EXTENDED ABSTRACT

Title: From Census tracts to metropolitan areas. Measuring multiscale residential segregation of immigrant population. Barcelona and Madrid (2008-2018).

Authors and e-mail of all: Joan Carles Martori. martori@uvic.cat

Rafa Madariaga. rafa.madariaga@uvic.cat

Department: Department of Economics and Business, University of Vic -UCC

University: University of Vic -UCC

Subject area: Desigualdad y cohesión social de los territorios.

Abstract The share of the immigrant population in Spain grew exponentially from the beginning of the century until the burst of the financial crisis of 2008. After a period of decline, in 2016 growth resumed. This massive flow of immigrants in a very short period has changed the traditional role of Spain as a country of emigrants to one of the most important host countries in Europe. The interest in residential segregation analysis has grown in parallel, and the debates about its social, economic, cultural and political

implications have gained prominence. As Reardon et al. (2009), Harris (2017) and Lan et al. (2020) have pointed out, the study of residential segregation has three main pillars: patterns, causes and consequences. Measurement issues (or the description of patterns) continue to be debated. The main reason is that changes in residential segregation over time depend on the scale at which it is measured (Lan et al., 2021). This drawback is problematic for the design and implementation of policies aimed to improve social cohesion. On the other hand, measurement is paramount as it challenges misperceptions and biased information with empirical evidence.

The seminal paper by Massey and Denton (1988) clarified the different aspects of segregation by establishing the well-known five dimensions; Evenness, Exposure, Concentration, Clustering and Centralization (Martori & Apparicio, 2011). Not all five dimensions are equally important. There is some agreement in the literature that evenness and clustering are the main dimensions of residential segregation (Reardon et al., 2004; Harris, 2017).

The measurement of residential segregation has developed for more than half a century and continues. It appears to be as difficult as the concept of segregation itself: a group may be segregated from others if it is small and all members reside in a specific area, but if its share of the total area is also small, it would not seem to be segregated and the area may be deemed diverse (Harris & Johnston, 2018). Furthermore, measurement issues are regularly revisited as new data is made available, new concepts are developed, and new computational devices are at hand. Some indices compute differences, some use probabilistic approaches, some are aspatial, some are spatial, some focus on one group of interest, and others are multigroup.

A great wealth of literature, theoretical and empirical, has been developed using classic indices of residential segregation of the immigrant population. Yet these indices are

"global": an average value at a single scale (e.g., city or metropolitan area) and residential segregation is the outcome of multiple choices, behaviors, processes and constraints that operate simultaneously at and across different geographical scales (Manley et al., 2015; Harris, 2017). In short, global indices do not capture shifts in the geographic scale.

For instance, Reardon, Yun, and Eitle (2000), in their analysis of segregation of public-school students in the US, showed that the contribution to the global values arising from between-district differences increased with respect to the within-district contribution. Yet this result was masked by using a global index. This outcome pointed to the need to use different spatial scales and led to the development of multilevel analysis (Harris and Owen, 2018; Manley et al., 2019;Lan, Kandt, and Longley, 2020). The new approach measures residential segregation taking account of a range of spatial levels that conform a hierarchy: for instance, census tracts, neighborhoods and districts. Notice that the approach uses available spatial levels that are somehow arbitrary, but at the same time are the only way to estimate the effects of scales. As pointed out by Harris (2017), it does not directly measure the effects of scales on segregation, but instead measures the share of segregation that can be assigned to each spatial level. It is based on statistical measures of the variance and on methods to allocate it at different spatial levels. Recently, Harris and Johnston (2018) and Piekut, Pryce, and van Gent (2019), point out that complementing different methodologies helps to extract a more accurate understanding of the ongoing processes.

Studies deploying this new multilevel approach have been performed mainly in countries with a long tradition as host countries, such as the United States, Australia, New Zealand and the UK. There is a lack of similar studies for Southern European countries. As far as we know, this new methodology has not been applied in Spain

before.[1] Some features make it a very interesting case, such as the sudden and rapid process of immigration, the great diversity of origins, its geographical location close to Africa,[2] historical relationships and common language with Latin American countries, the economic modernization and growth that followed Spain's entry in the European Union spurring economic activity and labor demand and the attraction of European skilled workers and retirees.

This paper makes three connected and complementary contributions. First, it measures residential segregation by means of global indices for the most numerous nationalities in Barcelona and Madrid and analyzes their evolution. Second, it applies multilevel analysis of the dissimilarity index: decomposing the variance of the index in a regression framework complements the view of the overall pattern of residential segregation. Third, taking together the results of global indices and those of multilevel analysis, it carries out a typology of nationalities by means of a cluster analysis.

The empirical results shed light on changes in residential segregation of the immigrant population throughout the 2008-2018 period in the two most populated cities (Barcelona and Madrid) of a Southern Country. Marcińczak and Bernt (2021) recently highlight that research on changes in the intensity of immigrant segregation are scarce. Furthermore, they stress that less is known about the mixing patterns of residential segregation and its dynamics. This study intends to fill these research gaps, widening the scope with results from the multilevel methodology that complement the global indices. The results of multilevel analysis allow us to detect neighborhoods with high impact on residential segregation. The extent of mixing patterns may be assessed from these results

[1] For recent studies about residential segregation in Spain see, for instance, Galeano and Bayona-i-Carrasco, (2018), Benassi et al.(2020), Sorando et al.(2021) and López-Gay et al.(2020).

[2] Southern Europe has become the second largest migratory route in the world (IOM, 2018), cited by Benassi et al.(2020)

Additionally, there is a debate about a specific Southern European immigration model. For instance, Peixoto et al. (2012) argued for its existence, Baldwin-Edwards (2012) provided a skeptical view, and Martori and Apparicio (2011) and Arbaci (2019) contributed to this debate highlighting specific features. Recently, Benassi, Iglesias-Pascual, et al., (2020) pointed out some particularities of the southern European case. The results presented here may help to compare segregation patterns with other European and American countries and to assess their properties.

This paper seeks to shed light on some specific research questions:

1) Are there any differences in the segregation patterns of both cities? How has residential segregation evolved in Barcelona and Madrid between 2008 and 2018 for the most numerous nationalities when using global indices? Are there any differences in their evolution?
2) At which spatial levels (neighborhoods or districts) are there larger differences in population shares between immigrant nationalities and the Spanish population? Where are the spatial areas that have large and significant impact on residential segregation? Is there any empirical evidence of mixing spatial areas?
3) How can patterns of segregation for different nationalities be grouped? What are the similarities and differences between national groups? Does the grouping of different nationalities by continent or by income level of the country of origin make sense?

Our first approach to residential immigration is to apply global indices to have a general view, compare both cities and analyze its changes during the 2008-2018 period. Five indices have been selected, one for each dimension: the segregation index (IS) for Evenness, the ETA squared (ETA^2) for Exposure, the Delta Index (DEL) for Concentration, the Distance Decay Isolation Index (DPxx) for Clustering, and the Absolute Centralization Index (ACE) for Centralization. In total, as is well known, there are more than 40 segregation indices, but many of them in each dimension are highly

correlated. The selected indices are usually applied in many works, and therefore the results may be compared with other countries, cities and periods.

In Spain, municipalities are divided into census tracts: small areas containing between 500 and 2000 residents designed for organizing pooling tables for elections. These are the smallest spatial units used in this study and provide the most suitable disaggregation level for the study of segregation in Spain: population data is available and the areas are small enough to capture spatial details. Census tracts are grouped into neighborhoods and these into districts that conform the municipalities.[3] Barcelona has 2137 census tracts, grouped into 73 neighborhoods and 10 districts, while Madrid has 2405 census tracts, grouped into 128 neighborhoods and 21 districts. A three-level analysis, considering census tracts, neighborhoods and districts, is deployed.

The present study analyzes the spatial distribution of immigrant populations following a short period of exponential growth in Barcelona and Madrid. We focus on changes in the spatial patterns of residential segregation between 2008 and 2018 using three approaches: global measures of residential segregation, multilevel analysis of dissimilarity Index (*ID*) and a typology of nationalities by means of a cluster analysis.

In 2008, in general terms, residential segregation is higher in Madrid than in Barcelona. This is clear for Evenness, Concentration, Clustering and Centralization. In 2018, residential segregation is higher in Madrid than in Barcelona for all dimensions. Barcelona results in 2018 show a general reduction for all nationalities in all dimensions except Centralization. In contrast, global indices in Madrid in 2018 have increased for most dimensions and nationalities. The only exception is centralization, where all nationalities show decreases in the value of the indices. These results show that the

[3] Many municipalities belonging to Metropolitan Areas are formed by only one census tract, preventing the multilevel analysis. Therefore, we can only apply the method for Barcelona and Madrid municipalities.

segregation pattern in Barcelona is more centralized than in Madrid and that this difference has enlarged since 2008.

In Barcelona in 2018, the multilevel results show a mixed pattern where districts contribute more to segregation than neighborhoods: the HS is higher at the district level for ten nationalities out of fourteen, and the percentage of variance is higher at the district level for eight groups. Only two nationalities do not show neighborhoods with high and significant impact (Peruvians and Colombians). Regarding Madrid, the pattern is clearer: districts contribute more to segregation than neighborhoods. HS is higher at the district level for twelve out of thirteen nationalities, and the percentage of variance is higher at the district level for eleven nationalities. Only one nationality (Peruvians) do not show neighborhoods with a high and significant impact.

In Barcelona, the neighborhoods with a high and significant impact are located in district I, the center of the city and in two districts (VIII and IX) in the northern part of the city. In Madrid, most neighborhoods with a high and significant impact are in district XII, in the southeast of the city. The results provide empirical evidence of mixing neighborhoods: those that present a high and significant impact for more than one nationality. For example, *Gòtic* neighborhood in Barcelona has a Spanish population share of only 50.75%, and has a high and significant impact for Italian, French, Argentinian, Brazilian and German nationalities. The *Pradolongo* neighborhood in Madrid has a Spanish population share of only 67.85%, and has a high and significant impact for Colombian, Bolivian and Chinese nationalities.

The results of the cluster analysis to determine a typology of nationalities shows that very different nationalities in terms of continent or income level of the country of origin have similar values in the global and multilevel measures of residential segregation. These results show that analyzing large groups (of nationalities) may yield confusing

patterns because within each group there are important differences (e.g., Latin American nationalities).

Our results do not provide clear empirical evidence in favor of the spatial assimilation model. In both cities, despite the general reduction of global indices, not all nationalities and dimensions follow this pattern. On the other hand, the multilevel results show an increase in the number of neighborhoods with a high and significant impact between 2008 and 2018. Spatial areas with a high concentration of the immigrant population in 2008 maintain a high concentration in 2018 and even extend to other contiguous areas. This result may be interpreted as empirical evidence of the place stratification model. Finally, multilevel results point to an increase and extension of high concentration areas for some nationalities, specially Latin Americans in both cities and Europeans in Barcelona. This result supports the ethnic enclave model.

From a methodological point of view, the use of multilevel methodology allows us to capture characteristics of spatial patterns of residential segregation that are not accessible using a global approach. They provide richer results that provide a deeper understanding of segregation processes. A natural extension of this work would be to investigate local urban characteristics that drive this process.

Two important implications for public policies are as follows: multilevel results allow us to detect the spatial levels (neighborhoods and districts) for potential conflicts; and the design of public policies aimed to improve social integration could benefit from the knowledge about the most important spatial levels of segregation.

References

Alba, R. D., Logan, J. R., Stults, B. J., Marzan, G., & Zhang, W. (1999). Immigrant groups in the suburbs: A reexamination of suburbanization and spatial assimilation.

American Sociological Review, *64*(3), 446–460.

Alonso, W. (1964). *Location and land use. Toward a general theory of land rent.* Harvard University Press.

Apparicio, P., Martori, J. C., Pearson, A. L., Fournier, É., & Apparicio, D. (2013). An Open-Source Software for Calculating Indices of Urban Residential Segregation. *Social Science Computer Review*, *32*(1), 117-128.

Apparicio, P., & Séguin, A.-M. (2008). Retour sur les notions de ségrégation et ghetto ethniques et examen des cas de Montréal, Toronto et Vancouver. In *Research Report*. INRS-UCS.

Arbaci, S. (2019). *Paradoxes of segregation : housing systems, welfare regimes and ethnic residential change in southern European cities*. John Wiley & Sons.

Baldwin-Edwards, M. (2012). The Southern European 'Model of Immigration': A Sceptical View. In *European Immigrations* (pp. 149–158).

Benassi, F., Bonifazi, C., Heins, F., Lipizzi, F., & Strozza, S. (2020). Comparing Residential Segregation of Migrant Populations in Selected European Urban and Metropolitan Areas. *Spatial Demography*, *8*(3), 269–290.

Benassi, F., Iglesias-Pascual, R., & Salvati, L. (2020). Residential segregation and social diversification: Exploring spatial settlement patterns of foreign population in Southern European cities. *Habitat International*, *101*(January), 102200.

Bolt, G., & van Kempen, R. (2010). Ethnic Segregation and Residential Mobility: Relocations of Minority Ethnic Groups in the Netherlands. *Journal of Ethnic and Migration Studies*, *36*(2), 333–354.

Buch, T., Meister, M., & Niebuhr, A. (2021). Ethnic diversity and segregation in

German cities. *Cities*, *115*, 103221.

Dirección General de Vivienda y Suelo. (2020). *Observatorio de Vivenda y Suelo. Boletin especial Vivienda Social 2020*. Madrid.

Duncan, O. D., Cuzzort, R. P., & Duncan, B. (1961). *Statistica geography:Problems in analyzing areal data.* The Free Press of Glencoe.

Galeano, J., & Bayona-i-Carrasco, J. (2018). Residential segregation and clustering dynamics of migrants in the metropolitan area of Barcelona. *Quetelet Journal*, *6*(1), 99–127.

Harris, R. (2017). Measuring the scales of segregation: looking at the residential separation of White British and other schoolchildren in England using a multilevel index of dissimilarity. *Transactions of the Institute of British Geographers*, *42*(3), 432–444.

Harris, R., & Johnston, R. (2018). Measuring and modelling segregation – New concepts, new methods and new data. *Environment and Planning B: Urban Analytics and City Science*, *45*(6), 999–1002.

Harris, R., & Owen, D. (2018). Implementing a Multilevel Index of Dissimilarity in R with a case study of the changing scales of residential ethnic segregation in England and Wales. *Environment and Planning B: Urban Analytics and City Science*, *45*(6), 1003–1021.

Iceland, J., & Wilkes, R. (2006). Does socioeconomic status matter? Race, class, and residential segregation. *Social Problems*, *53*(2), 248–273.

Instituto Nacional de Estadística (INE). Labour Force Survey, 2020. Available at <https://www.ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254

736176918&menu=resultados&idp=1254735976595 > Accessed on 4 April 2022.

International Organization for Migration (IOM). World migration report 2018. In *World Migration Report* (Vol. 2018, Issue 1). International Organization for Migration. Geneve.

Jones, K., Johnston, R., Manley, D., Owen, D., & Charlton, C. (2015). Ethnic Residential Segregation: A Multilevel, Multigroup, Multiscale Approach Exemplified by London in 2011. *Demography*, *52*(6), 1995–2019.

Jones, K., Manley, D., Johnston, R., & Owen, D. (2018). Modelling residential segregation as unevenness and clustering: A multilevel modelling approach incorporating spatial dependence and tackling the MAUP. *Environment and Planning B: Urban Analytics and City Science*, *45*(6), 1122–1141.

Lan, T., Kandt, J., & Longley, P. (2020). Geographic scales of residential segregation in English cities. *Urban Geography*, *41*(1), 103–123.

Lan, T., Kandt, J., & Longley, P. (2021). Measuring the changing pattern of ethnic segregation in England and Wales with Consumer Registers. *Environment and Planning B: Urban Analytics and City Science*, *48*(6), 1591–1608.

Lichter, D. T., Parisi, D., & Taquino, M. C. (2015). Toward a New Macro-Segregation? Decomposing Segregation within and between Metropolitan Cities and Suburbs. *American Sociological Review*, *80*(4), 843–873.

López-Gay, A., Andújar-Llosa, A., & Salvati, L. (2020). Correction to: Residential Mobility, Gentrification and Neighborhood Change in Spanish Cities: A Post-Crisis Perspective. *Spatial Demography*, *8*(3), 379–385.

Manley, D., Johnston, R., & Jones, K. (2019). Decomposing Multi-Level Ethnic

Segregation in Auckland, New Zealand, 2001–2013: Segregation Intensity for Multiple Groups at Multiple Scales. *Tijdschrift Voor Economische En Sociale Geografie*, *110*(3), 319–338.

Manley, D., Johnston, R., Jones, K., & Owen, D. (2015). Macro-, Meso- and Microscale Segregation: Modeling Changing Ethnic Residential Patterns in Auckland, New Zealand, 2001–2013. *Annals of the Association of American Geographers*, *105*(5), 951–967.

Marcińczak, S., & Bernt, M. (2021). Immigration, segregation and neighborhood change in Berlin. *Cities*, *119*, 103417.

Martori, J. C., & Apparicio, P. (2011). Changes in spatial patterns of the immigrant population of a southern european metropolis: The case of the barcelona metropolitan area (2001-2008). *Tijdschrift Voor Economische En Sociale Geografie*, *102*(5), 562–581.

Martori, J. C., Madariaga, R., & Oller, R. (2016). Real estate bubble and urban population density: six Spanish metropolitan areas 2001–2011. *Annals of Regional Science*, *56*(2), 369-392.

Massey, D. S., & Denton, N. A. (1988). The dimensions of residential segregation. *Social Forces*, *67*(2), 281–315.

Mills, E. (1972). *Studies in the Structure of the Urban Economy*. The John Hopkins University Press.

Morgan, B. S. (1982). The properties of a distance-based segregation index. *Socio-Economic Planning Sciences*, *16*(4), 167–171.

Muth, R. F. (1969). *Cities and housing: The Spatial Pattern of Urban Land Use*. Univ.

of Chicago Press.

Pais, J., South, S. J., & Crowder, K. (2012). Metropolitan heterogeneity and minority neighborhood attainment: Spatial assimilation or place stratification? *Social Problems*, *59*(2), 258–281.

Peixoto, J., Arango, J., Bonifazi, C., Finotelli, C., Sabino, C., Strozza, S., & Triandafyllidou, A. (2012). Immigrants, Markets and Policies in Southern Europe: The Making of an Immigration Model? In *European Immigrations* (pp. 107–148). Amsterdam University Press.

Piekut, A., Pryce, G., & van Gent, W. (2019). Segregation in the Twenty First Century: Processes, Complexities and Future Directions. *Tijdschrift Voor Economische En Sociale Geografie*, *110*(3), 225–234.

Reardon, S. F., Farrell, C. R., Matthews, S. a., O'Sullivan, D., Bischoff, K., & Firebaugh, G. (2009). Race and space in the 1990s: Changes in the geographic scale of racial residential segregation, 1990–2000. *Social Science Research*, *38*(1), 55–70.

Reardon, S. F., O 'sullivan, D., Firebaugh, G., Farrell, C., & Gorman-Smith, D. (2004). Measures of Spatial Segregation. *Source: Sociological Methodology*, *34*, 121–162.

Reardon, S. F., Yun, J. T., & Eitle, T. M. (2000). The changing structure of school segregation: Measurement and evidence of multiracial metropolitan-area school segregation, 1989-1995. *Demography*, *37*(3), 351–364.

Schelling, T. C. (1971). Dynamics Model of Segregation. *Journal of Mathematical Sociology*, *1*(May 1969), 143–186.

Serrano Sanguilinda, I., Barbiano di Belgiojoso, E., González Ferrer, A., Rimoldi, S. M.

L., & Blangiardo, G. C. (2017). Surveying immigrants in Southern Europe: Spanish and Italian strategies in *comparative* perspective. *Comparative Migration Studies*, *5*(1), 1-18.

Sorando, D., Uceda, P., & Domínguez, M. (2021). Article inequality on the increase: Trajectories of privilege and inequality in madrid. *Social Inclusion*, *9*(2), 104–116.

Keywords: *Residential segregation, Barcelona, Madrid,*
JEL codes: C50, Q53