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The impact of local policies on the fight against school segregation. An analysis of the Catalan case

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Abstract

This work delves into the study of the objective causes of school segregation, emphasising sociodemographic, political, and institutional factors that vary at the local level. Among other variables, it examines the influence of the ideological orientation of local governments, the sociodemographic characteristics of municipalities, the features of their school maps, policies for identifying and distributing students with special educational needs (SEN), and school zoning policies. The analysis was conducted in the 120 Catalan municipalities with more than 10,000 inhabitants, excluding Barcelona. Using various multiple linear regression models, the study explores the impact of these variables on the Dissimilarity Index (DI) of students of foreign nationality in pre-primary and primary education during the 2018-2019 academic year. The results reveal a significant impact of variables such as residential segregation, the proportion of public versus private schools, the number of SEN students, and their distribution among schools. Furthermore, early

identification of SEN students, high sensitivity in detection, and the adjustment of reserved places to the number of identified students also prove to be significant variables for a more balanced distribution of these students. Lastly, the analysis of the impact of school zoning yields divergent results depending on the size of the municipalities. Overall, the findings show that there is room for manoeuvre in reducing school segregation at the municipal level, identifying the detection and balanced distribution of SEN students as key factors not only in combating the segregation of the most vulnerable students, but also in addressing structural school segregation.

Keywords: school segregation; educational inequalities; education policy; local policy

Resumen. *El impacto de las políticas locales en la lucha contra la segregación escolar. Un análisis del caso catalán*

Este trabajo profundiza en el estudio de las causas objetivas de la segregación escolar, poniendo el acento en los factores sociodemográficos, políticos e institucionales que cambian a escala local. Entre otras variables, se ha contrastado el peso de la sensibilidad ideológica de los ayuntamientos, las características sociodemográficas de los municipios, las características de su mapa escolar, las políticas de detección y distribución del alumnado con necesidades educativas especiales (NEE), y las políticas de zonificación escolar. Este análisis se ha llevado a cabo en los 120 municipios catalanes de más de 10.000 habitantes, todos excepto Barcelona. Mediante diferentes modelos de regresión lineal múltiple, se ha explorado la incidencia de estas variables sobre el índice de disimilitud (ID) del alumnado de nacionalidad extranjera en las etapas de educación infantil y primaria durante el curso 2018-2019. Los resultados revelan una incidencia significativa de variables como la segregación residencial, el peso de la titularidad de los centros, el volumen de alumnos NEE o su distribución entre las escuelas. Asimismo, la detección precoz del alumnado NEE, la alta sensibilidad en su detección y el ajuste de la reserva de plazas al volumen de alumnos detectados también muestran ser variables significativas para una distribución más equilibrada de este alumnado. Por último, el análisis del impacto de la zonificación escolar ofrece resultados divergentes según el tamaño de los municipios. En conjunto, los resultados evidencian que hay margen de maniobra en la reducción de la segregación escolar a escala local, situando la detección y la distribución equilibrada del alumnado NEE como factores clave no solo en la lucha contra la segregación del alumnado más vulnerable, sino también contra la segregación escolar estructural.

Palabras clave: segregación escolar; desigualdades educativas; política educative; política local

Summary

1. Introduction

The study of school segregation has, from the outset, focused on the distribution of students considered vulnerable across the different schools within a given territory. Vulnerability is an intrinsic characteristic of human beings as social and, therefore, interdependent beings (Seguró, 2021). Nevertheless, the concept of vulnerability is often linked to situations of objective precariousness. Not everyone has the same capacity to live with a *presumption of autonomy*, which presupposes access to economic, cultural, and institutional resources that are not available to the entire population in our societies.

The consideration of vulnerability has also been associated with what the political agenda of any given historical moment has defined as a "social problem." It is therefore unsurprising that the earliest studies on school segregation were connected to the racial categorisation of students in the United States during the 1960s (Coleman et al., 1966). Nor is it surprising that concern about school segregation reached Europe in general, and Spain in particular, during the 1990s, linked to the school distribution of students from immigrant backgrounds (Gorard, 2009; De Madaria & Vila, 2020). Over the years, research on segregation has diversified to encompass the distribution of children from families with low cultural or economic capital, low academic achievement, or confirmed educational vulnerability. Nevertheless, the distribution of students of immigrant heritage or foreign nationality remains a primary focus of analysis.

In Catalonia, the fight against school segregation has played a central role in demands for equal educational opportunities and school equity for a number of years. Catalonia enjoys considerable autonomy in the regulatory framework for academic planning within its territory, as generally established by Catalan Law 12/2009 of 10 July 2009 on education, and set out in Catalan Government Decree 11/2021 of 16 February 2021 on the planning of the educational provision and the admission procedure in the schools of the Catalan Education Service. This decree, enacted under the framework of the Pact Against School Segregation in Catalonia (PSEC), promoted by the Síndic de Greuges [Catalan Ombudsman] and the Catalan Department of Education, and signed in 2019 by a broad spectrum of political parties and municipalities with more than 10,000 inhabitants in Catalonia, replaces Catalan Government Decree 75/2007 of 27 March 2007, which established the admission procedure for students in publicly funded schools. Our research focuses on the period before the new decree had been implemented, but during which the PSEC was being introduced. The PSEC established the promotion of the policies necessary to advance the fight against school segregation, with the implementation of measures at the municipal level becoming a cornerstone of the new approach to addressing what, in political discourse, was framed as a social problem of the first order.

In this respect, our study allows for an assessment of the potential effectiveness of the new decree, as we analyse the impact on school segregation of

certain educational policies that the most pioneering local authorities had been applying, wholly or partially, prior to its entry into force. Beyond the urban morphology and the elements that structure the planning of the educational provision in Catalonia, we were interested in understanding the extent to which the discretion available at the local level to implement public policies (in this case, educational policies aimed at combating segregation) affects the success of their deployment, particularly within the framework of a decree that encourages this type of local commitment. To this end, we focused on the analysis of three elements.

The first element concerns the extent to which the ideological orientation of municipal governments influences the effectiveness of efforts to combat segregation. Beyond the more obvious ideological factors, which determine whether the bulk of school planning is conducted under quasi-market parameters (Ball, 2003), the political orientation of municipal councils may also influence the intensity with which specific public policies that ultimately affect school segregation are implemented. Additionally, we sought to explore the concrete methods of student allocation (the second element) and school zoning (the third element) employed at the local level, in order to determine whether those most closely aligned with Decree 11/2021 have a positive impact on the fight against segregation.

2. Theoretical background: The institutional causes of school segregation

Research on school segregation is primarily linked to the interest in demonstrating its impact on children's academic achievement as a result of the so-called *peer effect*. This may occur either directly, through the spread of attitudes and learning among peers (Benito et al., 2014; Van Ewijk & Sleegers, 2010; Dupriez & Dumay, 2006; Zimmerman, 2003), or indirectly, through the way it shapes the capacity of schools and teachers to implement certain pedagogical and organisational processes (Dumay & Dupriez, 2008; Bellei, 2013; Willms, 2006; Krüger, 2019).

The OECD's PISA[1] programme itself recognises segregation as a significant factor in explaining inequalities in outcomes (OECD, 2019: 85). It is true that the literature does not always reach fully aligned conclusions (Van Ewijk & Sleegers, 2010), but most evidence points in the same direction: less segregated educational contexts tend to promote more equitable academic outcomes, and improvements in performance primarily benefit the most vulnerable groups (Benito et al., 2014).

In the study of the causes of school segregation, it is possible to distinguish research that examines subjective causes versus those that examine objective causes. The former examines the motivations and preferences that influence the direct choice of school (Alegre et al., 2010; Alegre & Benito, 2012). A

1. Results corresponding to the 2018 PISA tests, which compare the acquisition of competencies across different knowledge areas among 15-year-old students in OECD countries.

significant part of the deepening of segregation may be linked to the subjective dispositions of more advantaged groups (Zancajo & Bonal, 2022), which promote processes such as "social closure" in socially homogeneous schools through subtle mechanisms of exclusion or the gradual reallocation of less privileged families (Van Zanten, 2009; Siegel-Hawley et al., 2017; Zancajo, 2019), or the phenomenon known as *white flight* in residential choice (Bowe et al., 1994; Valenzuela et al., 2010).

With regard to the objective causes of school segregation, research has analysed the impact on segregation of a wide range of territorial and institutional factors (Gonzàlez et al., 2023). Among the territorial factors, linked to urban morphology, the variable with the greatest influence on school segregation is none other than residential segregation (Bonal & Zancajo, 2020). This factor is particularly relevant in countries where school allocation is heavily determined by proximity to the school (Bernelius & Vaattovaara, 2016). Nevertheless, it is also a highly relevant factor in Catalonia and across Spain, given the model of *restricted choice* (Alegre, 2010), since residential proximity becomes a key tie-breaker in school allocation, even though it is secondary to family choice of school (Bonal, 2018).

Among the institutional factors, research has focused particularly on the amplifying effect of educational inequalities in general, and of school segregation in particular, resulting from the adoption of normative and organisational models of education systems based on the concept of educational quasi-markets (Van Zanten, 1996, 2001; Ball, 2003), through mechanisms such as policies that incentivise schools to select students. These models are designed according to liberal principles of school choice, competition among educational stakeholders (between schools, among students, or among teachers), organisational autonomy, and accountability. In relation to school segregation, the influence of the private sector has been demonstrated (Escardibul & Villarroya, 2009; Murillo et al., 2018): the greater its presence in the educational network, the higher school segregation tends to be. Furthermore, some studies suggest that certain approaches to policies promoting school choice can help reduce segregation, such as the introduction of targeted school vouchers for specific groups (Hastings & Weinstein, 2008) or certain approaches promoting school autonomy, for example the development of magnet schools in vulnerable areas (Tarabini, 2013). Nevertheless, most of the literature points in the opposite direction: quasi-market dynamics (Gonzàlez et al., 2021) generated by policies promoting organisational and pedagogical autonomy tend to increase, rather than decrease, segregation between schools (Bonal, 2025).

Beyond these general factors, there are educational policies directly related to school planning and student allocation that can also have a significant impact on school segregation, and which do not always depend entirely on broad regional or national regulatory frameworks. As noted earlier, this article analyses the effectiveness of two fundamental planning instruments in combating school segregation: student allocation policies and school zoning. In Catalonia, both of these are conditioned by decisions made at the municipal level.

School zoning systems, which establish residential areas prioritised for enrolment at particular schools, can influence school segregation and modulate the explanatory impact of residential segregation. Often, the relationship between school segregation and residential segregation is reinforced by school zoning, particularly in areas with high residential segregation, because it limits choice to the schools closest to students' homes. School segregation thus tends to be greater in systems where choice is shaped by school zoning policies (Taylor & Gorard, 2001; Ong & Rickles, 2004). Zoning could therefore be a factor generating school segregation, particularly in residentially segregated areas, because students tend to attend schools within their designated zones (Gorard et al., 2003; Alegre et al., 2008).

However, school zoning can help reduce educational segregation, as it determines the main social base from which schools draw (Rossetti, 2014) and can prevent the flight processes of families making more strategic school choices. Without zoning, they would have greater means to enrol their children far from their own neighbourhoods, in areas and schools with a more advantaged social composition (Gortázar et al., 2020). Although, in theory, free school choice weakens the link between the school and its local area (Córdoba Calquin et al., 2017), scientific evidence indicates that in more open, free-choice models without student allocation based on residential area, high levels of school segregation can still occur (Söderström and Uusitalo, 2010).

Decoupling student allocation from place of residence and allowing school choice to promote geographic mobility does not always have positive effects, as the willingness to move is highly conditioned by social background, and socially advantaged families tend to move more in order to access schools they regard as higher quality (Ball et al., 1996; Valenzuela et al., 2010). To prevent a link between school segregation and residential segregation, the size and configuration of zones must be considered. In this respect, to combat educational segregation, school zoning models should be constructed on the basis of socially heterogeneous zones (Benito & Gonzàlez, 2007).

Even more explicitly, quota policies, which prioritise student allocation to certain groups, also impact educational segregation. If student allocation is based on prior academic achievement (for example, in the transition from primary to secondary schools), segregation between schools is reinforced (Gorard & Siddiqui, 2016). In contrast, if quotas are designed to ensure a balanced distribution of vulnerable groups, this measure appears to produce clear mitigating effects on school segregation (Alegre, 2017). However, quota policies have their detractors (Carrasco et al., 2009), who argue that such measures primarily limit the school choice options of vulnerable families, that allocation to schools with a student profile very different from their own may generate adaptation problems due to stigmatisation, or that these policies do not address the main negative effects of segregation, as they do not tackle within-school segregation, through widespread practices such as *streaming by ability*, which have measurable impacts on academic outcomes (Duk & Murillo, 2017).

3. Methodology

This study compares all Catalan municipalities with more than 10,000 inhabitants, excluding Barcelona (omitted due to its atypical size in terms of population[2]). In total, the sample comprises 120 municipalities. Using multiple linear regression models, we examine the impact of various independent variables (relating to the sociodemographic characteristics of each municipality and its school map) on a single dependent variable: the Dissimilarity Index (DI) of foreign-nationality students in pre-primary and primary education (ages 3–12) across schools in each municipality during the 2018–2019 academic year.

The selection of variables in empirical research is often conditioned by the availability of datasets, which are linked to what the administration records as socially significant. This is the case in our study, which analytically examines the causes of school segregation among foreign-nationality students, the main dependent variable of our research. This variable indirectly reflects situations of economic and institutional disadvantage, because, although not all members of the group necessarily share these disadvantages, the correlation between nationality and actual vulnerability is very high. Therefore, it is a variable that provides a fairly reliable approximation of the distribution of a significant portion of vulnerable students, as well as one of the groups that underlying social racism tends to stigmatise and isolate (Olmos, 2012; Álvarez-Sotomayor, 2015).

The Dissimilarity Index is one of the principal indicators used to measure school segregation (Murillo, 2016). It ranges from 0 (maximum desegregation) to 1 (maximum segregation), depending on the proportion of individuals in the group analysed (which in our dependent variable is foreign-nationality students) who would need to be relocated (in our case, to another school) to achieve exact proportionality. The Catalan Ombudsman has calculated this index for Catalan municipalities with more than 10,000 inhabitants[3], both for foreign students and for SEN students. In our analysis, we use both indicators: the Dissimilarity Index (DI) for foreign-nationality students as the dependent variable, and the DI for SEN students as one of the independent variables included in the regression models. The aim is to distinguish the impact of policies for identifying and distributing a particularly vulnerable group of students (SEN students) from that of more structural segregation (measured through students' nationality).

As for the independent variables used in the analysis, many of them operationalise municipality-level data linked to our research objectives. The first

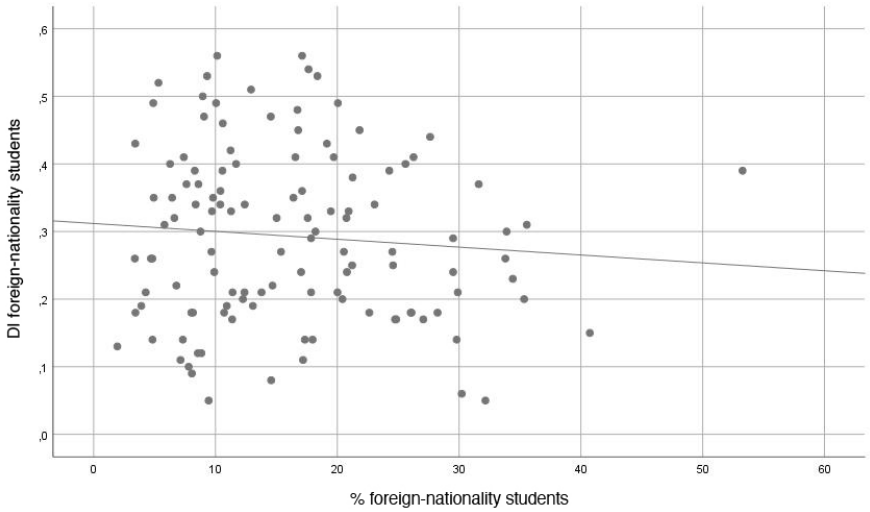
2. The entire analysis was also replicated including the city of Barcelona; however, its exclusion allows for the incorporation of several interesting nuances in the study. Barcelona has a population six times larger than the second-largest city in Catalonia, L'Hospitalet de Llobregat. Including it in the sample would markedly distort the effect of one of the key sociodemographic variables, municipal size, thereby negating its explanatory power. It is worth noting that, in this respect, this research is complemented by an analysis of the impact of Barcelona's Anti-Segregation Action Plan (Bonal & González, 2023).
3. https://www.sindic.cat/ca/page.asp?id=503

objective was to determine whether the ideological orientation of local councils influences the effectiveness of efforts to combat school segregation at the local level. In line with this goal, we examined whether, independently of or in correlation with political orientation, there are other characteristics of municipalities that make them more proactive in promoting anti-segregation policies. The second and third objectives seek to test whether the two policy areas in which municipalities have a certain degree of autonomy, and which are implemented differently across the cases analysed, namely school allocation policies and school zoning, actually have an impact on reducing educational segregation.

In addition to operationalising these variables, our models also incorporate sociodemographic and school map variables which, according to the literature, have their own explanatory power and can therefore help refine the actual explanatory capacity of the dependent variables that are the focus of our research. In this process, certain variables that were initially expected to be highly explanatory, such as the proportion of foreign-nationality students or the proportion of foreign adult inhabitants in the municipality, were ultimately excluded from the analytical model. The following scatterplot (Figure 1) shows the relationship between the DI of foreign-nationality students and their relative weight within the total population of pre-primary and primary students in each municipality. As can be observed, the large differences in these numbers between municipalities do not appear to affect the level of segregation of this group, which in itself is a revealing secondary finding of the study.

Returning to the operationalisation of the variables related to our research objectives, in relation to the first objective, we constructed a variable referred

Figure 1. Relationship between the segregation of foreign-nationality students and the percentage of foreign-nationality students in each municipality



Source: Own elaboration.

to as the *left–right axis*, which was developed based on the political orientation of each municipality's local government during the last three electoral terms (2007 to 2019). Each municipality is positioned further to the left or to the right depending on the political party holding the mayor's office each year. Specifically, a score between 1 (most left-leaning) and 3 (most right-leaning) is assigned.[4] The final calculation therefore places municipalities on a scale ranging from 12 points (all years governed by centre-left or left-wing parties) to 36 points (all years governed by centre-right or right-wing parties). Only one municipality in the sample, El Prat de Llobregat, appears at the leftmost position (12 points). In contrast, several municipalities reach the maximum score of 36 points, having been governed for 12 consecutive years by centre-right parties (Vic, Sant Cugat del Vallès, Banyoles, Figueres, etc.).

Regarding the second objective, it should be noted that in Catalonia, even before the implementation of the new decree, the reservation of places had already become a key policy instrument in the balanced distribution of students. However, the way this measure was implemented varied widely. Many municipalities underused this tool, either because of the under-identification of SEN[5] students prior to the admission process, because the number of reserved places did not correspond to the number of identified students, or because there were no support mechanisms for students admitted through the reserved places scheme (Síndic de Greuges, 2008, 2016)[6]. It therefore appears that the intensity of both the identification process and the balanced distribution of SEN students may be crucial in assessing the effectiveness of this policy. We parameterised this dimension using variables reflecting the proportion of students identified as SEN in each municipality and the degree to which these students were evenly distributed among schools.

Regarding our third objective, which is to analyse the impact of school zoning, we addressed it by comparing municipalities with a single-zone model (where all residents share the same zone encompassing all the schools), and those with multi-zone models, where residents receive proximity points for some schools but not others, depending on whether their home falls within the school's designated catchment area. As we will see, this model comparison only becomes meaningful and statistically significant when the analysis differentiates municipalities by population size, since this makes it

4. The municipalities were assigned 1 point for each year with a mayor's office led by CUP, ICV, Comuns, Podem or similar local parties and groups; 2 points for each year with a mayor's office led by ERC, PSC or similar local parties and groups; and 3 points for each year with a mayor's office led by CiU, Junts, PP or similar local parties and groups.
5. SEN students are those certified as vulnerable by the Educational Psychology Support Teams (EAP), either because they have a disability (SEN A) or because they experience socio-economic or socio-cultural vulnerability (SEN B–C).
6. Under Catalan Government Decree 75/2007 of 27 March 2007, which was in force at the time of the research, all municipalities in Catalonia were required to reserve two places per classroom for these profiles of students during the school pre-enrolment phase. Our aim was to assess the extent to which this policy has proved effective in reducing school segregation, and whether its effects have been stronger in some municipal contexts than in others.

Table 1. List of variables

Variables	Description
DI of foreign-nationality students	Dissimilarity Index of foreign-nationality students between schools. Source: Síndic de Greuges de Catalunya.
Left–right axis	Intensity of the left–right ideological orientation of the mayoralty between 2007 and 2019. Source: Own elaboration based on the *Database of mayors and councillors of the Ministry of Territorial Policy and Democratic Memory*.
Number of inhabitants	Total number of inhabitants in the municipality. Source: Idescat.
Disposable family income	Disposable family income per inhabitant (in thousands of euros). Source: Idescat.
Residential DI of foreign-nationality population	Dissimilarity Index of foreign-nationality inhabitants among census sections. Source: Own elaboration based on data available from Idescat.
% of students in private schools	Percentage of students enrolled in privately owned schools. Source: Department of Education of the Government of Catalonia.
Average number of classes per year group per school	Average number of classes per year group across schools. Source: Own elaboration based on data available from the Department of Education of the Government of Catalonia.
% of SEN students	Percentage of students with special educational needs (SEN). Source: Síndic de Greuges de Catalunya.
DI SEN students	Dissimilarity Index of SEN students between schools. Source: Síndic de Greuges de Catalunya.
Single-zone model	School zoning model (single-zone or multi-zone). Source: Own elaboration.
Ratio % SEN students / municipal disposable family income	Ratio between the percentage of SEN students and the municipality's disposable family income. Source: Own elaboration based on data from the Síndic de Greuges de Catalunya and Idescat.
Ratio % SEN students / municipal educational deficit	Ratio between the percentage of SEN students and the percentage of adults without post-compulsory education in the municipality. Source: Own elaboration based on data from the Síndic de Greuges de Catalunya and Idescat.
Ratio % SEN students in first year of pre-primary / % SEN students in other school years	Ratio between the percentage of SEN students in first year of pre-primary and the percentage of SEN students in the remaining grades of pre-primary and primary education. Source: Own elaboration based on data from the Síndic de Greuges de Catalunya.
DI of SEN students in first year of pre-primary	Dissimilarity index of SEN students in first year of pre-primary between schools. Source: Síndic de Greuges de Catalunya.
Reserved places in first year of pre-primary for SEN students	Number of places in first year of pre-primary per classroom reserved for SEN students. Source: Own elaboration based on data from the Síndic de Greuges de Catalunya and the Department of Education of the Government of Catalonia.
Adjustment between reserved places in first year of pre-primary / % SEN students in first year of pre-primary	Degree of alignment between the number of reserved places in first year of pre-primary and the percentage of SEN students in first year of pre-primary. Source: Own elaboration.

Source: Own elaboration.

Table 2. Descriptive values of the variables

	Fewer than 20,000 inhabitants		Between 20,000 and 50,000 inhabitants		More than 50,000 inhabitants		Total	
Variables	Mean	SD	Mean	SD	Mean	SD	Mean	SD
DI of foreign-nationality students	0.21	0.10	0.34	0.10	0.40	0.10	0.29	0.13
Left–right axis	28.6	4.4	28.3	5.8	25.4	5.2	27.9	5.2
Disposable family income	15.3	2.7	15.7	2.6	16.6	2.2	15.7	2.6
Residential DI of foreign-nationality population	0.08	0.08	0.16	0.09	0.19	0.07	0.13	0.09
% of students in private schools	20.0	19.6	26.0	16.7	36.2	9.8	25.1	18.0
Average number of classes per year group per school	1.68	0.27	1.72	0.30	1.72	0.17	1.70	0.27
% of SEN students	12.5	7.9	11.8	8.6	11.8	5.0	12.1	7.6
DI SEN students	0.16	0.10	0.24	0.08	0.29	0.08	0.21	0.10
Ratio % SEN students / municipal disposable family income	0.86	0.58	0.81	0.65	0.73	0.33	0.82	0.57
Ratio % SEN students / municipal educational deficit	0.58	0.33	0.49	0.29	0.50	0.22	0.54	0.30
Ratio % SEN students in first year of pre-primary / % SEN students in other school years	0.42	0.30	0.36	0.25	0.33	0.20	0.38	0.27
DI of SEN students in first year of pre-primary	0.39	0.22	0.52	0.23	0.54	0.19	0.46	0.23
Reserved places in first year of pre-primary for SEN students	2.53	1.31	2.82	1.51	2.45	0.89	2.62	1.32
Adjustment between reserved places in first year of pre-primary / % SEN students in first year of pre-primary	65.5	45.1	54.6	28.6	48.8	26.5	58.5	37.2
Single-zone model (% of municipalities with a single zone)	76.4%		69.8%		31.8%		65.8%	
N	55		43		22		120	

Source: Own elaboration.

possible to assess the consequences of adopting one of these two basic models in each local context.

Table 1 has a description of all the variables used in the various analyses, along with the data sources. Table 2 shows the mean and standard deviation of these variables, both in aggregate and disaggregated by municipal size, which is relevant in the final stage of our analysis.

4. Results

4.1. General analysis based on the regression models

In the first phase of the analysis, we run three regression models in which the dependent variable is the Dissimilarity Index (DI) of foreign-nationality students in pre-primary and primary education. We progressively include different independent variables. This approach allows us to assess their explanatory power and to see whether it remains stable or is nullified when additional variables are added, distinguishing between solid or spurious, direct or conditional, explanatory potential. The first model includes a single independent variable: the intensity of left–right ideological orientation of the municipalities in the sample.

The second regression model adds sociodemographic variables that showed potential explanatory power in preliminary correlations with the dependent

variable. These are: total population, disposable family income, and the residential DI of the foreign-nationality population[7].

The third regression model adds school-related variables. Firstly, it incorporates two variables characterising the municipality's educational landscape: the proportion of students enrolled in private schools and the average size of schools in the municipality. Secondly, it also includes two variables relating to SEN students: their proportion of the total student population (i.e., the level of SEN detected in the municipality) and their distribution across the different schools (measured via the DI). Finally, this third model also incorporates a variable referring to the school zoning model implemented in the municipality.

Table 3 presents the results of the three multiple linear regression models. The first model shows a counter-intuitive result: the further to the right a municipality is on the ideological spectrum, the lower its level of school segregation tends to be. In this model, each one-point shift to the right on the ideological scale of the municipality (as stated above, the *left-right axis* variable fluctuates over a total of 24 points) corresponds to a small but significant decrease of 0.006 in the Dissimilarity Index. So, it could be inferred that a stronger left-wing orientation in municipalities would have a negative impact on efforts to combat school segregation.

The second regression model, however, contradicts this conclusion, which had reflected a spurious causal link. This model considerably increases the explanatory power of the regression (R^2 = 0.05 in the first model rising to R^2 = 0.34). By adding the municipality size, residential segregation, and household disposable income (the latter having no significant effect), the model's explanatory capacity increases substantially, while the explanatory weight of the left-right orientation is no longer significant. Therefore, the higher levels of school segregation in left-leaning municipalities can be explained not by their ideological orientation but by their sociodemographic morphology. In many cases, these are municipalities in the so-called "*red belt*," characterised by strong population growth during the first decades of the second half of the 20th century. This factor has resulted in densely populated municipalities with urban characteristics particularly prone to residential segregation, which appears to be the main driver of higher levels of school segregation, rather than political orientation[8].

7. This variable was calculated by comparing the distribution of the foreign-nationality population in 2019 across the different census groupings within each municipality. Census groupings are a population unit created by Idescat: "constituted by a set of contiguous census sections with similar socioeconomic characteristics. Census groupings are territorially balanced units with an average population of 9,000, ranging from 5,000 to 20,000 inhabitants" (www.idescat.cat). Their size and socioeconomic characteristics make them an ideal unit for measuring and interpreting residential segregation.
8. Although there is no official list of municipalities forming the "red belt," this definition generally includes those in the Barcelona Metropolitan Area and nearby counties that, during the second half of the 20th century, absorbed much of the population arriving in Catalonia against the backdrop of industrialisation. Eight of the ten municipalities in our dataset with the highest residential segregation index (DI) for foreign-nationality residents

Table 3. Multiple linear regression models

	Model 1	Model 2	Model 3
Constant	0.447***	0.228**	0.331**
	(0.062)	(0.087)	(0.096)
Left–right axis	–0.006**	–0.003	–0.001
	(0.002)	(0.002)	(0.002)
Total number of inhabitants (in thousands)		0.001***	0.000
		(0.000)	(0.000)
Disposable family income		0.003	-0.003
		(0.004)	(0.003)
Residential DI of foreign-nationality population		0.380***	0.317***
		(0.112)	(0.093)
Percentage of students in publicly funded private schools			0.002***
			(0.000)
Average number of classes per year group per school			–0.051*
			(0.029)
Percentage of SEN students			–0.004***
			(0.001)
DI SEN students			0.472***
			(0.091)
Single-zone model			–0.034*
			(0.019)
Observations	120	120	120
R^2	0.05	0.34	0.59

Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Dependent variable: DI of foreign-nationality students in pre-primary and primary education.

Source: Own elaboration.

In the third model, with the inclusion of school-related variables, the explanatory power of the regression increases further ($R^2 = 0.59$). Among the previous variables, municipality size loses significance. In contrast, residential segregation continues to have a very strong explanatory potential. Among the new variables, notable effects are observed for school ownership (a higher proportion of students in private schools corresponds to higher levels of school

can be considered part of the red belt: Les Franqueses del Vallès, Martorell, Montornès del Vallès, Badalona, Canovelles, Santa Perpètua de Mogoda, Ripollet, and Santa Coloma de Gramenet. Other large municipalities, such as L'Hospitalet de Llobregat, Terrassa, and Cornellà de Llobregat, are among the top twenty in the ranking.

segregation), the number of SEN students detected (a higher proportion of SEN students corresponds to lower segregation), and the distribution of these students among schools (higher SEN DI corresponds to higher segregation of students by nationality).

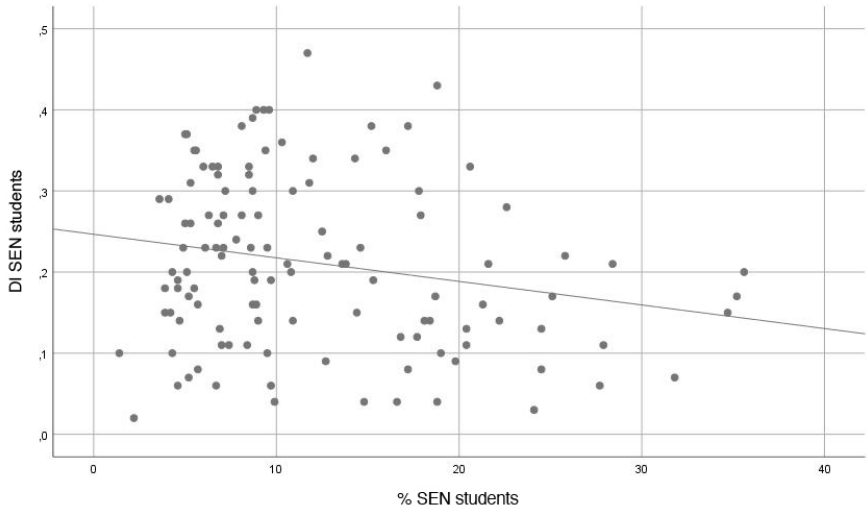
Thus, the detection and equitable distribution of SEN students have a substantial effect on structural segregation in the municipality, as measured in our regression model through students' nationality. Implementing policies that promote a balanced allocation of SEN students, the most vulnerable minority, therefore has a strong impact on reducing broader structural school segregation. Finally, we find two variables that also prove to be significant, albeit less strongly: the average number of classes per year group per school (the larger the schools, the lower the level of school segregation) and the zoning model, with this initial generic approach indicating that a single-zone model is less susceptible to school segregation. We will explore this issue in more detail further on by disaggregating the analysis according to the size of the municipality.

4.2. Specific analyses on the impact of SEN student detection and allocation and the zoning model

The second phase of the analysis focuses on two aspects that provide additional, significant information on the explanatory impact of SEN student detection and allocation, as well as school zoning. The first aspect is addressed through an exploration using a series of statistical correlations, examining the relationship between SEN student segregation (taken here as the dependent variable) and a set of indicator variables reflecting certain educational policy measures that may contribute to a significantly lower SEN student DI. In some cases, these correlations take the DI of all SEN students in pre-primary and primary education as the dependent variable. In other cases, we consider only the DI of SEN students in the first year of pre-primary, as we are examining measures whose effects are crucial in achieving equitable allocation for these students. It should be noted that, after pre-enrolment for the first-year or pre-primary, the capacity to implement balanced allocation mechanisms is greatly reduced, since most pre-enrolled children already have an allocated school.

This second phase, focusing on SEN detection and allocation policies, is based on analyses of a series of correlations and scatterplots using the DI of SEN students as the dependent variable. The aim is to distinguish the characteristics of SEN detection and allocation practices that make them particularly effective. In this context, it is important to refer to some of the features of Decree 75/2007 and its territorial implementation. Although reservation of two places per class was established, this was only effective during the ordinary pre-enrolment phase; if these two places were not filled, they became available to the general student population. Furthermore, the reservation of two places did not limit the total number of SEN students a school could accommodate beyond these two places, in cases where other places for ordinary students were unfilled. Finally, from the first year of pre-primary on, the two-place reserva-

Figure 2. Relationship between SEN student segregation and the percentage of SEN students detected in the municipality



Source: Own elaboration.

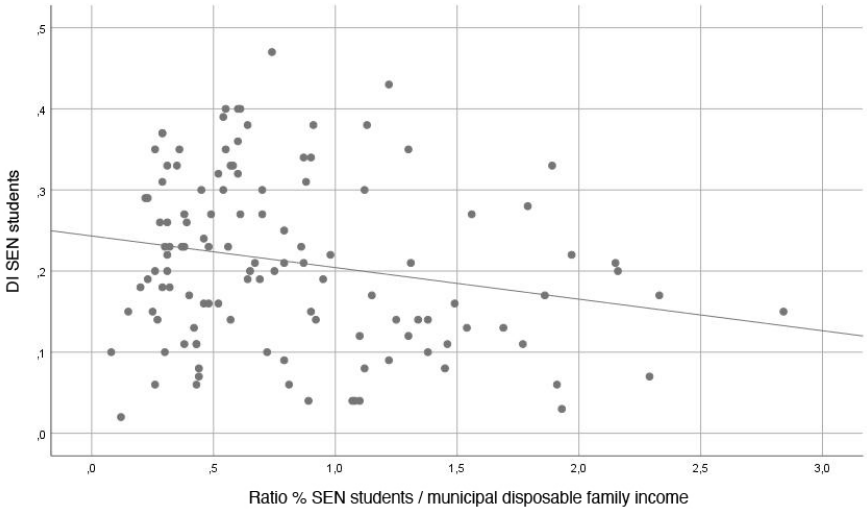
tion was only activated if the school had vacant spaces not already filled by allocated students. These conditions reduced the effectiveness of this measure once the ordinary pre-enrolment period had ended.

Another important feature of the regulation, highly relevant in the context of this research, is that the two-place reservation was a minimum and flexible criterion. Thus, it could be increased to more places, especially when the detection of SEN students prior to pre-enrolment indicated a greater need. In practice, however, few municipalities actually exercised this option during the 2018–2019 school year (only 33 of the 120 municipalities analysed allocated three places or more[9]). This is a key element in assessing the effectiveness of balanced allocation measures, and also for their potential implementation under the new decree on admissions.

The above scatterplot (Figure 2) links the distribution of SEN students with the intensity of their detection. It shows the trend that a higher detection rate of SEN students is associated with a more balanced allocation among schools. One might have expected the opposite result, given that the difficulties in achieving a balanced allocation would presumably increase with a larger number of vulnerable students detected. However, the reality is exactly the opposite: the effectiveness of balanced allocation policies is greater in municipalities where there is higher sensitivity in detecting SEN students.

9. Of these 33 municipalities, only five can be considered part of the red belt: Canovelles del Vallès, La Llagosta, Sant Adrià de Besós, Badalona, and Montornès del Vallès.

Figure 3. Relationship between SEN student segregation and the ratio of detected SEN students to the municipality's available family income

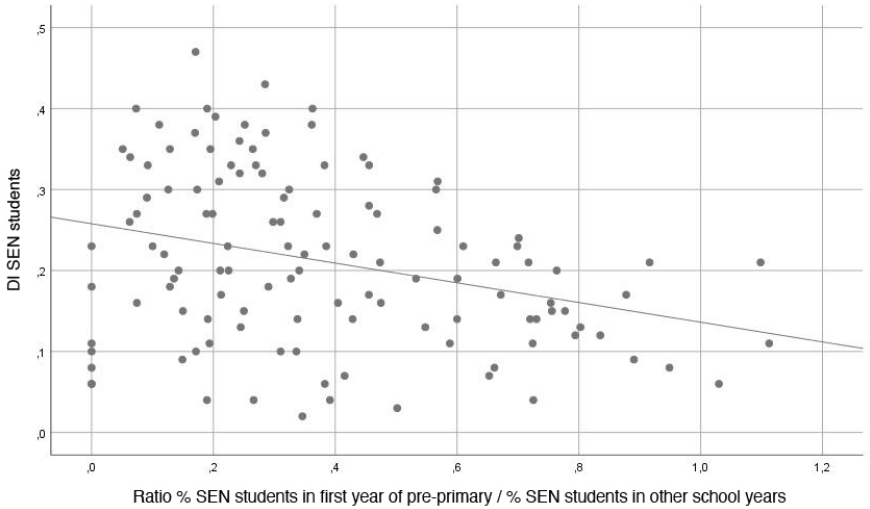


Source: Own elaboration.

Figure 3 confirms the previous observation. Using an indicator that calculates the ratio between the percentage of detected SEN students and the available family income (we also calculated it using the proportion of adults without post-compulsory education, with similar results), we created an independent variable in which the sensitivity to detecting a larger proportion of SEN students is no longer dependent on the objective characteristics of the municipalities (such as capitalisation), but instead reflects more directly the administration's willingness to recognise vulnerability. In this way, the correlation between the SEN student DI and the ratio of detected SEN students relative to available family income (or to educational deficit) shows that in municipalities where the tendency to detect SEN students is higher relative to their objective vulnerability, the allocation of vulnerable students tends to be more effectively balanced. Once again, higher sensitivity in detection correlates with an improvement in the implementation of balanced allocation of students.

Figure 4 is particularly relevant. Here, we correlate the DI of SEN students with the proportion of SEN students detected in the first year of pre-primary relative to the proportion detected across all pre-primary and primary school years. This indicator allows us to identify whether municipalities typically detect SEN students as early as possible. As previously noted, this is a central issue in balanced allocation policy, since such a policy can only be activated if detection occurs before initial school enrolment. If detection occurs after enrolment for the first year of pre-primary, it may have positive effects on

Figure 4. Relationship between the segregation of SEN students and the ratio of SEN students detected in the first year of pre-primary to those detected in the rest of the pre-primary and primary school years

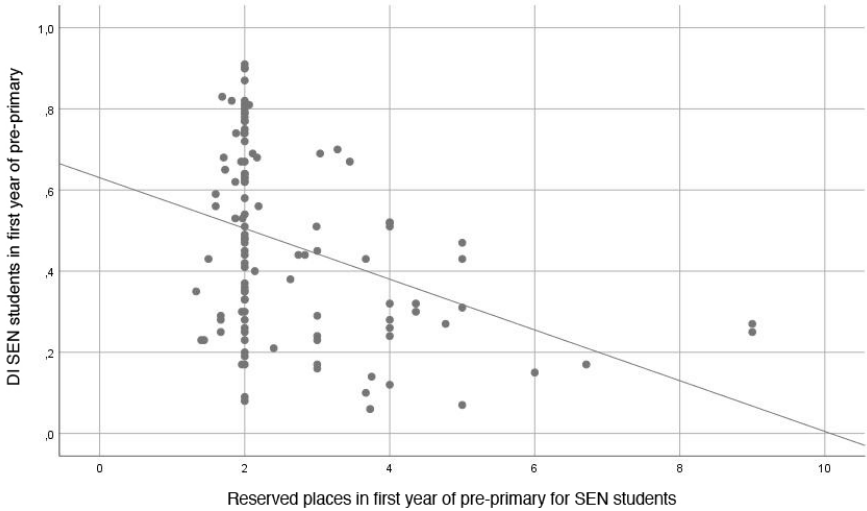


Source: Own elaboration.

student monitoring but not on reducing school segregation. While we cannot be certain that municipalities that have already detected a significant proportion of SEN students in the first year of pre-primary will do so before the pre-enrolment deadline, it is far more likely that early detection is effectively taking place when most SEN students are already identified in the first year of pre-primary rather than in later years. The graph shows that balanced allocation is indeed much higher in municipalities where a large proportion of SEN students have already been detected in the first year of pre-primary. We consider this a strong indication of the critical importance of early detection of SEN students.

In these last two scatterplots (figures 5 and 6), we use the DI of SEN students in the first year of pre-primary as the dependent variable. This allows us to examine how two municipal approaches to allocating SEN places affect balanced allocation. First, we look at the effect of allocating more than the legal minimum of two places per class. Figure 5 shows that increasing the allocation effectively correlates positively with a more balanced distribution of SEN students. Second, we examine the importance of aligning the allocation with the level of detection, meaning that reserved places should neither exceed nor fall short of the number of SEN students detected in the municipality. Figure 6 shows that the closer the allocation matches the number detected (i.e., the indicator approaches zero), the more effective the balanced allocation of SEN

Figure 5. Relationship between the segregation of SEN students in the first year of pre-primary and the allocation of places for SEN students in the first year of pre-primary



Source: Own elaboration.

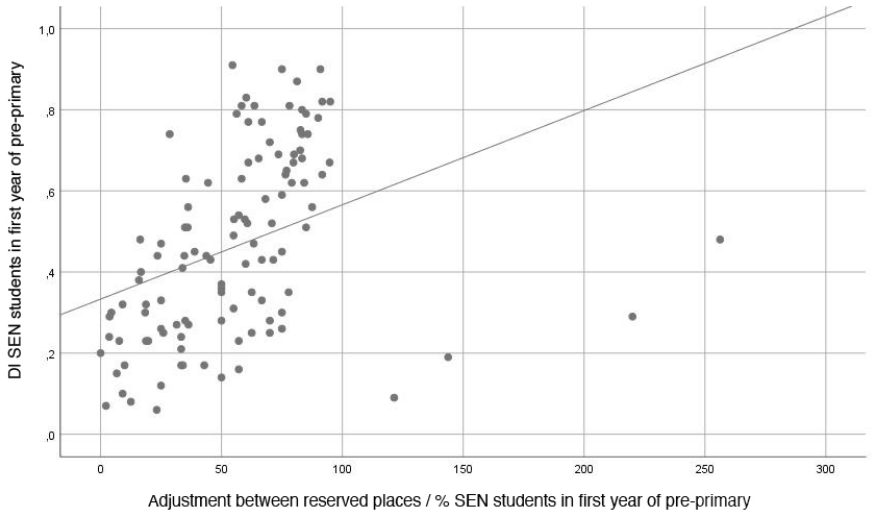
students is, and the more successful the policy is in reducing school segregation.

In other words, both expanding allocations and aligning them with detection levels has a positive influence on the balanced allocation of SEN students. The policy of increasing places is most effective in combating segregation when it is calibrated according to the proportion of SEN students detected.

The analysis of the effects of school zoning is addressed by repeating the third regression model, this time breaking down the sample by municipality size. The aim is to contrast the impact of the zoning model in small municipalities (fewer than 20,000 inhabitants), medium municipalities (20,000 to 50,000 inhabitants), and large municipalities (more than 50,000 inhabitants). The choice between single-zone or multi-zone models produces different effects depending on municipality size. In small municipalities, a single-zone model behaves similarly to what a heterogeneous zone of 10,000 to 20,000 inhabitants would imply in a medium or large municipality, because all schools are generally accessible without significant travel costs. In medium or large municipalities, however, a single-zone model does not make all schools equally accessible, as the large size of the zone means not all schools are close to all inhabitants. This justifies our decision to examine this fragmentation, which, as we will see, produces highly significant results.

Regarding school catchment models, the results observed in the initial regressions (Table 3) vary when the sample is stratified according to municipality size (Table 4). What this stratified analysis allows us to qualify is that

Figure 6. Relationship between the segregation of SEN students in the first year of pre-primary and the alignment between allocated places and the percentage of SEN students in the first year of pre-primary



Source: Own elaboration.

the impact of the catchment model (controlling for the other independent variables) is only significant in the segment of smaller municipalities, namely those with between 10,000 and 20,000 inhabitants. Within this range, those organised under a single-zone model tend to show lower levels of segregation. Therefore, contrary to what one might assume, the single-zone model proves to be a better catchment model for tackling segregation, but only within a very specific context: smaller municipalities.

How can this phenomenon be explained? The reason is that, in the case of smaller municipalities, the single-zone model most closely approximates the theoretical model recommended as a mechanism for combating segregation: the integrated school catchment (ISC) model (Benito & Gonzàlez, 2007). In this theoretical model, school zones must meet two criteria. First, they must respect the notion of proximity that underpins the original rationale for catchment zoning, in order to promote the schooling of children in schools located relatively close to their homes. In most smaller municipalities, the distances between schools and students' homes are short enough to ensure that the single-zone model is consistent with the proximity criterion. Second, zoning must also ensure that all the zones meet an additional criterion: they must be socially heterogeneous, replicating, as far as possible, the diversity of the municipality as a whole. In other words, all zones should be as socially homogeneous with one another as possible.

In most municipalities in Catalonia, catchment zoning is not designed with this second criterion as a priority (Síndic de Greuges, 2022), and this

Table 4. Multiple linear regression models by size of municipality

	Fewer than 20,000 inhabitants	Between 20,000 and 50,000 inhabitants	More than 50,000 inhabitants
Constant	0.367**	0.321*	0.517**
	(0.155)	(0.187)	(0.235)
Left–right axis	–0.001	–0.004	–0.001
	(0.003)	(0.003)	(0.003)
Total number of inhabitants (in thousands)	0.000	0.001	0.000
	(0.005)	(0.002)	(0.000)
Disposable family income	–0.001	–0.002	–0.026**
	(0.005)	(0.006)	(0.010)
Residential DI of foreign-nationality population	0.212	0.283*	0.098
	(0.156)	(0.161)	(0.293)
Percentage of students in publicly funded private schools	0.002***	0.001	0.005*
	(0.001)	(0.001)	(0.002)
Average number of classes per year group per school	–0.077*	–0.010	0.047
	(0.044)	(0.054)	(0.113)
Percentage of SEN students	–0.003*	–0.003*	–0.006*
	(0.002)	(0.002)	(0.003)
DI SEN students	0.404***	0.329	0.659*
	(0.112)	(0.248)	(0.325)
Single-zone model	–0.065**	0.047	–0.059
	(0.032)	(0.033)	(0.041)
Observations	55	43	22
R^2	0.48	0.42	0.80

Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Dependent variable: DI of foreign-nationality students in pre-primary and primary education.

Source: Own elaboration.

explains why, in municipalities with more than 20,000 inhabitants, the multi-zone model is no more effective than the single-zone model in combating segregation. In municipalities with fewer than 20,000 inhabitants, where the single-zone model does not depart significantly from the proximity criterion, introducing zoning often means that, while proximity is reinforced, social contrasts between the zones are also deepened. As a result, zoning does not neutralise but rather accentuates the effects of residential segregation on school segregation. In this sense, the correct interpretation of this finding is not that

the single-zone model is more favourable than the multi-zone models in tackling segregation, but that multi-zone models can only be effective if they are designed according to the principles of the ISC model.

5. Conclusions

Municipalities display differing levels of commitment when it comes to activating local education policies that influence segregation, revealing that there is indeed room for action at the local level with potentially positive effects on school segregation. Although municipalities have limited competences in shaping education policy, this situation demonstrates that local action is possible, even if it does not always depend exclusively, or even primarily, on the local councils themselves.

The initial exploration of the relationship between the political orientation of local governments and the intensity of school segregation (first regression model) yields counterintuitive and surprising results: the further to the left a municipality's administration lies, the higher its level of school segregation. When the sociodemographic characteristics of municipalities are incorporated into the regression model, however, this link ceases to be significant. One possible explanation is that the limited powers of local administrations mean that their capacity to intervene in the fight against segregation is too weak and indirect. As a result, governments that might be expected to be more inclined to prioritise this issue in their political agenda (those positioned further to the left) in practice lack the means to exert real influence. Issues that fall outside municipal competences (for example, the weight of publicly funded private schools), that are not designed with an eye to their impact on school segregation (such as municipal size and demographic growth), or that can only be addressed partially and over the long term (for instance, residential segregation, which depends on urban planning policies implemented over decades), carry too much explanatory weight for the political orientation of local councils to have any meaningful impact on the effectiveness of efforts to combat segregation.

However, the regression models show that certain types of municipalities act much more effectively than others in detecting and distributing SEN students, which is a factor that has a crucial impact on reducing segregation. The element that explains why some municipalities perform better in this regard is not the ideological leaning of their councils, but rather their size. The smaller the municipality, the more likely it is to detect SEN students at an early stage and to promote their balanced distribution among schools. This effectiveness derives in part from the municipalities' morphology: smaller towns tend to exhibit less residential segregation, which gives them an advantage in combating school segregation. However, this is not only a structural matter.

In smaller municipalities, it is also easier for the educational psychology support teams to improve the detection of SEN students, and to do so early, before the pre-enrolment period begins for the first year of pre-primary, when this detection can activate mechanisms for a balanced distribution of vulnerable students. It also appears that smaller municipalities are more likely to

reach a consensus on measures such as expanding the number of places reserved during the pre-enrolment period beyond the statutory minimum of two per class established by the decree in force in the 2018–2019 school year. Ultimately, rather than the ideological orientation of local councils, it is the smaller size of the municipality that facilitates coordination between administrations, the activation of detection protocols, and the establishment of municipal-level consensus aimed at effectively tackling school segregation. For this reason, among (some) smaller municipalities we can identify good practices that could be scaled up and transferred to other population contexts.

More specifically, the study also shows that municipal-level educational actions that promote the identification and distribution of SEN students are not only effective in combating the segregation of these students, who represent the most vulnerable situations, but also help reduce structural segregation, reflected here in the group of foreign-nationality students. Among these actions, the following stand out: a) early detection of SEN students (if they are not identified before the enrolment process, they cannot take part in the balanced distribution); b) high sensitivity in identifying SEN students; and c) adjusting the quota of reserved places to the number of SEN students detected. At the same time, there are also indications that zoning based on the ISC criterion may help combat segregation.

Decree 11/2021 on the planning of the educational provision and the admission process for Catalan Education Service schools establishes a new framework for the distribution of students in publicly funded schools, one that seems consistent with the conclusions of our analysis. The philosophy of the new decree is characterised above all by its promotion of a quota-based policy linked to the expansion and systematisation of the identification of vulnerable students, as well as the protection and reinforcement of forms of access to schools for both vulnerable and non-vulnerable students (Gonzàlez, 2022; Síndic de Greuges, 2022). This reinforcement is pursued through mechanisms such as extending the reservation of school places until the start of the academic year, promoting early identification of SEN students, minimising educational oversupply in municipalities, and defining a maximum proportion of SEN students per school similar to the average for this group within each catchment area.

The entire rationale of the decree rests on the main finding that emerges from our research: the number and balanced distribution of vulnerable students is a key factor in the fight against school segregation. The new decree encourages all relevant stakeholders (social services, educational psychology support teams, municipal enrolment offices, etc.) to act to increase the identification and improve the distribution of SEN students, following the path already taken by the most effective municipalities. In this regard, it promotes a broader conception of vulnerability, one that should be subject to identification and balanced distribution, which moves beyond definitions limited to officially validated educational psychology diagnoses made by support teams.

Thus, the decree opens the possibility of developing a conception of vulnerability that is both systematic and sufficiently broad to align with the more

general notion of social disadvantage. If this broader conception allows vulnerability to be identified in a substantial proportion of children, roughly comparable to the share of the population at risk of poverty (around 25%–30% in Catalonia over the past decade), the new decree could effectively amount to a quota-based approach to school allocation rather than one limited to distributing only the most vulnerable students. The establishment of two broad quotas, one for the majority group of ordinary students and another for a similarly large group of vulnerable students, entails, in practice, a notion of balanced student distribution that concerns the whole population, not just a minority allocated in the name of equity. Conceived in this way, and provided that accompanying policies (such as the extraordinary allocation of resources linked to the enrolment of vulnerable students) are implemented while avoiding stigmatising dynamics, by ensuring anonymity in resource allocation and maintaining neutral treatment of vulnerable students by educational stakeholders, the potentially negative effects of a policy perceived by its critics as stigmatising could be prevented.

In this regard, it is worth noting that a recent report by the Catalan Ombudsman (Síndic de Greuges, 2023) shows that between the 2018–2019 and 2022–2023 school years, the Dissimilarity Index in Catalonia fell by more than 28%, both in the first year of pre-primary and the first year of secondary education. This period coincides with the rolling out of the new allocation policy, and with the growing awareness of local education stakeholders and the increasing implementation of measures to combat school segregation. This improvement highlights the effectiveness and transformative potential of the measures undertaken in recent years, as well as of those envisaged in the new Decree 11/2021.

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