

Significant correlations in residential segregation in medium-sized cities: The case of Ciudad Real (Spain)

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Abstract

In the field of urban studies, residential segregation has traditionally been viewed as closely linked to social inequality. However, recent research in the European context has empirically demonstrated that this relationship is much more complex. From this perspective, this paper focuses on Ciudad Real, a medium-sized Castilian-La Mancha city. It is observed that medium-sized cities present lower levels of residential segregation than large urban areas, but with a marked difference between high and low incomes. This paper emphasises the importance of case studies in understanding the relationship between residential segregation and social inequality, and how an increase in inequality does not always translate into greater segregation. The relevance of addressing residential segregation in medium-sized cities is recognised in order to better understand this phenomenon at a global level. This analysis has provided a clear insight into the complex socioeconomic interactions that characterized the year 2021. Several significant correlations were identified between sociodemographic variables and income-related variables, highlighting the close connection between these aspects in the socioeconomic reality. Results underscore the need to adopt a comprehensive approach when addressing contemporary issues of inequality and labor dynamics. Furthermore, the importance of Geography as a key discipline to address socio-spatial disparities and promote equity in cities is highlighted. The complexity of the relationships between segregation and inequality is emphasized, underlining the importance of meaningful correlations to understand the patterns of socio-spatial differentiation in these cities. The need to study residential segregation at an infra-municipal scale is raised for a more detailed analysis.

Keywords: medium-sized city, residential segregation, correlations, inequality, neighbourhoods

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1. Introduction

In the field of urban studies, residential segregation has traditionally been considered a phenomenon closely related to social inequality. However, recent research carried out in the European context has empirically shown that this relationship is much more complex than previously assumed (Porcel, 2020). In other words, an increase in social inequality does not always automatically lead to an increase in socioeconomic residential segregation, as combinations can vary significantly depending on the context, underscoring the importance of conducting case studies for a more complete understanding of this phenomenon.

Social inequality has become enormously important in Western societies in recent years, especially since the beginning of the economic and financial crisis in 2007. This problem has acquired significant relevance in the urban sphere, so much so that the urban planner Bernardo Secchi (2015) has pointed out that social inequality is currently the new urban issue in large metropolises, making it an unavoidable aspect to address. In the urban environment, social inequality is commonly associated with another phenomenon, socioeconomic residential segregation. This process reflects how the social structure is shaped in the urban territory, since the different social classes tend to be grouped residentially according to their capacities to access housing. As a result, social inequality, which at first might seem intangible, becomes evident and visible in urban space (Porcel, 2020).

Although there is no consensus on whether socioeconomic residential segregation is a clearly harmful phenomenon in terms of social cohesion, there is nevertheless some approval among scholars who point out that the social problems arising from socioeconomic residential segregation are more relevant than its positive aspects (Porcel, 2021). Thus, the appearance of these socioeconomic differentiations in the urban territory can give rise to processes of residential segregation. This phenomenon has been studied from various academic perspectives and scientific analyses (Van Eijk, 2010; Vasconcelos et al., 2013; Musterd, 2020). However, residential segregation is not simply a direct consequence of socio-spatial differentiation, but is an extremely complex phenomenon, being of notable interest to Geography (Correa, 2022).

The differential distribution of social groups in urban spaces generates disparities and inequalities that contribute to the fragmentation of cities (Sposito, 2007; 2020; Kesteloot, 2005; Caravaca, 2022). These internal differentiations and the existence of inequalities are increasingly present in cities around the world. Inequality can manifest itself in various ways, from place of residence to income level, education, access to services or different levels of employment and unemployment.

In a context of increasing socio-economic residential segregation in European cities, this research focuses on Ciudad Real, a medium-sized city in the interior of Spain, to measure levels of segregation and analyse their main correlations. Although there is no established definition for an average city, most studies frame them between 50,000 and 300,000 inhabitants (Andrés et al., 2023; Bellet & Andrés, 2021). In a context marked by the increase in residential segregation, this paper aims to investigate several fundamental questions: 1) What are the key factors and complexity of the relationships that influence residential segregation and social inequality in medium-sized cities in Castilla-La Mancha?; 2) What are some effective measures to address residential segregation and socio-urban vulnerability in medium-sized cities? 3) Are there patterns in the sociological processes of residential segregation in medium-sized cities? In this way, its objective is to understand whether residential segregation processes can directly reveal existing inequalities in cities. The paper proposes a methodology that can be taken as a guide to reflect on the various relationships between urban residential segregation, applicable to different scales and territories in other regions. In doing so, it seeks to foster new dialogues and broaden the understanding of this phenomenon at a global level.

This article delves into the complex relationship between residential segregation and social inequality in cities, examining recent empirical evidence and exploring diverse academic perspectives to better understand these urban dynamics. The relevance of case studies in the analysis of these phenomena will be addressed and their implication in the configuration and cohesion of cities in the current context will be reflected. In addition, the importance of Geography in the understanding of socio-spatial differentiation and its effects on the urban environment will be highlighted. At the end, it

will seek to shed light on possible strategies and solutions to address these challenges and promote more inclusive and equitable cities in the future. To this end, after a review of the literature on these topics, a selection and analysis of different socioeconomic and housing indicators is undertaken, carrying out an analysis based on their correlation. It allows us to interpret the results from the perspective of the factors that affect socio-spatial differences at an intra-urban scale. The paper ends with a brief section of discussion and conclusions.

2. Urban socio-residential structuring

2.1 City and residential segregation

The city presents a complex nature, composed of a multitude of dimensions (territorial, demographic, social, cultural, economic, political) which are intertwined with each other constituting a whole in a continuous process of transformation. This circumstance makes the city an object of study that cannot be grasped from a single discipline if we want to aspire to its global understanding. Porcel's work masterfully addresses the open debate on the sociological approach to the structure of urban space (2020, pp.15-20). A scientific debate that is not yet closed, and we could synthesize in the fact that there are two types of approach to socio-spatial phenomena. "These are, on the one hand, the study of the aspects concerning the formation and transformation of urban space as a result of social processes (the city as a dependent variable) and on the other hand, the analysis of the particularities of social practices that derive from the urban structure (the city as an independent variable)" (Lezama, 1990). We understand that both must be studied in a complementary and non-exclusive way, in order to understand the complex interaction that occurs between the social and the spatial, although for their analysis it must be approached in a fragmented way. It is important to note that inequalities do not always generate processes of concentration of social groups in the territories, since segregation involves a multitude of factors that require complex observation, becoming a multi-causal phenomenon closely linked to the environment and contexts (Maloutas & Fujita, 2012; Musterd, 2020).

The concept of segregation, with the passage of time and as it has been subjected to different uses, has become increasingly ambiguous. Some well-known authors, such as Massey and Denton (1988), understand residential segregation as the degree to which one or more groups live separately from another group in different parts of the urban environment. With this definition, the authors point out that it is a phenomenon that affects only a part of the residents, but not the whole of the citizenry. However, Michael White (1983) refers to segregation in a geographical sense, as the unequal distribution of social groups throughout physical space, which integrates the residential behavior of the group of inhabitants in the city.

However, the approach that seems to have gained more weight in recent years is the one proposed by Marcuse (2001) who states categorically that segregation would refer specifically to the process of formation and maintenance of a ghetto, stating that segregation only affects a part of the urban population, and that it is a process and not a state. Segregation is a process by which a population group is forced to cluster in a given urban area. Other authors who have followed the same line would be the works of Leal (2002).

In general, residential segregation has been considered a process, to a certain extent, inevitable in many cities, where a group or segment of the population is limited to residing in a certain area of the city, without moving to other regions (Marcuse, 2001). This poses a problem for the internal organization itself and the social and spatial dynamics of urban space. If we consider the city on two inseparable levels, one morphological and the other social, urban segregation would occur simultaneously with other social and/or population groups (Vaughan, 2007). In this sense, residential differentiation is not so much a process, but rather reflects a state that alludes to the different socio-residential components or areas, it would somehow reflect the social differentiation in the territory (White, 1988), which has a hybrid nature, which integrates as many social elements as territorial morphology. In other words, it is a phenomenon that entails that different social groups reside in morphologically different spaces of the city (Ocaña, 1985; Omer & Goldblatt, 2012).

One of the most relevant factors of socio-spatial differentiation in urban space is closely related to

the internal organisation of cities. Specifically, the distribution of the population in different sectors and neighborhoods within each urbanized area is not random, but occurs as a result of various political, economic, social, and cultural factors (Capel, 2002).

These internal differentiations and, above all, the existence of inequalities, are increasingly present in cities around the world. Inequality can manifest itself in various ways, from place of residence to income level, education, access to services or different levels of employment and unemployment. These aspects are ultimately related to the level of well-being achieved by each community (Linares, 2013; García y Módenes, 2019). In addition, social differences translate into spatial disparities that can be linked not only to these aspects, but also to issues related to gender, social status, age, ethnicity, nationality, religion, among others (Sposito, 2007; 2020; Kesteloot, 2005; Caravaca, 2022).

2.2. Approaches to the study of socioeconomic residential segregation

The structure of urban space and the processes that shape it are topics widely reflected and analyzed in the field of urban studies. For almost a century, these topics have been a priority in research, especially since they acquired great importance in the Chicago School. The Dissimilarity Index (D) of Duncan and Duncan (1955) has been established as the reference measure in the study of residential segregation. This index assesses the inequality in the residential distribution of a social group, usually a minority, compared to another group. Their scores range from "0" (when all spatial units have the same composition, there is no segregation) to "1" (when there are no mixed spatial units, indicating the maximum level of segregation). However, improvements have been proposed in this index due to its lack of sensitivity towards the spatial relationship between the different territorial units. Some authors consider it "aspatial" because it assesses the social composition of territorial units independently, without taking into account their location (Porcel, 2020, p.45, citing Tauber and Tauber, 1976; Winship, 1977).

In the 1980s, the study by Massey and Denton (1988) introduced a new approach that made it possible to address residential segregation in a more coherent way, which generated some stability in this field of study and remains a relevant frame of reference today. These indicators proposed by Massey and Denton (1988) arose from a factor analysis of 20 possible indicators of segregation in 60 metropolitan areas, and 5 dimensions were identified that reflect the complexity of the spatial arrangement of social groups: Uniformity (1), exposure (2), concentration (3), centrality (4) and grouping (5). From this perspective, the authors consider the usefulness of several indicators in a complementary way, although there have been criticisms about the number of relevant dimensions to measure residential segregation.

In addition to these indicators, it is important to mention that the progressive interdisciplinarity of urban studies and technological advances have led to a methodological renewal in the field of residential segregation. The incorporation of Geographic Information Systems (GIS) has made it possible to analyse and visualise how a social group is distributed in the city and to establish certain patterns.

This evolution and diversity of methods and techniques for analysing residential segregation throughout history has created a certain theoretical and methodological disorder, making it difficult to compare research between studies.

The complexity of socio-urban relations is a fundamental aspect that must be deeply analyzed. In Europe, residential segregation has gained prominence, especially due to inequalities and imbalances generated by economic and health crises, changes in migratory and demographic trends, and the weakening of the welfare state (Tammaru et al., 2015). Efforts have been made to understand how this phenomenon manifests itself in different cities of the continent and how it relates to other regions of the world.

In the Spanish context, this topic has captured the attention of numerous researchers in recent years (Sorando & Leal, 2019; Sorando, 2022; Nel. Lo and Blanco, 2018; Nel.Lo, 2021; Porcel, 2019; Alonso, 2020, 2021; Rubiales, 2020; Bayona & Wormwood, 2018; Bayona, Gil, & Pujadas, 2013). These studies have focused mainly on analysing socio-spatial differentiation and the manifestation of segregation in metropolitan areas and large cities, leaving a gap in terms of an adequate approach to this

phenomenon in smaller urban spaces. With the exception of some approaches to the phenomenon of socio-spatial differentiation in medium-sized cities in Catalonia and other specific cases (Bellet & Vilagrasa, 2001; Checa & Arjona, 2006; García *et al.*, 2009; Madariaga *et al.*, 2020; Martins *et al.* 2023), the study of residential segregation in Spanish medium-sized cities needs further in-depth, especially on an intra-urban scale, where the results are still incipient and mainly focused on large urban areas (Méndez & Prada, 2014). It is important to note that socio-spatial differentiation, inequality, and urban segregation also manifest themselves at these intermediate scales.

This research focuses on the empirical study of urban inequality in a particular case, following the approach proposed by Mikel Savage (cited in Roitman, 2003), who considers it important to give scientific relevance to empirical case studies and offer results that can contribute to the design of public policies through methodological innovations.

3. Research materials and methods

3.1 Materials and area of study

The selection of Demographic, Educational and Economic variables at the intra-municipal scale obtained from different official sources such as the latest statistical edition of the INE for the years 2020 and 2021. Variables that include demographic data, such as: the total population, foreign population, foreign-born population, young population and elderly population. It also includes educational variables such as the level of primary and university education, and economic variables such as the percentage of unemployed compared to the active population, the GINI Index of wealth distribution and different indicators of income and income distribution.

This work focuses on Ciudad Real (74,850 inhabitants in 2023), capital of the province of the same name in the region of Castilla-La Mancha (Spain) and is a city that has undergone a significant transformation in the last forty years, becoming a leading nucleus both demographically and functionally of its province. This change has been reflected in its urban growth and in the diversity of functions it offers to its territory. Key factors in this process have been the arrival of the Spanish High-Speed Line (AVE), initially connecting Madrid with Seville, and the foundation of the University of Castilla-La Mancha, generating important synergies that boosted its development (Rodríguez-Domenech & Rodríguez, 2021).

Considering Ciudad Real's strong tertiary focus, it is essential to analyse how this economic vocation may be related to the patterns of residential segregation in the city. Studying the relationship between the expansion of educational institutions and the distribution of housing in low- and high-income areas could shed light on how urban development can accentuate or attenuate socio-spatial disparities in medium-sized cities, an issue worked on at other scales (Arbaci, 2019; Porcel, 2020), but which still does not have research for medium-sized cities in the interior. Likewise, research on residential segregation at an infra-municipal scale, census tract, will allow a more detailed and precise analysis of local dynamics and their implications for urban equity.

Residential segregation can be a complex phenomenon and studying it in medium-sized cities will allow us to better understand how urban dynamics can affect social inequality. In addition, research in this area can help identify differences in access to services, opportunities, and resources between different social groups within the city. In this context of urban growth, it is relevant to study residential segregation in medium-sized cities in Spain, such as Ciudad Real. Although it is observed that these cities have lower levels of residential segregation than large urban areas, it is essential to analyze how urban transformation and development can influence the socio-spatial distribution of the population. In this way, the study of residential segregation in medium-sized cities in Spain, such as Ciudad Real, is of great importance to understand how urban changes and infrastructure development can influence the socio-spatial configuration of these cities and their impact on social inequality.

3.2. Methodology

This research presents a methodology that integrates socioeconomic data into a Geographic Information System (GIS) for the analysis of quintiles and correlations, with the aim of understanding residential segregation. The variables selected for the study are described, including demographic, educational and economic aspects corresponding to the years 2021 and 2020. Integrating socioeconomic data into a GIS is a powerful tool for analyzing geographic patterns and inequalities in a population. By applying quintile methodology and correlation analysis, it is possible to understand how variables are distributed and how they are related to each other. This approach is crucial to understanding residential segregation and its socioeconomic implications. And the following phases are established:

First, a quintile methodology was used, based on the division of the data into five equal parts, representing 20% of the sample in each group. The choice of this methodology is based on recent findings from studies on socio-spatial vulnerability, which highlight the complexity of relationships in this area (Kok et al., 2015; Porcel, 2020). In this sense, the quintile methodology allows for a detailed and differentiated segmentation of the data, facilitating a more nuanced analysis that goes beyond traditional relationships, allowing the distribution of variables in different geographical areas to be evaluated and how different segments of the population behave to be compared. Second, these data were analyzed individually and represented by GIS from these quintiles. This has made it possible to visualize and analyze socioeconomic data in a spatially significant way. The thematic maps generated facilitate the identification of patterns of residential segregation and territorial inequalities, providing valuable information for decision-making in urban planning and social development. This tool allows the understanding of residential segregation and socioeconomic inequalities. By visualizing and analyzing data spatially, key patterns and relationships can be identified that inform more equitable and effective policies. Thirdly, a correlation analysis between variables has been carried out, which is essential to understand the relationships between the selected variables. Using Pearson's correlation coefficient, the degree of association between pairs of variables has been evaluated. These correlations allow us to identify patterns of spatial association and understand how factors such as income, education, and demographics are interrelated in different geographic areas. The results have been interpreted based on the authors' previous knowledge, which has made it possible to relate the statistical information to more specific aspects and avoid a purely quantitative bias in the work.

4. Results

4.1 Analysis of indicators

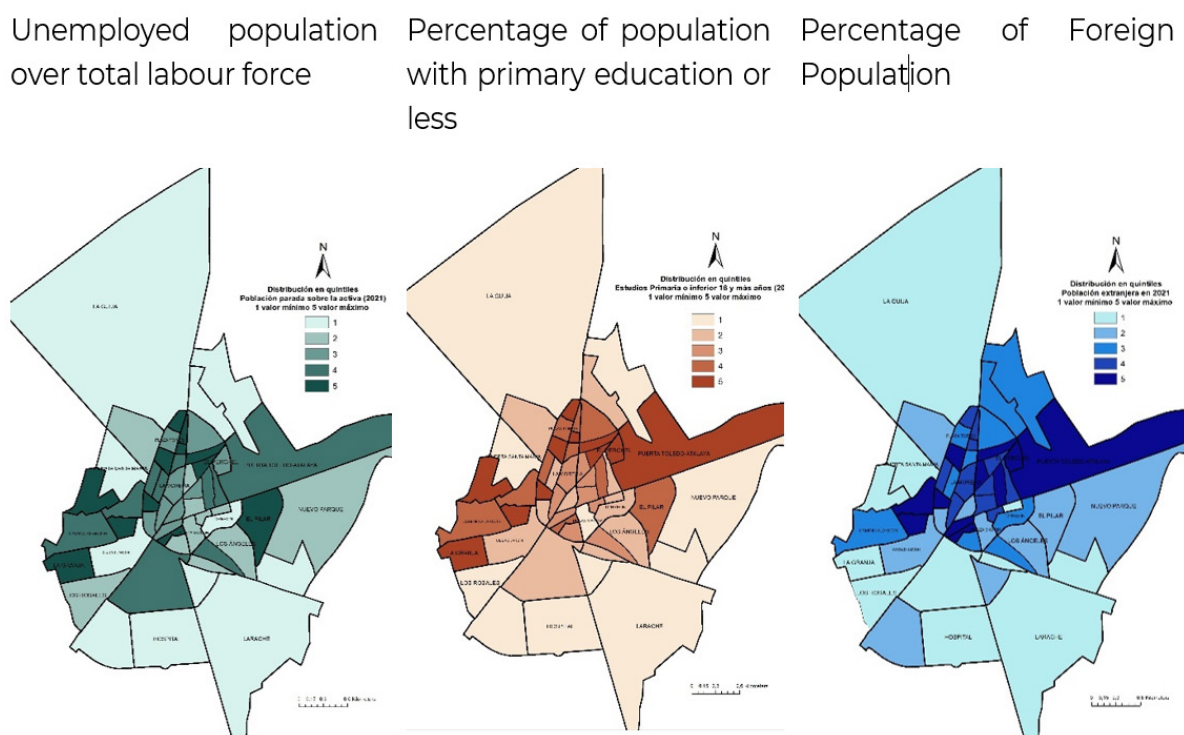
Based on the analysis of indicators carried out, 14 variables were identified that could be of greater interest, in the opinion of the researchers, to interpret the processes of residential segregation in Ciudad Real. These variables can be grouped into two main categories: sociodemographic variables, which include six indicators, and income-related variables, which include eight indicators. Firstly, the sociodemographic variables show important differences, for example, in relation to the percentage of foreigners, which shows important differences between neighbourhoods such as El Perchel or Puerta de Santa María (above 10%) and others such as Larache or La Guija, which do not reach 2% (Figure 1). Two other variables, generally linked, that present significant differences are the percentages of the population under 16 years of age and over 64. In this sense, neighbourhoods such as Larache or Hospital show less ageing, bringing together more than 25% of the population under 16 years of age and a population over 65 of less than 5%, which is linked to new neighbourhoods, populated by a population that is still young. At the opposite extreme are traditional neighbourhoods, such as Plaza de Toros or La Morería, whose population over 65 years of age exceeds 30% of the total, compared to a population under 16 years of age that does not even reach 10%. They are strongly aged neighbourhoods, present in the urban centres of many Spanish cities.

In relation to the level of education, if we use the extreme values again, that is, the percentage of the population with primary education or less compared to the percentage of the population with university education or higher, we find a coincidence again. On the one hand, certain neighbourhoods

such as Puerta de Santa María or Plaza de Toros appear with percentages of the population with a low level of education above 20% compared to percentages of the population with university studies of around 30%. The most striking case in this regard is La Granja, the only neighbourhood in Ciudad Real where the population with less education (21%) is double the population with university studies (10%). On the other hand, in areas of recent expansion, such as Hospital, Nuevo Parque or Larache, the picture is completely different: the population with less education does not reach 5% of the total, while the population with at least university education clearly exceeds 50% and, in some specific cases, 60%. Finally, the variable referring to the percentage of unemployed over the active population tells us again of two antagonistic realities. While sectors such as La Granja or Puerta de Santa María shoot up to over 40% of unemployed, other areas such as Hospital or Ciudad Jardín are around 10%. In this sense, the case of Ciudad Jardín is especially striking, whose location next to La Granja, marks two contiguous values, but radically different.

Secondly, with respect to the variables related to income, the analysis of indicators can, in some cases, be articulated again in pairs, as in the case of the Gini Index and the ratio between the 80th and 20th percentile of income. In them, we again find neighbourhoods where these values are skyrocketing, indicating situations of greater inequality in the distribution of income, as is the case of Puerta de Santa María or El Perchel, compared to other neighbourhoods where there is greater homogeneity in the distribution of income and fewer differences between those with higher and lower incomes. La Guija or Larache being an example of a more equitable distribution of income. A different indicator, but with a certain relationship with these, is the Average Income per Unit of Consumption, which, as in the case of most of those discussed in this section, presents verifiable differences within Ciudad Real. In this way, we find sectors already mentioned such as Plaza de Toros, El Perchel, Puerta de Santa María or La Granja, whose income is around or below 15,000 euros per year. On the other hand, Ciudad Jardín, Plaza Mayor, Nuevo Parque or Torreón exceed 25,000 euros per year in average income per unit of consumption. On the one hand, we would be seeing central neighbourhoods where the middle and upper-middle classes of Ciudad Real have traditionally been located (Torreón or Plaza Mayor) while, on the other, Nuevo Parque or Ciudad Jardín represent the areas of urban expansion for the new professional classes.

Figure 1. Sociodemographic indicators in Ciudad Real



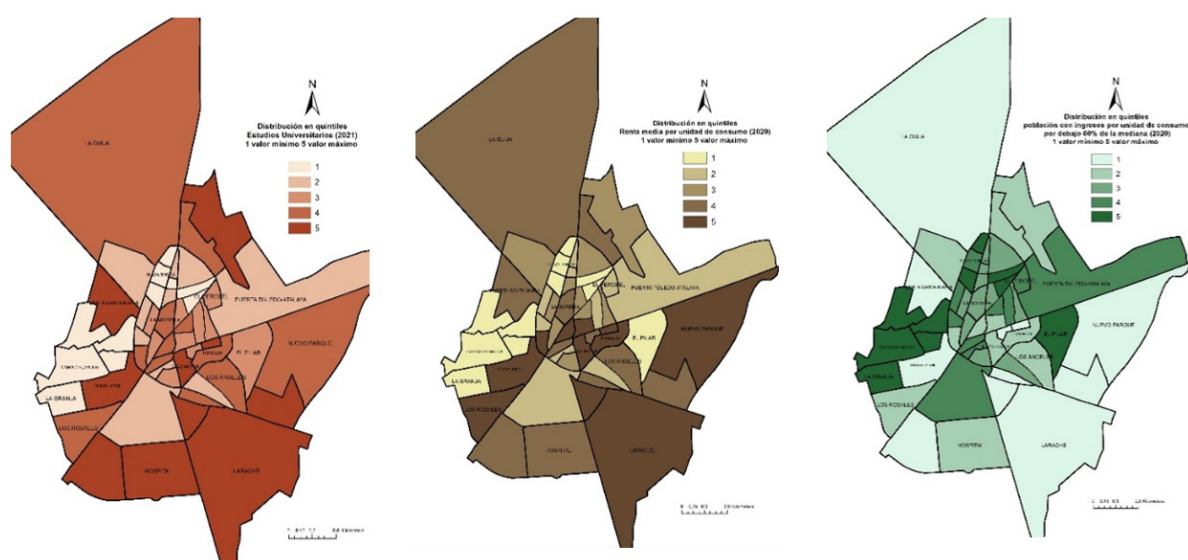
Source: Own elaboration

This same duality is found in the analysis of the distribution of the percentage of the population with income per unit of consumption below 60% (Figure 2) and above 160% of the median. On the one hand, sectors such as La Guija, Torreón or Larache do not even have 10% of their population in the first group, while they have percentages of population above 40 and 50% in the group of people with the highest income in the cases of Larache and Torreón. On the other hand, neighbourhoods such as La Granja or Puerta de Santa María have percentages of population with income per unit of consumption below 60% in more than 40% of their inhabitants, with the percentages of the population with the highest income in the first case being 4% and in the second case at a meagre 13%.

Finally, the indicators relating to the sources of gross personal income show relevant differences in the different neighbourhoods of the City, which aim to cement this difference between some sectors that have been mentioned in the section. In the first place, neighbourhoods such as Larache, Hospital or La Guija have incomes from salaries above 80%, and consequently other types of very low incomes. They correspond to new sectors, with a very young population and middle class of working age. In the case of this indicator, very old sectors, such as Plaza Mayor or Torreón, mark the other side of the coin, with percentages of around 40%. Secondly, in relation to income from pensions, these same neighbourhoods (Torreón, Plaza Mayor or La Morería) are around 40%, which contrasts precisely with Hospital or Larache, which do not reach 5% of the population whose income comes from pensions. Thirdly, very depressed social sectors, such as La Granja, Plaza de Toros or Puerta de Santa María, have the highest values in terms of the percentage of the population whose income comes from unemployment benefits, being between 5-10% of the total, to which must be added a contingent of around 10% in each neighbourhood whose income comes from other social benefits. On the other hand, La Morería, Plaza Mayor or Torreón have the lowest values in these indicators, which do not reach 2%. Finally, in relation to the percentage of the population whose income comes from other incomes, in Plaza Mayor or El Perchel these exceed 15%, while in Plaza de Toros or Puerta de Santa María they are around 3%. This income is generally linked to investors or rentiers, clearly corresponding in the case of study to wealthy or older sectors that have the possibility of investing their capital or obtaining an income from real estate rentals.

Figure 2. Sociodemographic and income indicators in Ciudad Real

Percentage of population with a university or higher education Average income per unit consumption Revenue per unit consumption below 60%



Source: Own elaboration

In short, the individualized analysis of the selected indicators has allowed us to see significant spatial differences. These translate into certain continuities in certain neighborhoods that usually appear at

the extremes of these variables. However, moving beyond a mere description and trying to obtain a more complex and spatial interpretation of socioeconomic segregation requires more in-depth work. In this sense, in the following section, a correlation is established, based on the Pearson index, between certain variables that seem to be articulated in Ciudad Real.

4.2 Correlation between indicators

A second stage of this research consisted of trying to identify the relationships between the fourteen variables identified in the first stage. These, as shown in Table 1, unevenly present a significant correlation (considered as such from 0.39 or -0.39). As in the previous section, the fourteen variables can be divided into 2 large groups: on the one hand, the sociodemographic variables, which group together 6 indicators; and on the other hand, the variables related to income, which add up to 8.

Table 1. Correlation between the indicators used

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	1,00													
2	-0,47	1,00												
3	0,52	-0,84	1,00											
4	0,67	-0,54	0,50	1,00										
5	-0,39	0,39	-0,21	-0,87	1,00									
6	0,24	-0,24	0,14	0,76	-0,87	1,00								
7	0,45	-0,17	0,24	0,56	-0,40	0,52	1,00							
8	0,41	-0,07	0,15	0,51	-0,38	0,51	0,90	1,00						
9	-0,38	0,11	0,03	-0,77	0,91	-0,82	-0,34	-0,37	1,00					
10	0,35	-0,15	0,08	0,78	-0,85	0,91	0,70	0,71	-0,85	1,00				
11	-0,37	0,12	0,02	-0,75	0,90	-0,78	-0,28	-0,30	0,99	-0,79	1,00			
12	-0,49	0,79	-0,95	-0,55	0,30	-0,31	-0,41	-0,31	0,06	-0,26	0,06	1,00		
13	0,55	-0,81	0,96	0,58	-0,31	0,28	0,34	0,24	-0,10	0,22	-0,10	-0,97	1,00	
14	0,06	0,05	-0,24	0,53	-0,80	0,80	0,28	0,29	-0,86	0,82	-0,83	0,08	-0,11	1,00

Note: 1] Percentage of foreign population 2021; 2] Percentage of population under 16 years of age; 3] Percentage of population over 64 years of age; 4] Percentage of the population with primary education and below over 16 years of age; 5] Percentage of population with higher university education (2021); 6] Percentage of unemployed population over active population 2021; 7] GINI Wealth Distribution Index calculated in 2020; 8] 80-20 distribution or ratio between the 80th percentile and the 20th percentile of income calculated in 2020; 9] Average income per unit of consumption in 2020; 10] Percentage of population with income per consumption unit below 60% of the median in 2020; 11] Percentage of population with income per unit of consumption above 160% of the median in 2020; 12] Percentage of gross personal income due to salary; 13] Percentage of gross personal income due to pensions; 14] Percentage of gross personal income due to unemployment.

Source: Authors.

In the case of sociodemographic variables, Table 1 allows us to identify a direct correlation between the percentage of foreigners and the percentage of the population with less education and between the percentage of foreigners and the percentage of people over 64 years of age. In relation to the percentage of the population with less education, a significant correlation is also identified with the percentage of unemployed (0.76) and, on the contrary, an even more striking inverse correlation between the percentage of unemployed and that of the population with university studies (0.87). In relation to this type of correlation, there are several that can be highlighted, such as, for example, the existing one between the percentage of foreigners and the population under 16 years of age, which may be due to labour migration or the fact that the children of foreigners born in Spain already have Spanish nationality.

Similarly, the percentage of foreigners shows an inverse correlation (-0.39) with the percentage of the population with university studies, which was to be expected given the aforementioned correlation with the percentage of the population with less education (0.67). This again indicates the existence of a population with a low-skilled job profile, whose performance occurs mainly in

market niches that do not require very specialized training. The fact that more than 36% of the foreigners registered in 2021 in Ciudad came from South America and almost another 16% from Africa confirms the presence of a migrant population with the aforementioned socio-labour profile.

In the case of the correlation between sociodemographic variables and income variables, in the first place, the fact that three variables stand out: percentage of foreign population, percentage of population with less education and percentage of unemployed population maintain a significant correlation with two variables that affect economic segregation, such as the Gini Index and the 80-20 distribution or ratio between the 80th and 20th percentile of income. Similarly, the correlation between the population with less education and the unemployed population and the percentages of gross personal income due to unemployment and the population with income per unit of consumption below 60% of the median are also significant, resulting in the idea that a situation of unemployment and lack of education can lead to processes of material deprivation. Although the percentage of foreigners does not show a significant correlation with the percentage of the population whose income depends on unemployment benefit (which may be due to the fact that their situation is so precarious that they are not even entitled to this benefit), it does come close to a significant correlation with the percentage of the population with income per unit of consumption below 60% of the median.

On the other hand, these three groups (foreigners, unemployed and those with a low level of education) have an important inverse correlation with three variables that, unlike the previous ones, imply a better economic situation: the average income per unit of consumption, the percentage of the population with income per unit of consumption above 160% of the median and the percentage of gross personal income due to wages. Although age (percentage of people under 16 or over 64 years of age) did not show significant correlations except for the percentage of income from salaries and pensions (as expected), the percentage of the population with a university education did. In this case, this variable behaved as an antithesis of the other three indicators discussed above (foreigners, low educational level and unemployed) in that it showed very intense correlations, but of the opposite sign, to these in relation to the aforementioned indicators (Table 1). In this way, it can be considered that the level of education, the situation of unemployment and the origin constitute three clear variables in their correlation with others of a socioeconomic nature.

Finally, in the case of income variables, there is, as expected, a significant correlation between those that are linked to a more limited or concentrated income, such as the GINI Index, the 80-20 distribution and the percentage of the population with income per consumption unit below 60% of the median. Similarly, a higher average income per unit of consumption is positively correlated with the percentage of the population with income per unit of consumption above 160% of the median. In relation to income from unemployment benefit, these are negatively correlated with the previous two and positively with the existence of income per unit of consumption below 60% of the median. A curious element is that, although income from unemployment benefit correlates with several indicators linked to income scarcity, income from wages does not correlate in the opposite direction. To find a positive correlation with gross income per unit of consumption and the percentage of the population with income per unit of consumption above 160% of the median, we must look at another indicator, such as the percentage of gross personal income due to other income, which correlates respectively with 0.68 and 0.65. This indicator, which has not been included in Table 1, refers to income from investments or rentals, being correlated with the presence of the population with university studies or over 64 years of age.

4.3 Significant correlations in socio-urban relations influencing residential segregation in Ciudad Real

The analysis above, while enabling to establish links between indicators, does not allow an interpretative reading of the situation in Ciudad Real. Therefore, it is necessary to go a step further and look for specific spaces where the correlations identified in the previous section can occur. First, some neighborhoods can be identified where there is a high prevalence of foreign population, without education and unemployed who have greater difficulties (Figure 1). We highlight the neighbourhood of La Granja, which has the highest values of low level of education and unemployed

population, but not of foreign population. This is mainly due to the fact that it is a neighbourhood of Roma ethnicity and with very significant social segregation. Secondly, on the other hand, there are some neighbourhoods with a high number of people with university studies and better income indicators with fewer difficulties, as can be seen in the southern part of the city, in the Larache or Hospital neighbourhood. Areas with a high level of education, high consumer incomes and low unemployment (Figure 2).

This analysis has provided a clear view of the complex socio-economic interactions that characterised the year 2021. Several significant correlations have been identified between sociodemographic variables and income-related variables, which highlights the close connection between these aspects in socioeconomic reality. The results highlight the need to take a holistic approach when addressing issues of inequality and work dynamics in today's society. No single factor can be analyzed in isolation, as multiple variables are intertwined and exert mutual influence. Properly understanding these patterns requires considering a variety of factors, such as the population's educational level, unemployment rate, income distribution, and dependence on unemployment benefits.

This research invites us to recognize the importance of comprehensive public policies that address both sociodemographic aspects and income issues together. A holistic approach is essential to developing effective strategies that promote equity and economic well-being for all segments of society. In addition, the need for further research and analysis of these issues in depth is emphasized, as socioeconomic dynamics are constantly evolving. Through a deeper understanding of these complex relationships, we will be able to develop more effective and sustainable policies that address current and future challenges equitably.

5. Discussion

As evidenced, the city is an object composed of various interconnected dimensions in a continuous process of transformation (Porcel, 2020, pp.15-20). The results of this research, by analyzing 14 variables and their significant correlations, reaffirm this complexity. By relating residential segregation to socioeconomic and income variables, it is evident how political, economic, social, and cultural factors influence the configuration of intra-urban space (Capel, 2002). In the results, residential segregation indicators are used that cover different aspects, such as the social composition of territorial units and the spatial distribution of social groups. The presence of significant correlations between socioeconomic and income variables reinforces the relevance of residential segregation as a multi-causal phenomenon linked to the environment and urban contexts (Porcel, 2020). This establishes a concentration of population of a certain characteristic (income level, level of education, unemployed, etc.) in certain sectors, establishing a relationship between inequality and segregation already mentioned in some studies on another scale (Nel.Lo, 2021; Madariaga *et al.*, 2020).

On the other hand, by identifying correlations between socioeconomic and income variables, they confirm the existence of socio-spatial differentiation in the city of Ciudad Real. Some population groups, such as foreigners and people with low levels of education, tend to be concentrated in specific areas of the city, while those with higher levels of education and employment have a different spatial distribution. This emphasizes that socio-spatial differentiation reflects social differentiation in the urban territory, and that it is related to the internal organization of cities (López Martínez, 2021; White, 1988; Ocaña, 1985; Omer & Goldblatt, 2012). The analyzed case expands this issue to the medium-sized cities of the interior of Spain, which would also participate in these processes.

The sectors identified in this work represent the heads and tails of the analyzed case, confirming the existence of important socio-spatial differences within the average city analyzed. The concentration of the foreign, less educated and unemployed population (which can sometimes be the same) in specific neighbourhoods has an impact on their poorer performance with respect to elements such as income or employment, generating not only situations of socio-spatial segregation, but also contributing to a greater vulnerability of these spaces, which sometimes results in a worse performance in times of economic uncertainty (Prada-Trigo, 2018).

6. Conclusions

In this article, we have explored the complex link between residential segregation and social inequality in the urban context, by closely analyzing the most recent empirical evidence and exploring various academic perspectives to gain a deeper understanding of these dynamics. One of the fundamental tools we have used to address this issue is the analysis of case studies, which allows us to examine specific situations and draw valuable lessons about residential segregation and its impact on the configuration and cohesion of cities today. By delving into these aspects, it has sought to shed light on the complexity of residential segregation and its influence on social inequality, providing a solid theoretical framework supported by updated empirical evidence. In addition, it has reflected on how these phenomena can affect social cohesion in cities, highlighting the importance of developing inclusive urban policies that promote greater equity and citizen participation.

The case study in Ciudad Real has made it possible to analyse the spatial distribution of sociodemographic and income indicators, identifying correlations with residential segregation. The research confirms the existence of socio-spatial differentiation in Ciudad Real, with certain groups concentrated in specific areas. Some, such as foreigners and people with low levels of education, tend to be concentrated in neighbourhoods such as La Granja or Puerta de Santa María, while those with higher levels of education and employment have a different spatial distribution, generally associated with new peripheral neighbourhoods or affluent areas of the urban centre. Areas with a high concentration of foreign population, low education and unemployment, such as the neighbourhood of La Granja, and areas with a high level of education, better income and low unemployment rate, such as the neighbourhood of Larache or Hospital in the southern part of the city, have been found.

The analysis highlights the importance of a comprehensive approach when addressing inequality and labor dynamics, as multiple variables are interconnected and exert mutual influence. It is necessary to consider aspects such as educational level, unemployment rate, income distribution and dependence on unemployment benefits, so it is not strategic to analyse the factors in isolation. Properly understanding these patterns requires considering a variety of variables, such as the population's educational level, unemployment rate, income distribution, and dependence on unemployment benefits. In conclusion, understanding and addressing residential segregation and its social implications requires a holistic approach and continuous research to develop effective and sustainable strategies that promote more inclusive and equitable cities in the future.

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