is especially interesting because perceived economic deprivation concerning the surrounding areas might be one of the reasons that certain segments of the population voted to leave the EU. These claims are in line with the economic studies of Los et al. (2017) and Rodríguez-Pose (2018), who show how the referendum allowed those unhappy with their disadvantaged situation to take "revenge" on the so-called metropolitan elites. In this vein, we expect a negative and significant relationship between Leave vote shares and the spatial relative inequality indicator introduced here; the lower the value of the indicator (meaning more negative and thus a worse economic performance of the area relative to its neighbours), the higher the share of Leave votes. It is important to highlight that this measure explicitly introduces into the analysis the sentiment created by the most proximate environment, meaning that an affluent locality in absolute terms might regard itself as a "lagging-behind" area if its surroundings are performing comparatively better and therefore might have shown its discontent through stronger support for the Leave option.

3.4 | Sources and definition of the control variables

To complete the model, we need to add the set of other variables identified in the literature as relevant to properly explain the Brexit referendum result. In line with the other studies reviewed in Section 2, previous papers on this

matter consider the economic, demographic, educational and cultural scenario, along with labour market conditions and the ideological position regarding international economic integration (Euroscepticism) as drivers of the vote result (Arnorrsson & Zoega, 2016; Becker et al., 2017; Clarke et al., 2017; Crescenzi et al., 2017, among others).

Following the trend established in previous empirical exercises, this paper will include as many reviewed drivers as possible to explain the share of Leave votes in LAs across the UK (except Northern Ireland). Table 2 summarizes all the variables considered.

The dependent variable in our analysis is the share of valid votes in favour of the Leave option in an LA, while the main explanatory factor is the relative economic difference with the 15 nearest neighbours. Apart from this, we include other measures of economic inequality to control for the effect of individual inequality and absolute income level, as LAs with higher inequality within their populations and/or LAs that are poorer in absolute terms might have shown stronger support for Brexit. The model also includes a dummy variable to account for the specificities of Scotland.[3] To address the effect of age and ethnic diversity, the mean age of residents of the LA and the percentage of the UK-born population are the demographic characteristics considered, along with socio-economic features reflecting the educational level (share of residents without qualifications and with primary and tertiary education), the part-time and unemployment prevalence in the local labour market, the occupation skill level (high and low), and the sectoral distribution of workers.

4 | EMPIRICAL MODEL SPECIFICATION: IMPLEMENTATION OF THE SPATIAL DIMENSION OF THE ANALYSIS

Although the study of the effect of economic inequality on the result of the Brexit referendum is not new, to our knowledge, this is the first study to use local income data to assess the spatial effect of relative income differences and to quantitatively measure the extent to which it drove the revenge vote. From the methodological point of view, the indicator proposed (*Diff*) is a novelty, as is the application of a spatial econometric approach[4] to the case of the Brexit referendum vote outcome.

As the first step in our analysis, we explore the degree of spatial association that can be observed in the support for the Leave option. Figure 1 already suggests the existence of a geographical pattern, with clusters of high and low support, an intuition confirmed through the exploratory spatial data analysis (ESDA) (Anselin, 1999) presented below. The Moran scatterplot on the left of Figure 3 shows a clear positive relationship between the percentage of Leave votes of an LA and that of its 15 nearest neighbours. The specific spatial distribution of the mentioned relationship can be seen in the map on the right. A strong cluster of opposition to Brexit appears in Scotland and London and its surroundings (namely, LAs in Surrey, Hertfordshire and Buckinghamshire) (areas in blue). On the other hand, the belts between Newcastle and Liverpool and Shropshire and Lincolnshire, in addition to a large share of LAs in the east coast area, show a majority of votes in favour of Leave (areas in red). Interestingly, several LAs voted for Brexit to a significantly lesser or greater extent than their neighbours. In the former group (violet), we find localities such as Lancaster, Nottingham or Canterbury, while the latter (pink) is formed, for instance, by Swindon, Hillingdon (East London) and East Hertfordshire.

The presence of geographical patterns in the vote outcome justifies the use of a spatial approach, but further to the methodological discussion, it can also be argued whether income differences played a role in the referendum result. A comparison of the maps in Figures 1 and 2 provides convincing first evidence on the matter. The economically deprived areas of the Norfolk coast and Lincolnshire match the areas with stronger support for Brexit, as is also the case for some LAs in Nottinghamshire, West and South Yorkshire and Cumbria. The symmetric relationship mostly holds for LAs in London and the neighbouring areas in Surrey, East and West Sussex, Hampshire, Oxfordshire and Buckinghamshire, where higher incomes and lower Leave votes go hand in hand. Despite the clear association mentioned above, there are still some LAs that do not comply with this logic, with many of them, especially those close to London, belonging to the pink group depicted in Figure 3. The observations brought forward here support

TABLE 2 Variable definitions and sources

Variable name	Variable description	Source
Leave-vote (%)	Percentage of total votes supporting the Leave option in the LA	Electoral Commission of the UK
Diff. Income neighbours	Relative difference in local median income with respect to the fifteen nearest LAs (relative spatial inequality)	IMAJINE H2020 Project
Theil Index	Personal inequality in the LA	
Median Income (Ln)	Median income in the LA	
Scotland (1/0)	Dichotomous variable taking the value 1 if the LA is in Scotland	Open Geography portal from the Office for National Statistics (ONS)
Mean age (Ln)	Mean age of the resident population in the LA	Office for National Statistics (ONS)
Born in the UK (%)	Percentage of the resident population that was born in the UK	
No qualifications (%)	Percentage of the population aged 16 and over without any kind of qualification in the LA	
Primary Education (%)	Percentage of the population aged 16 and over in the LA whose highest educational level is a primary degree or equivalent	
Tertiary Education (%)	Percentage of the population aged 16 and over in the LA whose highest educational level is a tertiary degree or equivalent	
Part-time (%)	Percentage of the population aged 16 to 74 in the LA working 30 hours or less per week	
Unemployment (%)	Percentage of the population aged 16 to 74 in the LA that is unemployed	
High-skill occupation (%)	Percentage of the employed population aged 16 to 74 in the LA working as managers, or in professional/technical occupations (SOC2010 1,2 and 3)	
Low-skill occupation (%)	Percentage of the employed population aged 16 to 74 in the LA working as sales and customer clerks, basic production operatives or in other elementary occupations (SOC2010 7,8 and 9)	
Manufacturing (%)	Percentage of the employed population aged 16 to 74 in the LA working in the Manufacturing sector (SIC2007 C)	
Construction (%)	Percentage of the employed population aged 16 to 74 in the LA working in the Construction sector (SIC2007 F)	
Wholesale and retail trade (%)	Percentage of the employed population aged 16 to 74 in the LA working in the Wholesale and retail trade, and the repair of motor vehicles and motor cycles sectors (SIC2007 G)	
Information and communication (%)	Percentage of the employed population aged 16 to 74 in the LA working in the Information and communication sector (SIC2007 J)	
Financial and insurance activities (%)	Percentage of the employed population aged 16 to 74 in the LA working in Financial and insurance activities (SIC2007 K)	
Prof., scientific and tech. Activities (%)	Percentage of the employed population aged 16 to 74 in the LA working in Professional, scientific and technical activities (SIC2007 M)	

the idea that some localities that are not necessarily the poorest in the country backed Brexit and that this backing might be linked to regional inequality, as argued by Rodríguez-Pose (2018). We contend that, apart from comparing themselves with national metropolitan elites in terms of absolute income, LAs may look at their most proximate vicinity to define themselves as disadvantaged or not, moving the discussion towards the effect of relative inequality within a delimited subnational context.

In this vein, in the first part of this study, we check on the potential role played by spatial spillovers, as shown by the clustering of LAs with high and low shares of Leave votes, which can be seen in Figure 3. As Moran's *I* test confirms the existence of spatial autocorrelation, the specification chosen to deal with it is a spatial Durbin model (SDM),[5] as written in the following equation:

$$\begin{aligned} Pct_{Leave\,i} = \alpha + \rho WPct_{Leave\,i} + \beta_1 Diff_i + \beta_2 Theil_i + \beta_3 Med_{Inc\,i} + \beta_4 Dum_{Scot\,i} + \sum_{j=5}^{6} \beta_j Dem_{Struc\,i} + \sum_{j=7}^{9} \beta_j Educ_i \\ + \sum_{j=10}^{11} \beta_j Labourmkt_i + \sum_{j=12}^{13} \beta_j Occupation_i + \sum_{j=14}^{19} \beta_j Sector_i + \sum_{k=1}^{19} \gamma_k WX_i + \varepsilon_{i,} \\ i = 1,\ldots,285, \\ j = 1,\ldots,19\ , \\ k = 1,\ldots,19. \end{aligned} \tag{2}$$

To assess the influence of neighbouring localities (LAs) from a global perspective, in this analysis, we rely on a definition of a neighbourhood as the 15 nearest LAs[6] (the same used in the construction of the relative income difference indicator), contained in matrix W, using the LA's centroids as reference points. The proposed spatial scheme properly reflects the distribution of the percentage of Leave votes, as indicated in the examination of the data through the ESDA, and the parameter ρ measures the intensity of the spatial spillover in the vote to the proximate areas. β_j parameters accompany the main explanatory factor (Diff) and the control variables (a total of 19, although grouped under the themed vectors Dem_Struc, Educ, Labourmkt, Occupation, and Sector), while γ_k represents the coefficients of the spatially lagged controls (control variables for the neighbours, grouped in vector X). All variables characterize each of the 285 LAs considered in this study (represented in Equation 2 by suffix *i*). The model presented in the previous equation was estimated through Maximum Likelihood.

5 | MAIN RESULTS

The results of the estimation proposed in Equation 2 applied to data at the local level (by LA) are presented in Table 3 (see the supporting information included at the end of the manuscript to revise all the tests carried out to arrive at the model specification finally presented).

The first result that stands out in the estimation is the significance of the ρ parameter, which indicates the intensity of spatial dependence. After the ESDA presented in Figure 3, the significance of the coefficient confirms the existence of local concentration processes of the Leave vote in the Brexit referendum. This result supports the argument espoused by Rodríguez-Pose (2018) and Dijkstra et al. (2018) for more aggregated geographical levels that there are spatial patterns in the increase of populist movements, Euroscepticism and the loss of trust in European Union and national institutions.

However, this first set of results cannot be interpreted further, as the marginal impacts of the remaining factors should be computed in a second step in spatial autoregressive models. The direct effects on the LA itself, the indirect effect of the characteristics of the neighbours, and the combined total effect are summarized in Table 4. Nevertheless, Table 3 provides important information about the model, especially regarding the residual

TABLE 3 Spatial Durbin Model (SDM) estimation results

	Factor	(std. err.)	Spatial Lag	(std. err.)
Constant	0.686	(1.226)	–	–
Rho (share of Leave votes in neighbouring LAs)	0.527***	(0.103)	–	–
Diff. Income neighbours	−0.541*	(0.330)	0.230	(0.150)
Theil	0.101	(0.132)	−0.475*	(0.259)
Median Income (Ln)	0.594*	(0.338)	−0.655*	(0.365)
Scotland (1/0)	−0.142*	(0.090)	−0.094	(0.145)
Mean age (Ln)	0.559***	(0.094)	−0.444	(0.290)
Born in the UK (%)	−0.055	(0.068)	−0.660***	(0.228)
No qualifications (%)	−0.213	(0.219)	1.000	(0.862)
Primary Education (%)	0.403	(0.266)	1.412	(1.167)
Tertiary Education (%)	−1.212***	(0.232)	2.062**	(0.809)
Part-time (%)	−0.584***	(0.143)	−0.038	(0.408)
Unemployment (%)	0.127	(0.252)	−0.482	(0.844)
High-skill occupation (%)	0.197	(0.209)	−0.564	(0.809)
Low-skill occupation (%)	0.388*	(0.210)	−0.364	(0.549)
Manufacturing (%)	0.174*	(0.096)	0.285	(0.361)
Construction (%)	0.233	(0.252)	1.845**	(0.845)
Wholesale and retail trade (%)	0.363*	(0.189)	−0.839	(0.648)
Information and communication (%)	−0.964***	(0.256)	1.893***	(0.722)
Financial and insurance activities (%)	−0.079	(0.138)	−0.388	(0.503)
Prof., scientific and tech. Activities (%)	0.407	(0.262)	−2.288*	(1.175)
N	*285*			
Akaike Information Criterion (AIC)	−1163.6			
Log Likelihood	622.82			
Likelihood Ratio Test	12.68 ***			
LM Test for residual sp. autocorrel.	0.068			
Adjusted Jarque-Bera normality Test	5.46 *			
Shapiro–Wilk normality Test	0.99 *			
Studentized Breusch-Pagan Test	76.64 ***			

Notes: Dependent variable: share of Leave votes in the Brexit Referendum of 2016.
*, ** and *** represent statistical significance at 10%, 5% and 1% levels, respectively.

spatial autocorrelation. The concerned LM test cannot reject the null hypothesis of no residual spatial autocorrelation, leading us to believe that the error term in our SDM specification is no longer affected by a spatial effect.

The marginal effects presented in Table 4 allow us to move to our main objective for this research: to identify the influence of proximate spatial inequality on the pro-Brexit vote at the local scale (by LA). We incorporate spatial inequalities in our model in two ways: first, by means of the new index *Diff* that expresses local income inequality with respect to the neighbouring areas (closer LAs) and, second, by using a Theil index to measure the intensity of individual inequality within each LA. Additionally, absolute (median) income is included to control for the affluence level of the area, further to any considerations of relative affluence.

TABLE 4 Marginal effects (direct, indirect and total) from the SDM estimation

	Direct	(std.err.)	Indirect	(std.err.)	Total	(std.err.)
Diff. Income neighbours	−0.543**	(0.316)	−0.113	(0.553)	−0.656	(0.776)
Theil	0.083	(0.135)	−0.873	(0.625)	−0.790	(0.627)
Median Income (Ln)	0.579**	(0.308)	−0.708**	(0.364)	−0.129	(0.187)
Scotland (1/0)	−0.149*	(0.077)	−0.349	(0.255)	−0.498**	(0.251)
Mean age (Ln)	0.552***	(0.091)	−0.311	(0.534)	0.242	(0.554)
Born in the UK (%)	−0.084	(0.069)	−1.427**	(0.639)	−1.511**	(0.661)
No qualifications (%)	−0.175	(0.228)	1.839	(1.851)	1.664	(1.948)
Primary Education (%)	0.471*	(0.264)	3.363	(2.763)	3.835	(2.870)
Tertiary Education (%)	−1.153***	(0.247)	2.948*	(1.724)	1.795	(1.791)
Part-time (%)	−0.599***	(0.152)	−0.717	(0.814)	−1.316	(0.862)
Unemployment (%)	0.110	(0.276)	−0.858	(1.822)	−0.749	(1.893)
High-skill occupation (%)	0.178	(0.219)	−0.952	(1.623)	−0.774	(1.690)
Low-skill occupation (%)	0.382*	(0.221)	−0.331	(1.091)	0.051	(1.130)
Manufacturing (%)	0.190**	(0.090)	0.781	(0.809)	0.971	(0.831)
Construction (%)	0.316	(0.269)	4.075**	(1.937)	4.391**	(2.026)
Wholesale and retail trade (%)	0.335*	(0.195)	−1.342	(1.333)	−1.006	(1.402)
Information and communication (%)	−0.906***	(0.267)	2.869*	(1.510)	1.963	(1.549)
Financial and insurance activities (%)	−0.097	(0.149)	−0.890	(1.064)	−0.987	(1.117)
Prof., scientific and tech. Activities (%)	0.320	(0.280)	−4.295*	(2.523)	−3.975	(2.659)

Notes: Dependent variable: share of Leave votes in the Brexit Referendum of 2016.
*, ** and *** represent statistical significance at 10%, 5% and 1% levels, respectively.
Distribution of the estimated values (standard errors) obtained through simulations using 200 draws.

The main explanatory factor *Diff*, defined as the relative difference in median income between an LA and its 15 nearest neighbours (Equation 1), is significant and has a direct negative effect on the Leave vote. This result supports the hypothesis that economic status relative to an area's closest neighbours played a role in Brexit; the richer the LA in comparison to the surrounding localities (positive domain of *Diff*), the lower the percentage of votes for Leave, while a disadvantaged relative income of an area (negative domain of *Diff*) provides a local boost to the Brexit option. When we talk about the comparison of an LA with its surroundings in the context of a country such as the United Kingdom with strong metropolization (mainly around the Greater London area), we are referring to the divide between peripheral and central places *within* the area of influence of such metropolises, as shown by the pink areas of the map in Figure 3. Therefore, the coefficient of *Diff* represents discontent in the peripheral areas close to the great development and burgeoning of activity of the metropolitan centres. It is worth mentioning that this index has an indirect character in its conception (the neighbours are already included in its calculation), so we did not expect it to show a significant indirect effect in the estimation.

Inequality within each local unit (LA) is also significant and negative, but it relates to the share of Leave votes indirectly. The translation of this is that the higher the interpersonal inequality in neighbouring LAs, the lower was the support for Brexit. Again, the relative contextual dimension shows a relevant role, since regardless of inequality within an LA's borders, being surrounded by high inequality (possibly generating a feeling of local superiority) is linked to fewer votes for Leave.

Apart from the LA's relative economic position, the absolute position (median income) shows that if, for instance, there were no differences between neighbours, more affluent LAs would have supported Brexit to a greater extent than more deprived localities (LAs). Our interpretation is that despite the overall negative relationship between

income and Leave support revealed by the comparison of the maps in Figures 1 and 2, there are still cases that do not comply with that scheme, and that situation is being captured here.

As expected, the Scotland dummy has a negative and significant effect, corresponding to the clear support of the region for the Remain option.

In general, our results at the LA level are coherent with the conclusions from previous pieces of research on more aggregated geographies that highlight the relevance of demographic, educational and socio-economic conditions (Arnorrsson & Zoega, 2016; Clarke et al., 2016; Crescenzi et al., 2017; Harris & Charlton, 2017; and Manley et al., 2017, among others). In our analysis, we complement those conclusions with the influence of proximity by adding to the equation the indirect effect of the characteristics of neighbouring LAs on the vote outcome of a locality. According to the coefficients shown in Table 4, the coefficient of the average age of the LA is significant and has a positive impact, indicating that the older the population is, the greater the vote for Brexit. We also identify that a higher share of the native-born population corresponds to a lower preference for the Leave option, but this effect is driven indirectly by the neighbouring LAs; localities surrounded by areas with a larger share of the UK-born population seem to be less inclined to support Brexit. Both indicators for the local educational level show a significant direct impact, although the share of the population with a primary degree is linked to a higher Leave vote, conversely to the case of the share with tertiary education. Again, there is a marked indirect influence on the effect of the second educational factor; a high share of highly educated people in neighbouring LAs is related to high support for Leave in the reference locality. Regarding labour market conditions, the flexibility of contracts (reflected by the share of part-time workers) has a significant negative effect on the share of Leave votes, while unemployment shows no significant effect. A higher proportion of the employed population working in low-skill occupations in an LA relates to stronger support for Brexit, as does a higher share of workers in manufacturing, wholesale and retail trade. The relationship is negative and significant in the case of the information and communication sector, although the indirect effect shows that being surrounded by areas more specialized in those activities is linked to a significantly higher tendency towards Leave. The relevance of the positive indirect influence is even higher for the construction sector, driving the highest total effect among the factors included. The negative indirect impact on Leave votes of the share of workers in professional, scientific and technical activities is also remarkable.

Further to the inequality indicators analysed earlier, the results obtained for the demographic and socio-economic control variables once again bring forward a profile of stagnant localities (ageing population, lower educational level, and specialized in low value-added activities) supporting Brexit and dealing with indirect effects (positive and negative) coming from their better-performing neighbours.

It is particularly interesting to observe how the structure of the economic sector of the local areas affects electoral decisions. What our approach identifies is that in LAs with a higher presence of industries more exposed to the immigrant workforce, there is an increase in the pro-Brexit vote. However, many of these sectors are, at the same time, those that benefit most from belonging to the European single market. This result is particularly coincident with the thesis defended by McCann (2016): the general public did not understand the profits derived from Europeanization but magnified the impacts of globalization or immigration on their economies.

In summary, our analysis allows us to conclude that when we descend to the local scale (LA), the main conclusions obtained in previous contributions developed at a regional level are maintained and, in some cases, more evident. From our point of view, this result serves as empirical local evidence of two of the most important theses proposed to date on the general causes of the success of Brexit, both related to and proposed from the literature on the *geography of discontent*.

On the one hand, the results from the *Diff* indicator provide empirical support for the contention of McCann (2018), presented in several previously cited papers, that an important driver of the Brexit campaign's success was the so-called pro-Leave narrative, namely, that the EU benefited "metropolitan elites' while remaining areas were left out. As McCann himself remarks, this discourse is not factual, but the existence of inequalities in very close metropolitan spaces (which would have occurred in any case, independent of belonging to the EU) creates apparent evidence in favour of it.

On the other hand, our results support the thesis of Rodríguez-Pose (2018) on the revenge of places that do not matter. The idea of Rodríguez-Pose was formulated at the national level, comparing economically successful regions to places specialized in declining activities and heavily affected by the economic crisis. Our results show that this process occurs to an equal or greater extent at the local scale (by LA). In line with the argumentation of Rodríguez-Pose, the persistence of inequalities in the local environment, many levels lower than those at the national level but more easily observable, generated a climate of *discontent* with the institutions that resulted in a vote to punish the EU. Ironically, this happened despite the attempts of European policies to correct such inequalities.

Again, it is important to note that the EU is not responsible for the spatial inequalities generated at the local scale, as those are associated with the concentration processes around large cities, a macroeconomic trend that holds worldwide. Furthermore, European Union institutions aim to reduce these processes of concentration by trying to articulate programmes to enhance territorial economic and social cohesion. Against the EU's rationale, it seems that the integration process served as a tool to magnify the negative effects of globalization, distorting the perceptions of the gains from integration itself.

6 | CONCLUSIONS AND POLICY IMPLICATIONS

The success of the Leave campaign in the Brexit referendum of June 2016 surprised everyone. Despite the successes of the European integration process, the discourse against the European Union project took hold among British citizens through a set of anti-immigration, anti-globalization and anti-integration narratives.

The Brexit referendum has attracted the attention of researchers around the world, both because of the importance and relevant consequences of the decision made and because of the value of the information that it generates for understanding some of the keys to the rise of populist parties inside and outside the European Union. This research adds to the extensive previous literature by contributing a study at the local level using local authorities as the spatial unit of analysis. Thanks to the databases of the UK Electoral Commission, we have accurate information on the distribution of local vote shares, which have been analysed through a set of variables describing the local demographic, educational/cultural, and socio-economic context. The socio-economic dimension has been accounted for via the estimation of income within the framework of the European Union H2020 IMAJINE project, which enables us to use indicators of inequality within the LA and contribute a new indicator, namely, the income of each locality relative to the areas surrounding it.

In general, the results are consistent with those obtained in most of the previous studies, confirming that the main conclusions reached at higher spatial aggregations or in the analysis of individual behaviour hold when we work with information aggregated at the local level. Thus, we found that the higher the average age of the localities, the greater the tendency to vote Leave. Likewise, in those localities with a greater presence of native-born population, the propensity to vote in favour of Brexit decreased. Our results also confirm that the higher the average educational qualification of the LA, the lower the propensity to vote for Brexit. The socio-economic dimension is equally relevant, as unfavourable conditions in the labour market context significantly increase the propensity to vote Leave. Finally, the presence of sectors, such as retail and manufacturing, as well as low-skill occupations, normally most affected by the crisis, also increases the propensity to vote Leave. As stated, the direct results obtained mostly agree with those of the existing literature, although we point out here the effect of the relative location by providing an assessment of the indirect impacts of neighbouring localities, which are highly significant for several factors and should not be neglected.

Continuing with the importance of the geographical scope, we observe that there is a clear spatial dependence in the outcome of the referendum, meaning that there is spatial concentration in the vote for either alternative. This indicates that there is indeed a spatial pattern of dissatisfaction or, in other words, that there exists a *geography of discontent*. In this sense, special attention has been given to analysing the effect of spatial factors. In the results obtained, we identify that the higher the interpersonal inequality in the neighbouring LAs, the lower the support for Brexit. However, the relative income position of each locality, measured using our own indicator, is significant in our

estimations. Places with a worse position in the local context usually exhibit greater discontent, channelled through a punishment vote, as pointed out by Rodríguez-Pose (2018) and McCann (2016).

Brexit offers many important lessons for the rest of the countries in the European Union and for the government of the Union itself in its struggle against the rise of populist and anti-European political alternatives. One of the valuable outcomes that we can extract from this particular analysis is the importance of territorial cohesion policies at the local level. The justification for such policies emanates not only from the longing for spatially balanced development but also from the fact that it can sustain and assist in the construction of a European project embraced by all citizens. Although traditionally the EU has put great effort into its territorial and social cohesion policy, these policies have normally focused on reducing disparities between regions and countries. Much less attention has been given to the search for territorial balance at the local scale. According to our results, it is at this local level (as represented by LAs) that spatial inequalities are more visible, creating a strong proximity bias in the evaluation of the circumstances. In recent years, due to resource limitations, the European Union cohesion policy has sought greater efficiency in the projects it supports, leading to the concentration of funding in already successful locations, normally the main urban centres or areas close to them. Although this may respond to the logic of investments and returns, it can also be counterproductive, generating an image of abandonment in less favoured spaces, namely, the peripheries of cities and rural areas. This conclusion calls for more attention to be paid to the reduction in imbalances at the local level, further to the reduction in disparities among regions and countries, and the devising of a communication strategy that properly informs the public of efforts made in that direction.

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ENDNOTES

[1] See http://imajine-project.eu/ for more details about the project.

[2] After comparing spatial structures using the 5, 10, 12, 15, 17 and 20 nearest neighbours, we decided to use a 15-nearest-neighbours matrix as it produces a clustering pattern closer to the spatial pattern observed for the Leave vote (Fig. 3).

[3] It is quite common in the previous literature to capture the specificities of the Scottish case using a dichotomic variable (see McHarg and Mitchell (2017)).

[4] For an extensive review on the spatial econometric methods used in this analysis see Anselin (1988, 2006), Anselin and Bera (1998), LeSage and Pace (2009) or Elhorst (2014).

[5] Following the standard procedure in spatial econometrics, we estimate the analogous spatial lag (SLM) and error (SEM) models, but their statistical performance is worse in terms of the Akaike information criterion, and the SLM is affected by residual spatial correlation. These results are available upon request.

[6] Please see Annex III for Exploratory Spatial Data Analyses using alternative W matrices.

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