

Urban land stratification and the built environment: spatial mismatch and residential segregation in Bogotá, Colombia

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According to the United Nations, Latin America and the Caribbean is one of the most urbanized but also most unequal regions in the world (UNDP, n.d.). This social inequality is reflected in the spatial structure of its cities, which remain characterized by severe residential segregation (Caldeira, 1996; Portes & Hoffman, 2003; Rodriguez & Arriagada, 2004; Coy, 2006; Sabatini, 2006; Inostroza et al., 2013). While the new middle class enjoys dynamic urban spaces with employment opportunities and urban services, lower-income residents are relegated to peripheries, mostly of informal origin which suffer from disinvestment, crime, stigmatization and isolation. Although policy initiatives have been developed to “upgrade” or otherwise improve these marginalized peripheries in an effort to reduce spatial inequalities, in many cases these efforts have unexpectedly reproduced or exacerbated the patterns of residential segregation.

One such policy that has failed to promote residential integration is Colombia’s Urban-Land Stratification. Even though the policy has facilitated the delivery of low-cost basic utilities to the urban poor, it may have, nevertheless, promoted social segregation. The production of spatial divisions based on income levels has contributed to the perception of wealth differentiation between different urban areas, exacerbating spatial segregation in Bogota with a variety of severe social, political and economic implications that include over-pricing of middle and higher income areas, lack of generational and social mobility, concentration of poverty, and unequal access to employment and urban services. This phenomena has been analyzed by different studies:

A study conducted by the economic development department of Bogota’s planning office (DAPD, 2004) found that the current Stratification policy fails to properly identify vulnerable populations because of the capricious establishment of the number

of strata (6), its subjective classification criteria and its coarse scale of analysis. In addition, a similar study by Ibatá-Ceballos and Torres-Arias (2006) concluded that socio-demographic characteristics of the population in Bogota did not entirely match the strata in which they live. Another study examined property and rental prices in the different strata from 1991 to 2004, finding extremely high elasticity in prices inside higher strata neighborhoods which in turn limits the accessibility of those areas for households without a stable income (Fuentes-Durán, 2011).

Furthermore, studies conducted jointly by the planning secretary of Bogota and the statistics department of the National University of Colombia suggested that the stratification policy had become a key causal factor determining social segregation in Bogota (Lopez et al., 2015; SDP and UN-Departamento de Estadística, 2007). Other studies have determined a causal relationships between the stratification policy and residential segregation by investigating residents' attitudes and perceptions, (Uribe-Mallarino, 2008; Uribe-Mallarino et al, 2006). Finally, Stratification may also be influencing the development of secondary markets in settlements of informal origin, a benefit that land titling and improvement programs are based on (Gilbert, 2002).

While past research has documented mismatches between sociodemographic characteristics, neighborhood stratification and social segregation possibly due to the Stratification policy, no study have been conducted to assess associations between Stratification, residential segregation, and urban form. Specifically, the goals of this study were: 1) Document urban morphology and land use patterns —at the municipal scale— in order to analyze to what extent these have been determined by Stratification. 2) Conduct spatial analysis to determine whether this urban morphology and these land use patterns constitute *spatial mismatches* in the distribution of urban services — at the municipal scale—. 3) Document and analyze urban morphology at the neighborhood scale —in selected cases— to assess whether these are caused by Stratification. 4) Analyze whether urban morphology at the neighborhood scale are exacerbating *residential segregation* or, on the contrary, may be promoting *social diversity and integration*, thus presenting opportunities for modification of the Stratification policy.

To contribute a critical analysis of the possible implications of the Urban-Land Stratification Policy for urban form and residential segregation, I developed a mixed-method, multi-scale research design. I analyzed the relationship between built form and strata using OLS regression, Geographically Weighted Regression (GWR), on-site surveys and interviews to understand how this association is being determined by the Urban-Land Strata Policy, or shaped by the market or other factors. I triangulated the statistical findings using qualitative field data collection methods, specifically surveys and unstructured interviews with residents.

GIS data was obtained from the city's Tax Assessment Office (UAECD). It comprises data from parcel and building information, property value assessments, and construction dates. This information was joined with GIS data from Bogota's Planning Secretary (SDP) that show building regulations, land uses, and zoning. Social data was obtained from Bogota's Multipurpose Survey of 2011. Data was processed using GIS-based spatial statistical regression analysis (Pendall and Carruthers, 2003; Talen, 2005, 2006, 2008; Bramley et al. 2009; Dave, 2011). Interviews and surveys were conducted in selected neighborhoods to contribute a nuanced understanding of the role of the stratification policy in driving segregation in Bogota, including perceptions of residential segregation and mobility. Finally, specific Urban Design research methods like mental mapping and deep observation were used to validate both the results of interviews and the findings from the GIS analysis (Lynch, 1960; Jacobs, 1995).

This research seeks to inform urban planning policy in Bogota and Colombia and contribute to the international research in urban morphology and social integration. The study will potentially contribute the revision of the Bogota's comprehensive plan due in 2017, and the housing and integration provisions of the City of Bogota Development Plan of the upcoming mayoral administration. The methods employed are innovative for the local context as they introduce statistical analysis to the study of the city form, and the investigation will trigger further experimentation with these methods in Colombia. In the international context, this research will contribute to the young body of experimentation with spatial econometrics in the field of urban design and social sustainability that is being triggered by the new availability of GIS data.

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