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## ABSTRACT

The aim of this study is to advance factor analyses to characterize the housing deficit and important indicators of the socioeconomic and urban conditions of the Brazilian economy and territory, since it behaves differently from region to region. The North region has the largest relative deficit, while the South region has the smallest. This paper seeks to contribute to the ongoing debate taking into account the multiple configurations of urban dimensions, housing structure and regional development. Therefore, statistical information from the 2010 Demographic Census and two techniques are used: Exploratory Factor Analysis and Qualitative Comparative Analysis (fsQCA - fuzzy set Qualitative Comparative Analysis). The conclusive results indicate that a high socioeconomic development associated with a high provision of infrastructure and low urban growth leads to a low housing deficit. Therefore, Brazilian municipalities that have been directing public policies to improve the socioeconomic indicators of the population and urban infrastructure could contribute to reducing the housing deficit in Brazil.

**Keywords:** Housing deficit. Exploratory Factor Analysis. Qualitative Comparative Analysis. Socioeconomic and urban conditions.

## RESUMO

O objetivo do presente estudo é avançar em análises fatoriais para caracterizar o déficit habitacional e os indicadores importantes das condições socioeconômicas e urbanas da economia e do território brasileiro, uma vez que esse déficit se comporta de forma distinta de região para região. A Região Norte apresenta o maior déficit relativo, enquanto a região Sul o menor. Este trabalho procura contribuir para o debate em curso levando em consideração as múltiplas configurações de dimensões urbanas, a estrutura habitacional e o desenvolvimento regional. Para tanto, são utilizadas as informações estatísticas do Censo Demográfico de 2010 e duas técnicas: Análise Fatorial Exploratória e Análise Comparativa Qualitativa (fsQCA - *fuzzy set Qualitative Comparative Analysis*). Os resultados conclusivos sinalizam que um alto desenvolvimento socioeconômico associado à alta provisão de infraestrutura e ao baixo crescimento urbano levam a um baixo déficit habitacional. Assim, pois, os municípios brasileiros que vêm direcionando políticas públicas de melhorias nos indicadores socioeconômicos da população e de infraestrutura urbana poderiam contribuir para a redução do déficit habitacional no Brasil.

**Palavras-chave:** Déficit habitacional. Análise Fatorial Exploratória. Análise Comparativa Qualitativa. Condições socioeconômicas e urbanas.

## INTRODUCTION

Urbanization remains a central theme in the economic literature, particularly as cities have expanded in a disorderly manner and, as a result, face significant challenges regarding infrastructure, the rapid growth in automobile use, the intensive consumption of fossil fuels, and increasing demand for electric energy. The expansion of urban centers has unfolded swiftly and intensely over the years, driven by the migration of people from rural areas to industrial hubs. According to the World Bank (2016), the share of the global population residing in urban areas grew by approximately 59% from 1960 to 2015, rising from 34% to 54%. In 2019, this figure surpassed 55%. Brazil mirrored this global trend, with 85% of its population living in urban areas in 2015. Based on the Regions of Influence of Cities (REGIC) study, the Brazilian Institute of Geography and Statistics (IBGE, 2008) identified 12 metropolitan areas in Brazil: Manaus, Belém, Fortaleza, Recife, Salvador, Brasília, Goiânia, São Paulo, Rio de Janeiro, Belo Horizonte, Curitiba, and Porto Alegre. These metropolises are characterized by urban centers sharing common features and exerting extensive direct influence (IBGE, 2008). Thus, urban agglomerations emerge as phenomena marked by the rise, configuration, and growth of these cities. McCann (2013) describes a hierarchical delineation in the formation of urban networks and cities, each of distinct sizes and forms. Cities arise from agglomerations that generate

positive externalities through geographic proximity of firms; for instance, knowledge spillovers that stimulate industrial growth and development (Marshall, 1890; Galinari, 2006; Glaeser et al., 1992). Jacobs (1969) further argues that positive externalities foster urban growth due to the diversity of economic activities in cities.

According to Marshall (1890), urban increasing returns for industries are driven by three factors, known as the "Marshallian triad": (i) the formation of pools of specialized labor; (ii) relationships between suppliers and users; and (iii) knowledge spillovers. Building on this, Hoover (1936) proposed two classifications of static agglomeration economies. The first pertains to localization economies—external economies of scale for firms but internal to a sector within the agglomeration. The second concerns urbanization economies, which are also external to firms but affect all activities within the urban center formed by the agglomeration. Nonetheless, the agglomeration process also produces negative externalities. Quinet and Vickerman (2004) emphasize that residential densification, productive activities, and urban spatial expansion create various infrastructure-related environmental problems. Urban growth encounters limits when diseconomies outweigh agglomeration economies (Glaeser, 1998; Pereira & Lemos, 2003).

Within this discussion, it is important to highlight that urban form and transportation systems shape access to goods, services, and information in cities. The more efficient this access, the greater the urban economic and social benefits through economies of scale, agglomeration effects, and network advantages. In the long term, accessibility, combined with cities oriented toward public transportation, can reduce vehicular emissions and offer economic benefits (e.g., increased productivity) (Bloze & Skak, 2016; Rode & Floater, 2014).

The setbacks generated by excessive urban growth are evident in both infrastructure and housing markets. Bonduki (1997) notes that growth brings about difficult-to-resolve problems such as lack of sanitation, inadequate housing, insufficient public transportation, and unsafe and congested traffic. Azevedo (1996) points to the necessity of public policies to mitigate these externalities. Additional challenges include housing market failures observed through real estate speculation. Consequently, significant private investment in upgrading degraded regions leads to the displacement of lower-income families to increasingly distant urban areas, often of inferior

quality and lacking basic infrastructure, as private enterprises find investing in affordable housing unappealing (Harley, 2005; Lobato, 2000).

In this regard, the housing deficit is an index indicating the need to replenish the stock of new homes for society, aiming to address the shortage of residences and inform public policy formulation to tackle social issues (Furtado, Neto & Krause, 2013). According to Fundação João Pinheiro (FJP, 2016), in 2014 Brazil had a total of 6.068 million housing units facing a housing deficit. Based on microdata from the National Household Sample Survey (PNAD), in 2009 FJP (2012) reported a total of 5.998 million deficit households, with 84.8% (5.089 million) located in urban areas—37% of which were in the Southeast region (2.217 million). Thus, between 2009 and 2014, the country registered an increase of approximately 70,000 deficit housing units.

Moreover, FJP (2013) indicated that, in terms of housing deficit, the Southeast is the region with the highest national index, according to data from the 2010 Census, with a total of 2,674,428 units—equivalent to 38% of Brazil's total. The state of São Paulo registered the highest rate in the region, with 1,495,542 units, followed by Minas Gerais (557,371), Rio de Janeiro (515,067), and Espírito Santo (106,447). Family cohabitation was the main issue in the two states with the largest deficits, totaling 646,219 units in São Paulo and 217,652 in Minas Gerais. For Rio de Janeiro and Espírito Santo, excessive rent burden was the main deficit factor with 235,961 and 45,515 units, respectively. According to FJP (2010), the state of Minas Gerais exhibited an urban housing deficit of 507,756 households; of this total, 2% (10,261) consisted of households with no income, 64.2% (325,995) with income from 0 to 3 minimum wages, 15.6% (79,221) with income from 3 to 5 minimum wages, 13.2% (67,114) with income from 5 to 10 minimum wages, and 5% (25,166) with income of 10 minimum wages or more.

Therefore, the objective of this study is to advance factor analysis for characterizing the housing deficit and key indicators of socioeconomic and urban conditions in the Brazilian economy and territory. In this research context, the central question posed for the Brazilian economy is: What are the possible effects generated by the low housing deficit and the current socioeconomic and urban conditions of cities? To address this applied question, statistical data from the 2010 Demographic Census conducted by the Brazilian Institute of Geography and Statistics (IBGE, 2010) were utilized.

To accommodate this task, the study adopts a strategy combining two methods: Exploratory Factor Analysis and Qualitative Comparative Analysis (QCA). This research contributes to the national literature by highlighting the main associated and influential factors regarding the housing deficit in Brazilian municipalities, which present multiple configurations of urban dimensions—a recurring theme among regional and urban policymakers. Furthermore, this work contributes empirically by addressing a gap in ongoing research: housing deficit, urban conditions, public policies, and the Qualitative Comparative Analysis approach. In addition to this introduction, the article comprises five further sections. The second section characterizes cities and the housing deficit, while the third reviews empirical studies. The fourth section details the modeling and database employed in the study. The fifth section presents the main results obtained, and finally, the last section offers concluding remarks.

## GROWTH OF CITIES AND HOUSING DEFICIT

Urban expansion is fundamentally shaped by the spatial organization of activities. Understanding agglomeration economies is crucial for analyzing the causes underlying this process in specific regions. Henderson (1999) highlights the role of technology industries, which rely on knowledge spillovers, specialized labor markets, and supplier interactions. The author also emphasizes the diseconomies that may arise from excessive growth, where rising production and transportation costs, wage increases, and other factors are directly linked to the outflow of firms from these centers.

Within the urban economics literature, Von Thünen (1823) was the first to formulate a theoretical model that logically explains the locational foundations for agricultural activities. Later, Alonso (1964) advanced these theories through microeconomic analysis applied to spatial contexts, examining how cities develop. With contributions from Muth (1969) and Mills (1972), the Alonso-Muth-Mills (AMM) model emerged. In monocentric city models, there is a single employment center, and “urban households choose both the location and the size of their residences.” In equilibrium, Muth (1969) introduced the concept of rent, in which families consume not the land itself, but housing services. Given the preexistence of the rent price concept, it becomes important to analyze

heterogeneous households' willingness to pay for residential location. "This principle leads to an equilibrium condition in which families with steeper curves are located closer to the center than those with flatter curves" (Fujita, 1989).

This monocentric hypothesis is a simplification when compared to the actual urban spatial organization. Employment is not always concentrated in the geographical center of all cities. Therefore, Fujita and Ogawa (1982) presented a model of polycentric cities, wherein the decisions of firms and families are endogenous, drawing on the concept of linear cities. Families' residential choices depend on firm locations, and the principal factor in this decision-making process is the distance between one's home and place of work. Firms, in turn, choose their locations based on the proximity of other firms, which leads to the formation of intraurban agglomerations. For each cluster of firms, there are external economies of scale in the production function. This model formed the basis for the theory of Henderson and Mitra (1996), which observes the emergence of "edge cities"—a phenomenon in the United States highlighted by Garreau (1991). Glaeser and Kahn (2004) analyzed "a tendency, at least in that country, toward employment decentralization," a movement of firms relocating to peripheral, increasingly distant areas, thereby transforming urban structure.

Rapid urban growth, in turn, generates housing challenges—especially for lower-income families. Bonduki (1997) addressed the difficulties posed by high urbanization rates, such as poverty, environmental degradation, inadequate housing, lack of sanitation, congested traffic, insufficient public transportation, insecurity, and violence. The author further notes that some of these complications are rooted in structural issues and suggests they will not be solved unless exclusionary economic policies are addressed. In this vein, several authors describe Brazilian urban space as unevenly occupied, further exacerbated by flexible legal enforcement, which accommodates the poorest social strata in illegal settlements (Maricato, 2000). Urban planners acknowledge that zoning regulations, by means of spatial concentration, contribute to both housing scarcity and urban segregation (Villaça, 2000; Marques & Torres, 2005). From a similar perspective, Maricato (1997) reports that the real estate capital exerts monopolistic control over high-value areas, which, not coincidentally, results in vast regions of informal settlements, slums, and tenements. The author also suggests that spatial segregation attempts to render a portion of urban space invisible, even

though both “formal” and “informal” cities are parts of the same urban fabric.

Moreover, there is a social conflict inherent in urbanization projects, which, in most cases, are led by government agencies. Frequently, such projects entail the removal of numerous families from areas targeted for public works. Although governments often anticipate the possibility of replenishing housing stock for displaced families, the losses suffered by those expelled from their communities cannot be fully measured. These losses may include the disruption of residential dynamics deeply rooted in specific locales and the severing of relationships with close neighbors, which leads to the erosion of established cultural references (Zhouri & Teixeira, 2005).

Through this lens, Lefebvre (1999) distinguishes between “habiter” and “habitat.” The former is directly tied to the individual, daily life, and the personal meanings and feelings related to a specific space, while the latter pertains to the broader environment in which the individual is situated (Lefebvre, 1999).

Another aspect of accelerated growth and industrialization in large cities is the influx of migrants, who are not naturally integrated into prevailing legal frameworks. Consequently, migration to major urban centers fuels the proliferation of irregular housing clusters, such as slums (Soto, 2001). Correa (2000) adds to this discussion, asserting that the development of slums on public or private lands, invaded by socially excluded groups, positions these groups as agents who shape their own space independently of any other agent, such as public authorities. The author further contends that the construction of such spaces is a form of resistance and survival faced with adversity, including the forced displacement from urban areas undergoing renewal (Correa, 2000).

In summary, inadequate housing conditions and the emergence of irregular settlements result in increased deficiencies in housing quality. For Azevedo (1996), “a simple increase in housing programs is not always the most suitable solution for improving the housing conditions of the poorest populations,” since the lack of infrastructure constitutes a principal problem in irregular housing. Morais (2002) examined housing conditions in Brazil between 1992 and 1999. Table 1 reports on the main structural components for this period.

**Table 1** | Housing conditions in urban Brazil - 1992/1999

| Indicator | 1992 | 1993 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|
| Average number of people per household | 4.0 | 3.9 | 3.8 | 3.8 | 3.8 | 3.7 | 3.7 |
| Average number of people per bedroom | 2.0 | 2.0 | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 |
| Roof with tile or concrete slab % | 97.1 | 97.3 | 97.8 | 97.2 | 97.6 | 97.6 | 97.9 |
| Wall of masonry or fitted wood % | 96.9 | 97.2 | 97.6 | 97.4 | 98.1 | 98.1 | 98.1 |
| Internal plumbing from the general network % | 83.3 | 84.1 | 85.5 | 87.9 | 87.4 | 88.6 | 89.2 |
| Sewerage or septic tank % | 68.3 | 70.2 | 71.0 | 74.3 | 73.5 | 74.9 | 75.6 |
| Direct or indirect garbage collection % | 81.5 | 85.0 | 86.7 | 87.6 | 90.7 | 92.4 | 93.6 |
| Adequate water supply, sewage, and garbage collection % | 53.8 | 55.3 | 56.0 | 59.3 | 59.8 | 61.8 | 62.3 |
| Exclusive use bathroom % | 89.9 | 91.2 | 92.3 | 93.1 | 93.5 | 94.4 | 95.0 |
| Landline phone % | 23.2 | 23.9 | 20.7 | 30.2 | 33.1 | 37.8 | 44.2 |
| Electricity % | 97.5 | 98.0 | 98.6 | 98.9 | 99.0 | 99.1 | 99.2 |
| Rent as a percentage of income % | 15.3 | 13.8 | 25.8 | 27.9 | 28.4 | 27.8 | 27.4 |
| Households spending more than 30% of income on rent % | 12.1 | 11.0 | 33.5 | 36.1 | 38.4 | 36.7 | 35.6 |
| Households with more than 3 people per bedroom % | 10.0 | 9.7 | 8.6 | 8.8 | 8.0 | 7.5 | 7.1 |

Source: Ipea/Dirur based on microdata from PNAD and IBGE – Synthesis of Social Indicators 2000.

The indicators for water supply and waste collection exhibited the most significant percentage improvements during the period, rising from 53.8% to 62.3% and from 81.5% to 93.6%, respectively. Amid the lack of infrastructure in certain regions, another structural concern that warrants attention is the depreciation of residential properties. FJP (2013) asserts that "...the depreciation of dwellings fits within this category of replacement deficit, since there is an assumption of a lifespan limit for real estate. Upon reaching this threshold, and depending on the condition of the property, a complete substitution becomes inevitable." Consequently, residents often not only lack adequate local infrastructure but also do not meet the minimum standards required for habitability. For instance, the city of Juiz de Fora comprises both luxury condominiums and areas where basic infrastructure for families is absent. In this context, Harvey (2009) emphasizes that the city is increasingly fragmented and segregated; affluent neighborhoods benefit from comprehensive services, whereas, conversely, there are also districts characterized by illegal settlements and limited or nonexistent access to essential services (Harvey, 2009).

The housing market is shaped not only by the physical properties themselves but also by locational and structural characteristics, leading to the emergence of what are termed housing services. The observed prices reflect the aggregate market value. Rosen (1974) defines these individual prices for housing services as "hedonic prices or implicit prices of the characteristics of the housing good." Among the determinants of residential prices, spatial location is paramount, accounting for variations in property values. In such markets, the housing stock changes gradually. Varian (1994) notes that "due to the existence of stock, in the short term, the supply of housing is fixed." This slow change in inventory is based on the time the housing services market requires to adapt to new market demands, resulting in short-term price fluctuations that are driven solely by demand (O'Sullivan, 1993). The imperfections in housing supply and demand generate what is termed the vacancy rate, defined as the proportion of vacant dwellings relative to the total housing stock, reflecting the lack of equilibrium between supply and demand for residential units.

Failures in the housing market also contribute to spatial fragmentation. The first issue concerns infrastructure; in every development, the state enhances the value of an area by increasing investment to implement the "positivities of the urban" (Lefebvre, 2008). The second aspect of this fragmentation

is that those without access to such urban advantages are seldom supported through public policies designed to facilitate this access. Lobato (2000) highlights that, within capitalist societies, there is little interest from capital in investing in the production of affordable housing. This disinterest stems from the low wage levels of the poorest segments of the population, which do not cover the costs of capitalist housing production.

Real estate speculation is another noteworthy factor in discussions on the housing market. According to Harvey (2005), "new urban entrepreneurialism is based on public-private partnerships, focusing on investment and economic development through speculative place-making, rather than improving conditions in a specific territory [...]". The author further posits that projects established in the city attract public and political attention due to the substantial investments promised, thereby sidelining broader issues that may affect the region (Harvey, 2005). These large capital inflows into new areas often occur through the construction of high-value condominiums, which provide a high standard of local well-being; however, the city as a whole frequently does not extend this well-being to the broader population. Harvey (2005) also observes that investments increasingly target quality of life via the revitalization of degraded areas, cultural innovation, physical enhancements in the urban environment, and the creation of consumption and entertainment venues, such as shopping centers and sports stadiums—factors that become strategies for urban regeneration. Given the high values of properties resulting from such investments, with costs transferred to final prices, low-income families are displaced from newly regenerated areas to locations with increasingly lower land value or to zones characterized by illegal occupation.

The concept of housing deficit is intrinsically linked to the need for replenishment within the housing stock, signifying the construction of new dwellings to address housing shortages within society. Furtado, Neto, and Krause (2013) underscore that the housing deficit is an indicator that aids in the formulation and assessment of housing policies, guiding public agencies in determining residential needs. The purpose of this indicator is to orient public policymakers in designing programs capable of meeting the demand outlined in its estimates across all levels of government (Furtado; Neto; Krause, 2013). Despite the recognized need for such replenishment and the imperative to exhibit the necessity for public housing policies, Ribeiro (1996) notes that "for more than 40 years, since the consolidation

and expansion of modern housing construction, the housing deficit remains significant."

In Brazil, FJP is the institution officially recognized by the National Government for calculating the country's housing deficit indicator. This calculation involves characterizing the housing deficit and the inadequacy of dwellings by identifying the components of each distinct concept, thus determining both the need for new housing stock and repairs in substandard residences. According to FJP (2016), the method "is concerned with identifying housing needs, especially among the poor; the figures for the housing deficit and inadequacy are provided across various family income ranges [...]". The institution further emphasizes that the method "[...] primarily focuses on families earning up to three minimum wages, the upper limit for eligibility for a large number of social housing programs" (FJP, 2016, p.18).

Chart 1 and 2 present the components and subcomponents included in the calculation of the housing deficit and inadequacy of dwellings, respectively. To calculate the housing deficit, four main components are considered: Substandard Housing, Family Co-habitation, Excessive Urban Rent Burden, and Overcrowding in Rented Dwellings. All these components are mutually exclusive, ensuring that a single property is not counted more than once, thus avoiding double counting in the calculation. The first component, Substandard Housing, has two subcomponents: Rustic Dwellings and Improvised Dwellings. The IBGE defines rustic dwellings as those without masonry or wood walls. Improvised dwellings encompass all places or properties not intended for housing (commercial properties, abandoned vehicles, boats, caves, under bridges and viaducts, among others), which highlights the shortage and the need for new housing stock (FJP, 2016).

**Chart 1** | Methodology for calculating the Housing Deficit

| Components and Subcomponents of the Housing Deficit | | Space Units | Location | Attributes |
|---|---|---|---|---|
| Precarious housing | Rustic homes<br>Improvised homes | Brazil, Federation Units and selected metropolitan regions | Urban and rural | Income ranges in minimum wages |
| Family cohabitation | Living Families<br>Room | | | |
| Excessive burden with urban rent | | | | |
| Excessive density of rented homes | | | | |

Source: Fundação João Pinheiro (FJP).

The second component, family cohabitation, also comprises two subcomponents in its calculation: secondary cohabiting families and room-based dwellings. The issue of secondary cohabiting families is characterized by households in which more than one family resides together, with at least one expressing the intention or desire to establish a single-family unit—that is, to have a home solely for their own family. Room-based dwellings, as defined by IBGE, refer to private residences consisting of one or more rooms situated in shared housing, such as tenements and similar arrangements. This category was incorporated into the calculation because, as noted by Fundação João Pinheiro (FJP, 2016), "this type of housing obscures the real situation of cohabitation, since the residences are formally distinct."

The component relating to excessive rent burden in urban areas corresponds to the number of urban families with a household income of up to three minimum wages who allocate 30% or more of their income to rental payments. This dimension was included in the calculation and has become considered a deficit, stemming from the discussion that for certain families, it is preferable to rent in neighborhoods with better living conditions than to purchase property in peripheral areas ("suburbs") (FJP, 2016).

**Chart 2** | Methodology for Calculating Household Inadequacy

<table>
<tr><th colspan="2">Components e Subcomponents da Inadequacies de Urban Households</th><th>Space Units</th><th>Location</th><th>Attributes</th></tr>
<tr><td>Lack of urban infrastructure</td><td>Electricity<br>Water<br>Sanitation<br>Exclusive bathroom</td><td rowspan="5">Brazil, Federation Units and selected metropolitan regions</td><td rowspan="5">Urban and rural</td><td rowspan="5">Income ranges in minimum wages</td></tr>
<tr><td colspan="2">Excessive densification of urban households</td></tr>
<tr><td colspan="2">Lack of exclusive bathroom</td></tr>
<tr><td colspan="2">Inadequate coverage</td></tr>
<tr><td colspan="2">Urban land inadequacy</td></tr>
</table>

Source: Fundação João Pinheiro (FJP).

Excessive density in rented urban households, the fourth component of the housing deficit, is characterized by properties rented by families with more than three residents per bedroom. This is considered a deficit because tenants are unable to undertake renovations that would enlarge rented dwellings, rendering these households' potential candidates for new housing solutions (FJP, 2016). It is crucial to distinguish the elements included in the calculation of housing inadequacy, as they do not factor into the housing deficit itself, yet remain critical determinants of minimum residential quality and family well-being. The assessment comprises five components: lack of infrastructure, overcrowding in owner-occupied urban households, absence of exclusive bathrooms, inadequate roofing, and urban land tenure insecurity.

Residential infrastructure deficiency is identified when a dwelling lack at least one of the following essential services: electricity, public sewage or septic systems, waste collection, and a piped public water supply (FJP, 2016). In contrast, excessive density in owner-occupied urban households—differing from the deficit, which only considers rented units—refers to families with more than three residents per bedroom, counting only those rooms designated for sleeping. Only owner-occupied homes are included, as these can be improved or expanded by their residents (FJP, 2016).

The third component, absence of an exclusive bathroom, pertains to dwellings that do not have bathrooms or sanitation facilities reserved for exclusive use by the household, a scenario often observed in tenements or plots accommodating multiple households. The fourth component, inadequate roofing, encompasses homes with roofs made from salvaged wood, zinc, tin, or straw, provided these properties have masonry or dressed wood walls—otherwise, they would be classified as deficient (FJP, 2016). The fifth and final component of residential inadequacy is urban land tenure insecurity, which arises when at least one household member holds property rights to the dwelling but lacks full or ideal ownership of the land where the residence is located. This issue is often prevalent in the suburbs and peripheral areas of large urban centers (FJP, 2016).

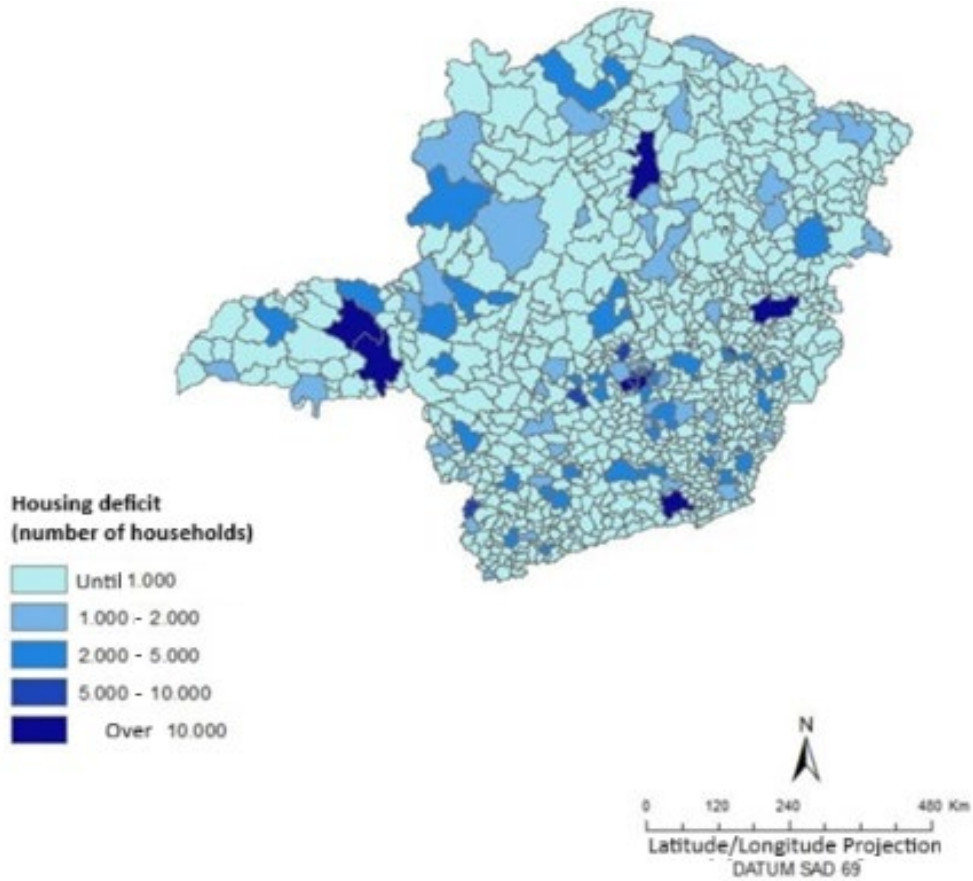
In Minas Gerais, infrastructure deficiencies typifying residential inadequacy affected 676,296 units. Of these, 130,870 lacked water supply; 557,809 suffered from inadequate or absent sewage systems; 23,069 were without electrical lighting; and 100,550 had no waste collection. The magnitude of inadequacy means that households may face one or several infrastructural issues. Of

the total, 562,422 units experienced a single deficiency, 93,093 faced two, 19,437 had three, and 1,344 were deficient in all four essential services (FJP, 2013).

Another lens on the housing deficit is offered by Alves and Cavenaghi (2006), who define the deficit as the gap between the total number of households and families; when the number of families exceeds the number of dwellings, a deficit is present, otherwise there is a surplus. Census families may consist of a Family Group, a Cohabitant Group, or a combination of both.

In 2010, Minas Gerais exhibited a heterogeneous distribution of housing deficit (Ribeiro, Viana, & Azevedo, 2015). In absolute terms, Belo Horizonte, its metropolitan area, the Triângulo Mineiro, and several municipalities in Zona da Mata and the Southern region showed higher concentrations of housing deficit. Among the state's 853 municipalities, 79% (674) had fewer than 500 deficient units, with Serra da Saudade reporting the lowest deficit: only six units (Ribeiro, Viana, & Azevedo, 2015). Figure 1 illustrates the spatial distribution of total housing deficit in Minas Gerais for 2010.

**Figure 1** | Total housing deficit by municipality, Minas Gerais, 2010




Source: Fundação João Pinheiro, Déficit Habitacional Municipal no Brasil, 2010.

## EMPIRICAL REVIEW

Studies focusing on urban housing environments abound in the literature. For example, Morais (2002), employing indicators derived from PNAD microdata for the period 1992–1999, examined housing conditions in Brazil's urban areas. The findings highlighted improvements in living standards, as evidenced by declining household and room densities, enhanced construction quality, increased share of exclusive-use bathrooms, and broader access to urban utilities such as water, sewage, electricity, and telephony. Nonetheless, persistent disparities exist across gender, regions, socioeconomic strata, and spatial units. Similarly, Castro (2014) conducted spatial analysis to identify the impact of public infrastructure components on the growth of Brazilian cities from 1970 to 2010. The methodology comprised a spatially dependent panel data model, adapted from Glaeser et al. (1995). Results indicated that access to energy positively correlates with regional economic growth.

Tiware et al. (1999) estimated both price and income elasticities of housing demand in Mumbai, India. Utilizing a two-stage estimation process, the authors first defined the market price function and subsequently the housing demand function. Their analyses revealed that housing demand is elastic with respect to both income and price, with coefficients approximating +1 and -1, respectively. Ermisch et al. (1996) provided a multifaceted study of housing demand in six major regions of England, employing five sequential steps: estimation of hedonic price functions within the housing markets studied; construction of a housing price index; calculation of housing consumption costs using the index; estimation of households' permanent income based on individual characteristics, such as head of household occupation; and finally, estimation of the housing demand function. The authors concluded that the price elasticity hovers around -0.4, while income elasticity is approximately 0.5.

Conversely, Albouy and Ehrlich (2018) investigated the social cost of land-use restrictions through a dual methodological approach. First, they estimated a housing cost function for metropolitan areas, leveraging land and construction input prices along with regulatory and geographic constraints; second, they assessed whether land-use restrictions elevate the relative price of housing compared to local wages in those metropolitan regions. Their findings suggest that regulatory land-use constraints reduce social welfare while inflating housing costs. In a related vein, Zhang et al. (2018) explored the effect of housing conditions on individual well-being in urban China. Employing an ordered probit model, they

found that homeownership and superior housing conditions are associated with higher residential satisfaction. Furthermore, individuals residing in better-quality housing report greater satisfaction compared to those in more economically accessible but lower-standard dwellings.

Alawadi et al. (2018) assessed Dubai's residential landscape in terms of morphology and accessibility, posing the central question: "How accessible is Dubai for its residents?" To measure housing accessibility, five methods were used: (i) relative methods, which calculate variations between family costs and income; (ii) subjective methods, based on how much families are willing to pay for housing; (iii) household budget methods, examining spending patterns; (iv) ratio methods, using income to establish a maximum acceptable housing cost; and (v) residual methods, identifying the minimum income necessary for non-housing needs. The results indicated that, for the middle-middle class, only 23% of affordable housing units are accessible, corresponding to 7% of Dubai's usable area; for the lower-middle class, access is restricted to just 12% of units, representing 3.5% of the usable area.

Research by Fundação João Pinheiro (2016) characterized both the housing deficit and housing inadequacy using microdata from PNAD 2013 and 2014 (IBGE). The study detailed Brazil's housing deficit for 2013 and 2014, finding that in 2013, the deficit totaled 5.846 million dwellings, with 85.7% (5.01 million) located in urban areas. In 2014, the deficit increased to 6.068 million units, with 87.6% falling within urban environments. Rural housing deficit declined from 835,000 units in 2013 to 752,000 in 2014. Another study by Fundação João Pinheiro (2013), based on 2010 demographic census data, mapped municipal housing deficits and inadequacies. Absolute figures revealed São Paulo as the Brazilian capital with the largest housing deficit, followed by Rio de Janeiro, Brasília, Salvador, and Manaus, while Vitória reported the lowest deficit among capitals.

This investigation distinguishes itself from the works by characterizing the housing deficit through the correlation between socioeconomic factors and the structural attributes of the municipalities analyzed. Moreover, it represents a methodological advance by employing the consecutive use of confirmatory factor analysis and qualitative comparative analysis, with the potential to significantly enrich the national literature.

## METHODOLOGY

The methodological strategy unfolds through two sequential stages, each employing distinct analytical techniques: Exploratory Factor Analysis (Spearman, 1904) and fuzzy set Qualitative Comparative Analysis (fsQCA). The initial phase serves to synthesize the characteristics of Brazilian regions—encompassing socioeconomic conditions, environmental attributes, and infrastructural features—in the year 2010, while also facilitating the identification of a typology among these regions. This framework posits that the vector of *p* standardized variables, $\boldsymbol{Z}' = [Z_1, Z_2, \ldots, Z_p]$, is linearly dependent on *m* common and unobserved factors, $\boldsymbol{F}' = [F_1, F_2, \ldots, F_p]$, as well as on *p* specific factors, $\boldsymbol{\varepsilon}' = [\varepsilon_1, \varepsilon_2, \ldots, \varepsilon_p]$, as represented in matrix notation:

$$\underset{(px1)}{\boldsymbol{Z}} = \underset{(pxm)}{\boldsymbol{L}}\underset{(mx1)}{\boldsymbol{F}} + \underset{(px1)}{\boldsymbol{\varepsilon}} \qquad (1)$$

where $\underset{(pxm)}{\boldsymbol{L}} = \{\ell_{ij}\}$ represents the matrix whose coefficients $\ell_{ij}$ correspond to the standardized value ($Z_i$) of the *i-th* variable in the *j-th* factor. The correlation matrix's structure is defined by $\underset{pxp}{\boldsymbol{P}} = \boldsymbol{LL}' + \Psi$, so that $\underset{(pxp)}{\Psi} = diag[\psi_1 \quad \psi_2 \quad \ldots \quad \psi_p]$ is the specific variance matrix; $Var(Z_i) = h_i^2 + \psi_i$, with $h_i^2 = \sum_{j=1}^{m} \ell_{ij}^2$ denoting the portion of variability in $Z_i$ described by *m* factors, commonly recognized as the communality (Johnson & Wichern, 2007).

For the estimation of $\ell_{ij}$ and $\psi_i$, this paper will employ the principal components method. Thus, if $m < p$, we have $\boldsymbol{LL}' \cong \sum_{i=1}^{m} \lambda_i \boldsymbol{e}_i \boldsymbol{e}_i'$ and $\boldsymbol{P} \cong \boldsymbol{LL}' + \Psi$ with pairs of eigenvalues and eigenvectors $(\lambda_i, \mathbf{e}_i)$, such that $\boldsymbol{e}_i'\boldsymbol{e}_i = 1, \boldsymbol{e}_i'\boldsymbol{e}_k = 0$. Given that the data utilized in this study do not exhibit normal distribution, the Weighted Least Squares (WLS) method proposed by Bartlett (1937) will be applied for factor score estimation (Johnson & Wichern, 2007).

The second stage of the methodological framework employs Ragin's (1987; 2000) fsQCA method, designed to identify distinct patterns of association among the latent factors previously delineated—namely, the socioeconomic characteristics of the individuals examined, the structural

attributes of municipalities in Minas Gerais, and the housing deficit. According to Ragin (2000), fsQCA addresses equifinality, which refers to the possibility of multiple causal combinations leading to the same outcome; for instance, "AB → Y" indicates that the logical conjunction of conditions A and B can plausibly result in outcome Y (Silva et al., 2019). However, such models may also reflect empirical associations between conditions and outcomes without necessarily establishing causality, as highlighted by Schneider and Grofman (2006).

Typically, fuzzy sets are anchored by three reference points: full membership (represented by a score of 1), full non-membership (score 0), and a crossover threshold (score 0.5) (Ragin, 2000). When cases exhibit differing scores on the same side of the crossover, they vary in degree; when scores fall on opposite sides, the cases are qualitatively distinct (Ragin, 2008). Qualitative anchors, as emphasized by Betarelli Junior and Ferreira (2018), are employed during calibration to define the maximum, intermediate, and minimum boundaries that demarcate full, ambiguous, and absent membership, respectively.

According to Betarelli Junior and Ferreira (2018), the logical configurations possible within the model are determined by the number of dimensions k, calculated as 2^k. Thus, with three dimensions (k = 3), there are eight possible logical combinations, each generating outcomes assessed in terms of consistency and coverage and summarized within a Truth Table. Coverage reflects the empirical prevalence of each configuration, while consistency measures the proportion of cases in which the configuration reliably predicts the outcome (Betarelli Junior & Ferreira, 2018). Configurations approaching a consistency value of 1 are considered robust, whereas those nearing zero lack reliability. Ragin (2000, 2006) recommends that consistency scores for adequate measures within fsQCA should ideally exceed 0.8. Coverage analyses are classified as: (i) global coverage, aggregating the prevalence of all sufficient configurations for the outcome; (ii) unique coverage, measuring the prevalence of each configuration exclusively of cases counted in other combinations; and (iii) raw coverage, encompassing the prevalence of each sufficient configuration regardless of overlapping with other cases (Schneider & Grofman, 2006).

The fsQCA approach utilizes Boolean minimization to reduce "primitive expressions," which are the initial consistent or sufficient configurations, thereby pinpointing all logical combinations that continue to yield the outcome. Given the multiplicity of configurations, Boolean minimization—implemented via the Quine-McCluskey algorithm—streamlines these expressions. For example, the expression "aBC + ABC → Y" is minimized to "BC → Y," as the comparison of {A and BC} and {not A and BC} simplifies to {BC}

(Schneider & Wagemann, 2012).

This methodological rigor ensures that the analysis is aligned with the highest standards of international economic research, providing a nuanced and replicable approach to the multifaceted issue of housing deficit through the lens of qualitative comparative analysis.

## DATA

The dataset employed in this study comprises information from the 2010 Demographic Census, conducted decennially by the Brazilian Institute of Geography and Statistics (IBGE, 2010), as well as figures from the Fundação João Pinheiro regarding the national housing deficit. These databases were selected as they provide comprehensive data on Brazilian municipalities. The Demographic Census stands as the primary source for understanding population living conditions at both national and local scales. The household characteristics, in turn, are drawn from Fundação João Pinheiro's dataset (FJP, 2013), focusing on the housing deficit index. The variable of interest is the relative total housing deficit, which offers a comparative perspective across different municipalities. This metric was chosen specifically because it mitigates the bias or effect of locality size and absolute household counts, disparities that are pronounced among the various municipalities and reflect their distinct attributes.

A regional overview reveals that the North of Brazil exhibited the highest relative housing deficit, encompassing 20.6% of households in deficit condition. Conversely, the South region reported the lowest indicator, at just 8.7%. At the municipal level, São João do Arraial in Piauí registered the highest relative deficit nationwide (80.6%), while Morrinhos do Sul in Rio Grande do Sul recorded the lowest (1.5%). The census data serves as the empirical foundation for extracting latent indicators, which are subsequently analyzed in relation to the housing deficit.

To operationalize this, the research delineated four distinct groups of variables, each reflecting a particular dimension and whose shared characteristics are synthesized into latent factors or constructs, as outlined in the initial methodological phase. These clusters are: (a) socioeconomic conditions; (b) urban environmental attributes; (c) infrastructure; and (d) collective services. Table 2 details the variables and their descriptive statistics.

**Table 2** | Selected indicators of municipalities in 2010

| Variable | Description | Mean | Standard Deviation | Mín | Max |
|---|---|---|---|---|---|
| Deficit | Total relative housing deficit | 13.65 | 3.98 | 8.6 | 22.5 |
| Per capita income | Sum of the income of all individuals residing in permanent private households divided by the number of individuals | 493.6 | 243.27 | 96.25 | 2043.7 |
| Formality | Share of people 18 years of age or older formally employed | 43.51 | 19.28 | 2.97 | 89.11 |
| Illiteracy | Rate of people over 18 who cannot read and write a simple note | 17.4 | 10.7 | 0.97 | 47.64 |
| Literacy | Rate of people over 18 who can read and write a simple note | 87.46 | 7.33 | 62.01 | 99.53 |
| Infant mortality | Number of children who will not survive their first year of life per 1,000 live births. | 19.25 | 7.14 | 8.49 | 46.8 |
| Urbanization | Rate of population in urban areas | 0.64 | 0.22 | 0.04 | 1 |
| Social vulnerability | Rate of unmet basic needs | 43.99 | 22.44 | 1.97 | 91.57 |
| Per capita trade rate | Ln. ratio of the sum of Imp. and Exp. to GDP | -54.91 | 43.45 | -89.8 | 5.74 |
| AV_ind | Ln. value added in industry to population | 4.45 | 1.42 | 1.89 | 10.08 |
| AV_serv | Ln. value added in services at current prices to population | 5.5 | 0.88 | 3.1 | 9.01 |
| Population | Ln. of the total resident population | 16.32 | 1.15 | 13.6 | 23.14 |
| Activity rate | Activity rate of people 18 years of age or older | 63.35 | 9.09 | 21.18 | 95.6 |
| HDI-M Longevity | HDI Longevity | 0.8 | 0.04 | 0.67 | 0.89 |
| Open sewerage | People who do not have open sewage around their homes | 26.29 | 8.05 | 0 | 73.78 |
| Accumulated wastewater | People who do not have accumulated garbage around their homes | 28.98 | 4.6 | 1.67 | 99.47 |
| Pipe water | Adequate running water | 27.71 | 5.99 | 0 | 39.55 |
| Electric energy | Adequate energy supply | 30.25 | 3.34 | 14.85 | 40.78 |
| Garbage collection | Adequate garbage collection | 28.81 | 5.1 | 0 | 40.78 |
| Lighting | People who have public lighting around their homes | 28.23 | 4.86 | 0.99 | 93.53 |
| Paving | People who have paving around their homes | 22.18 | 7.59 | 0 | 67.8 |
| Curb | People who have curbs on the street around their homes | 21.09 | 8.11 | 0 | 66.23 |

Source: Own elaboration.

The infrastructure group comprises three variables: Public Lighting, denoting the proportion of individuals residing in households situated in well-lit neighborhoods; Pavement, capturing the share dwelling in areas with paved surroundings (such as cobblestone or asphalt); and Curbs, indicating the proportion of people whose residences are bordered by functional road curbs. Collective services, on the other hand, are represented by: Piped Water, reflecting the share of individuals with adequate access to water supply; Electricity, corresponding to those with sufficient electric grid coverage; and Waste Collection, representing the proportion of the population residing in households with appropriate refuse collection services. The selection of variables within the domains of urban environmental conditions, infrastructure, and collective services follows the methodological approach established for the Urban Well-being Index (IBEU) (Ribeiro & Ribeiro, 2013).

This analytical rigor is aligned with the best practices in international economic research, enhancing both the clarity and replicability of the findings in the context of fsQCA-based studies.

The variables were selected for their ability to elucidate the multifaceted social, economic, and structural dimensions characterizing Brazilian municipalities (FJP, 2013). Per capita income, frequently highlighted in the literature, serves as a fundamental indicator for understanding housing deficits, as lower income levels tend to increase the likelihood of such deficits (Osório; Soares; Souza, 2011). Additional variables, including labor formality, social vulnerability, activity rates, and the municipal human development index, contribute significantly to the region's specific attributes—such as housing deficits—thus providing a more comprehensive characterization of municipalities (Angelsen, 1999; Hargrave; Kis-Katos, 2013; Faria; Almeida, 2016). Meanwhile, infrastructure and environmental indicators—pertaining to energy and water provision, waste collection, open sewage, paving, and curbs—are essential for understanding the structural conditions prevailing in these municipalities.

## RESULTS

The effectiveness of the exploratory factor analysis model, which constitutes the initial methodological step, fundamentally relies on the correlation matrix among variables, as it elucidates interdependencies or communalities through correlation coefficients. High correlations among certain variables should manifest in substantial factor loadings for the latent factors associated with these variables; otherwise, those latent factors may not be adequately represented. Thus, latent factors are expected to aggregate strong correlations between variables with statistically significant coefficients, making the analysis of the correlation matrix an essential procedure (Hair et al., 1998). In conducting this correlation matrix assessment, the variable of housing deficit was intentionally excluded, given its direct presentation in the subsequent methodological step (fsQCA).

Upon examining the correlation matrix, it was observed that, of a total of 207 significant coefficients ($p<0.01$), 111 surpassed the threshold of 0.3, representing 53.6%. This proportion allows for the inference that the structure of the variables under analysis is suitable for the factor analysis model (Hair et al., 1998). Notably, per capita income exhibited a strong association with the other variables, most prominently with literacy rates ($r = 0.77$, $p<0.01$), the human development longevity index ($r = 0.78$, $p<0.01$), and the value added by services ($r = 0.84$, $p<0.01$). Furthermore, per capita income demonstrated a pronounced negative correlation with social vulnerability ($r = -0.91$, $p<0.01$) and with illiteracy ($r = -0.82$, $p<0.01$), the latter also being highly associated with social vulnerability ($r = 0.88$, $p<0.01$). Regarding collective service variables, the presence of electricity distribution and waste collection was markedly correlated ($r = 0.88$, $p<0.01$). These findings suggest that socioeconomic factor variables are highly interconnected, which should be reflected in the factor loadings of the employed model. Table 4 presents the results of the factor analysis using the principal components method.

Statistical tests applied to validate this model included Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) criterion. Bartlett's test indicated the existence of statistically significant correlation coefficients, while the KMO criterion yielded a value of 0.9057, confirming the model's suitability (using the minimum reference value of 0.8) (Johnson & Wichern, 2007). The three selected latent factors meet conventional criteria for eigenvalues and total variance, including Kaiser's (1958) and Pearson's benchmarks. The eigenvalues for the three factors exceeded one unit, ensuring that each selected factor accounted for

the information of at least one original variable. For total variance, cumulative factor variance reached approximately 76%, surpassing the minimum acceptable threshold of 70%. The Varimax rotation, as proposed by Kaiser (1958), was applied to the factors to facilitate interpretation of the resultant loadings. It is noteworthy that the communalities of the factor loadings were above 0.60, indicating that the interrelationships among the variables are well described by the three factors, reflecting an appropriate correlation matrix for the methodology. Nevertheless, validating the reliability of variable measures remains essential (Flynn et al., 1990). Accordingly, Cronbach's alpha was employed, and the resulting value of approximately 0.95 is deemed acceptable by the literature.

The first latent factor revealed substantial factor loadings related to socioeconomic development, with high positive scores for per capita income, literacy rates, formal employment, activity rates, the municipal human development index, and value added from industry and services.

**Table 3** | Correlation Matrix

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Per capita income | 1 | | | | | | | | | | | | | | | | | | | | |
| 2. Formality | 0.77 | 1 | | | | | | | | | | | | | | | | | | | |
| 3. Illiteracy | -0.82 | -0.77 | 1 | | | | | | | | | | | | | | | | | | |
| 4. Literacy | 0.77 | 0.70 | -0.96 | 1 | | | | | | | | | | | | | | | | | |
| 5. Infant mortality | -0.74 | -0.68 | 0.83 | -0.79 | 1 | | | | | | | | | | | | | | | | |
| 6. Urbanization | 0.49 | 0.64 | -0.46 | 0.32 | -0.36 | 1 | | | | | | | | | | | | | | | |
| 7. Social vulnerability | -0.91 | -0.83 | 0.88 | -0.81 | 0.82 | -0.50 | 1 | | | | | | | | | | | | | | |
| 8. Per capita trade rate | 0.49 | 0.53 | -0.48 | 0.47 | -0.38 | 0.44 | -0.46 | 1 | | | | | | | | | | | | | |
| 9. AV_ind | 0.69 | 0.74 | -0.68 | 0.64 | -0.59 | 0.50 | -0.71 | 0.62 | 1 | | | | | | | | | | | | |
| 10. AV_serv | 0.84 | 0.80 | -0.80 | 0.74 | -0.71 | 0.59 | -0.84 | 0.59 | 0.84 | 1 | | | | | | | | | | | |
| 11. Population | 0.20 | 0.20 | -0.12 | 0.14 | -0.02 | 0.41 | -0.04 | 0.49 | 0.28 | 0.30 | 1 | | | | | | | | | | |
| 12. Activity rate | 0.67 | 0.49 | -0.67 | 0.66 | -0.58 | 0.20 | -0.71 | 0.36 | 0.52 | 0.61 | 0.05 | 1 | | | | | | | | | |
| 13. HDI-M Longevity | 0.78 | 0.71 | -0.83 | 0.79 | -0.97 | 0.40 | -0.84 | 0.41 | 0.62 | 0.74 | 0.06 | 0.58 | 1 | | | | | | | | |
| 14. Open sewerage | 0.49 | 0.42 | -0.54 | 0.49 | -0.57 | 0.16 | -0.59 | 0.12 | 0.33 | 0.45 | -0.20 | 0.40 | 0.55 | 1 | | | | | | | |
| 15. Accumulated wastewater | 0.37 | 0.27 | -0.35 | 0.30 | -0.40 | 0.02 | -0.47 | 0.00 | 0.19 | 0.31 | -0.29 | 0.28 | 0.38 | 0.67 | 1 | | | | | | |
| 16. Pipe water | 0.42 | 0.36 | -0.37 | 0.31 | -0.45 | 0.17 | -0.50 | 0.07 | 0.25 | 0.38 | -0.21 | 0.26 | 0.44 | 0.51 | 0.55 | 1 | | | | | |
| 17. Electric energy | 0.59 | 0.44 | -0.53 | 0.46 | -0.60 | 0.15 | -0.70 | 0.12 | 0.35 | 0.52 | -0.24 | 0.44 | 0.58 | 0.66 | 0.73 | 0.69 | 1 | | | | |
| 18. Garbage collection | 0.60 | 0.50 | -0.55 | 0.48 | -0.61 | 0.23 | -0.70 | 0.19 | 0.42 | 0.57 | -0.16 | 0.45 | 0.59 | 0.60 | 0.66 | 0.66 | 0.88 | 1 | | | |
| 19. Lighting | 0.42 | 0.36 | -0.38 | 0.30 | -0.43 | 0.18 | -0.52 | 0.07 | 0.27 | 0.39 | -0.17 | 0.28 | 0.42 | 0.64 | 0.83 | 0.61 | 0.73 | 0.69 | 1 | | |
| 20. Paving | 0.38 | 0.35 | -0.29 | 0.23 | -0.34 | 0.23 | -0.45 | 0.09 | 0.25 | 0.35 | -0.13 | 0.18 | 0.36 | 0.47 | 0.55 | 0.55 | 0.53 | 0.54 | 0.62 | 1 | |
| 21. Curb | 0.35 | 0.35 | -0.25 | 0.19 | -0.31 | 0.25 | -0.43 | 0.07 | 0.24 | 0.33 | -0.14 | 0.15 | 0.33 | 0.47 | 0.53 | 0.57 | 0.54 | 0.55 | 0.62 | 0.94 | 1 |

Source: Own elaboration.

Additionally, there was a strong negative relationship with infant mortality, social vulnerability, and illiteracy, indicating that, in municipalities with lower socioeconomic development, these associations are inversely proportional. Therefore, this factor can be characterized as socioeconomic development, as its results help elucidate disparities in development across municipalities (Faria, Betarelli Júnior, & Montenegro, 2019), which may offer explanations for housing deficits.

**Table 4** | Results of Factor Analysi

| Variables | Factors | | | Commonality |
|---|---|---|---|---|
| | Socioeconomic Development | Infrastructure | Urban Growth | |
| Per capita income | 0,83 | 0,28 | 0,24 | 0,83 |
| Formality | 0,73 | 0,25 | 0,42 | 0,78 |
| Illiteracy | -0,92 | -0,17 | -0,11 | 0,89 |
| Literacy | 0,91 | 0,08 | 0,05 | 0,84 |
| Infant mortality | -0,86 | -0,27 | 0,00 | 0,81 |
| Urbanization | 0,35 | 0,16 | 0,72 | 0,66 |
| Social vulnerability | -0,87 | -0,38 | -0,15 | 0,93 |
| Per capita trade rate | 0,50 | -0,07 | 0,59 | 0,61 |
| AV_ind | 0,71 | 0,12 | 0,45 | 0,72 |
| AV_serv | 0,80 | 0,25 | 0,41 | 0,87 |
| Population | 0,10 | -0,29 | 0,73 | 0,62 |
| Activity rate | 0,78 | 0,07 | -0,07 | 0,61 |
| HDI-M Longevity | 0,86 | 0,27 | 0,07 | 0,81 |
| Open sewerage | 0,50 | 0,59 | -0,20 | 0,63 |
| Accumulated wastewater | 0,28 | 0,76 | -0,27 | 0,73 |
| Pipe water | 0,29 | 0,72 | -0,07 | 0,60 |
| Electric energy | 0,51 | 0,71 | -0,21 | 0,81 |
| Garbage collection | 0,52 | 0,68 | -0,09 | 0,75 |
| Lighting | 0,27 | 0,82 | -0,08 | 0,75 |
| Paving | 0,08 | 0,86 | 0,22 | 0,80 |
| Curb | 0,05 | 0,88 | 0,23 | 0,83 |
| Eigenvalues | 10,88 | 3,50 | 1,51 | |
| Proportion of variance | 0,52 | 0,17 | 0,07 | |

Source: Research results.

Note: Cronbach's scale test: 0.95; Kaiser–Meyer–Olkin (KMO): 0.90; Bartlett's sphericity test: 150.00 (p value = 0.000).

The second latent factor, in turn, demonstrated significant interdependence among variables indicative of infrastructure. The factor scores revealed consistently high values for collective services such as piped water, waste collection, electricity supply, paving, public lighting, and sanitation, including the absence of open sewage and the lack of waste accumulation around residences. In addition to these pronounced positive associations with infrastructure, the factor also displayed a relatively negative relationship with social vulnerability, indicating that municipalities with better infrastructure tend to exhibit lower levels of deprivation regarding basic needs. This aggregation is plausible given the strong correlations among these services, suggesting that provision does not occur in isolation (Bichir, 2009). Such results reinforce the discourse on regional development, which encompasses the analysis of social and economic factors, as municipalities with more advanced infrastructure are inclined to attract investments, generate employment, and drive economic and social progress.

Moreover, the third latent factor presented substantial loadings for characteristics associated with urban growth, including highly positive scores for urbanization, population, and trade flows, all contributing to the significant participation of industry and services and to a relatively high degree of labor formality. Another indicator of urban growth is the negative association with waste accumulation, electricity access, waste collection, and the absence of open sewage, underscoring that in less urbanized areas, such infrastructure variables are often inadequately addressed. Once the three latent factors derived from the interdependence among variables for Brazilian municipalities have been analyzed, it becomes possible to verify whether these factors, defined as conditions, exhibit sufficiency relationships with the relative housing deficit pattern in the country for 2010. In other words, these relationships are potentially causal and should elucidate empirical concordances between these three conditions and the outcome of the relative deficit (Faria; Betarelli Júnior; Montenegro, 2019). To this end, the second methodological step will be applied—the fsQCA approach—which initially transforms the three latent factors into fuzzy sets, thus providing membership scores for the municipalities. This study adopts uppercase (lowercase) letters for each set to indicate high (low) conditional probabilities for cases within each causal condition: (D) Relative Housing Deficit; (S) Socioeconomic Development; (I) Infrastructure; and (U) Urban Growth.

Independently, the proportion of municipalities contained in each of the three conditions that coincides with the deficit can be assessed, preliminarily providing respective relationships of sufficiency and necessity (Faria; Betarelli Júnior; Montenegro, 2019). Table 5 presents the standardized overlap proportion between pairs of sets, using coincidence scores normalized by the respective sizes of the causal conditions. Urban Growth (U) set exhibits the highest sufficiency relationship with the Deficit (D) outcome, sharing 74% of its potential areas. Despite this substantial overlap, Table 5 does not report the coverage rate or the consistency index, making it impossible to determine whether (U) is a subset of (D), or vice versa. The lowest sufficiency index was observed between Infrastructure (I) and Deficit (D), with only 58% overlap, indicating that municipalities with higher infrastructure indices show less association with a high housing deficit.

**Table 5** | Matrix of sufficiency and necessity

| | D | S | I | U |
|---|---|---|---|---|
| D | 1,00 | 0,62 | 0,58 | 0,74 |
| S | 0,62 | 1,00 | 0,67 | 0,68 |
| I | 0,58 | 0,67 | 1,00 | 0,67 |
| U | 0,74 | 0,68 | 0,67 | 1,00 |

Source: Research results.

Nevertheless, considering this preliminary analysis, it is essential to test the sufficiency relationships and derive the logical combinations that cause or are associated with the deficit. Table 6 presents only those logical combinations that demonstrate sufficient relationships with both high and low housing deficit indices that are statistically significant, with consistencies exceeding 0.80, in accordance with the recommendations of Ragin (2000, 2006).

**Table 6** | Sufficient logical combinations

| Classification | Logical Combinations | Consistency | | F | p-valor | Cases and Frequencies | | |
|---|---|---|---|---|---|---|---|---|
| | | D | 1-D | | | Number | Relative | Accumulated |
| High Deficit | Siu | 0.85 | 0.73 | 150.2 | 0 | 824 | 0.15 | 0.15 |
| | siU | 0.93 | 0.68 | 915.9 | 0 | 737 | 0.13 | 0.28 |
| | SiU | 0.9 | 0.76 | 358.2 | 0 | 615 | 0.11 | 0.39 |
| Low Deficit | SIu | 0.68 | 0.94 | 964.7 | 0 | 610 | 0.11 | 0.5 |

Source: Research results.

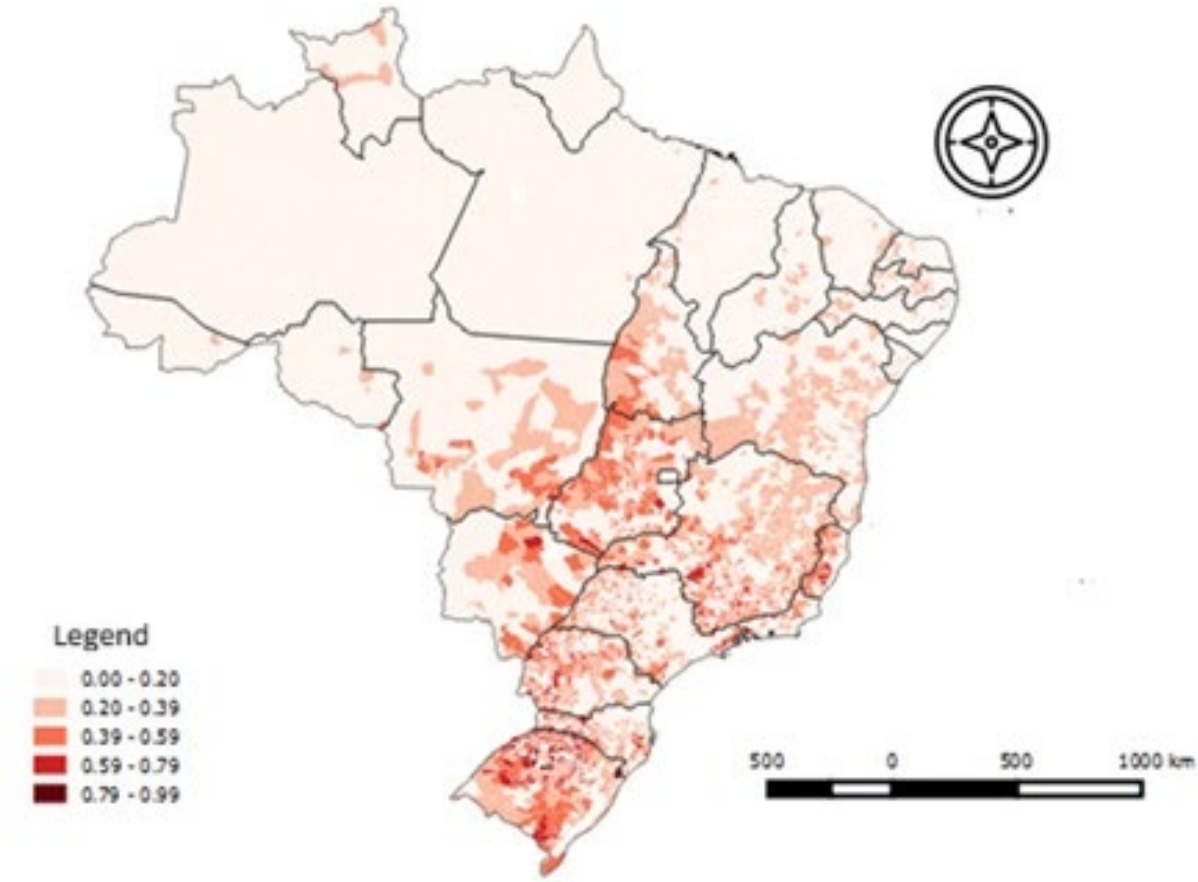
Notes: "F" represents the distribution F used for the Wald test on the consistency scores; "Significant" p-value denotes that the consistency D and 1-D is statistically different; Column "D" evaluates the consistency of the combination with high D; While "1-D" evaluates the cases without high D. "Number" is the number of cases with scores above 0.5.

Both the configurations leading to high and low housing deficits are statistically significant at the 1% level. A logical configuration associated with a low housing deficit in 2010 encompasses a total of 610 municipalities, representing 11% of all municipalities. The primitive and already minimized expression using the Quine-McCluskey algorithm is: $SIu \rightarrow d$. This denotes that a high level of socioeconomic development (S), combined with robust infrastructure (I) and low urban growth (U), results in a reduced housing deficit. Figure 2 displays this logical configuration across Brazilian municipalities. Notably, the states in the North and Northeast exhibit lower concentrations of the configuration characterized by elevated socioeconomic development, substantial infrastructure, and modest urban expansion.

Conversely, another logical combination, $siU$, incorporates 737 municipalities (13% of the total), comprising low socioeconomic development (S), insufficient infrastructure (I), and rapid urban growth (U). This finding reinforces prior literature (Noal & Janczura, 2011) which observed that the housing crisis intensified alongside urban expansion, as government initiatives often addressed issues only in an ad hoc manner, without establishing a sustainable foundation for long-term solutions.

Such results underscore the necessity of considering the interplay between infrastructure, development, and urban growth when designing policies to mitigate regional disparities. The persistent lack of investment in areas marked by low development may exacerbate regional developmental deficits, with certain municipalities receiving a disproportionate share of resources, thereby amplifying social inequalities.

**Figure 2** | Logical combination Siu




Source: Own elaboration.

In total, three logical configurations (multicausality) were identified in which the sets converge toward a high housing deficit (equifinality), as captured by the primitive form: $siu{+}siU{+}SiU \rightarrow D$. Application of the previously noted minimization algorithm reveals that a low Infrastructure (I) index emerges as a necessary but insufficient condition for producing high housing deficit outcomes. Thus, in its minimized expression, the configuration of logical combinations is $si{+}iU \rightarrow D$. The insufficient nature of low infrastructure for generating this outcome indicates that it must interact with low Socioeconomic Development (S) to reach the result.

The second necessary combination involves low infrastructure paired with high Urban Growth (U), reaffirming established findings in the literature, as the housing crisis has deepened alongside city expansion and urbanization. Government interventions, as observed by Noal and Janczura (2011), tended to be ad hoc, addressing problems in isolated fashion and failing to provide a sustainable foundation for resolving such challenges. Figures 3 and 4 illustrate the spatial

distribution of high-deficit logical configurations among Brazilian municipalities.

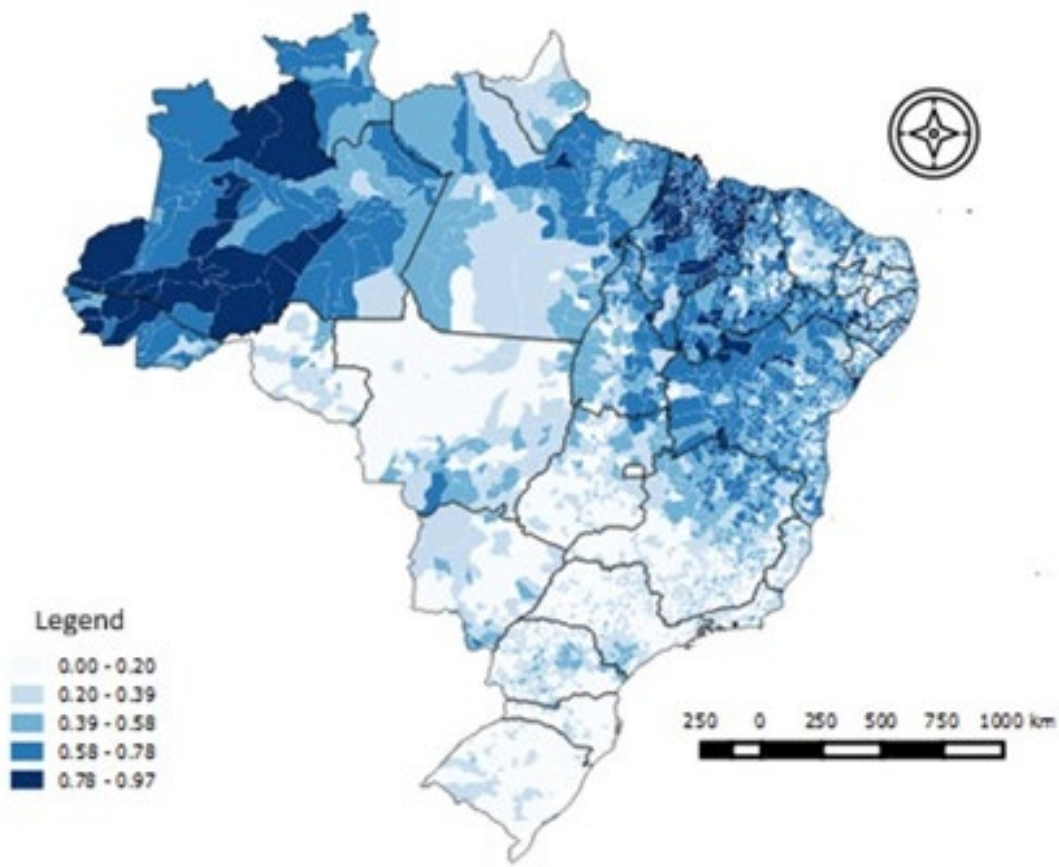
Given the comparative qualitative nature of this analysis, it is pertinent to highlight the model's adjustment metrics—namely, coverage and consistency—as presented in Table 7. A pronounced concentration of both logical configurations occurs in the North and Northeast regions of the country.

**Table 7** | Main adjustment indicators

| Logical Combinations | Coverage | | Consistency |
|---|---|---|---|
| | Raw | Unique | |
| Si | 0.58 | 0.11 | 0.866 |
| iU | 0.59 | 0.12 | 0.896 |
| Total Coverage = 0.703 | | Solution Consistency = 0.851 | |

Source: Research results.

**Figure 3** | Logical combinations Si

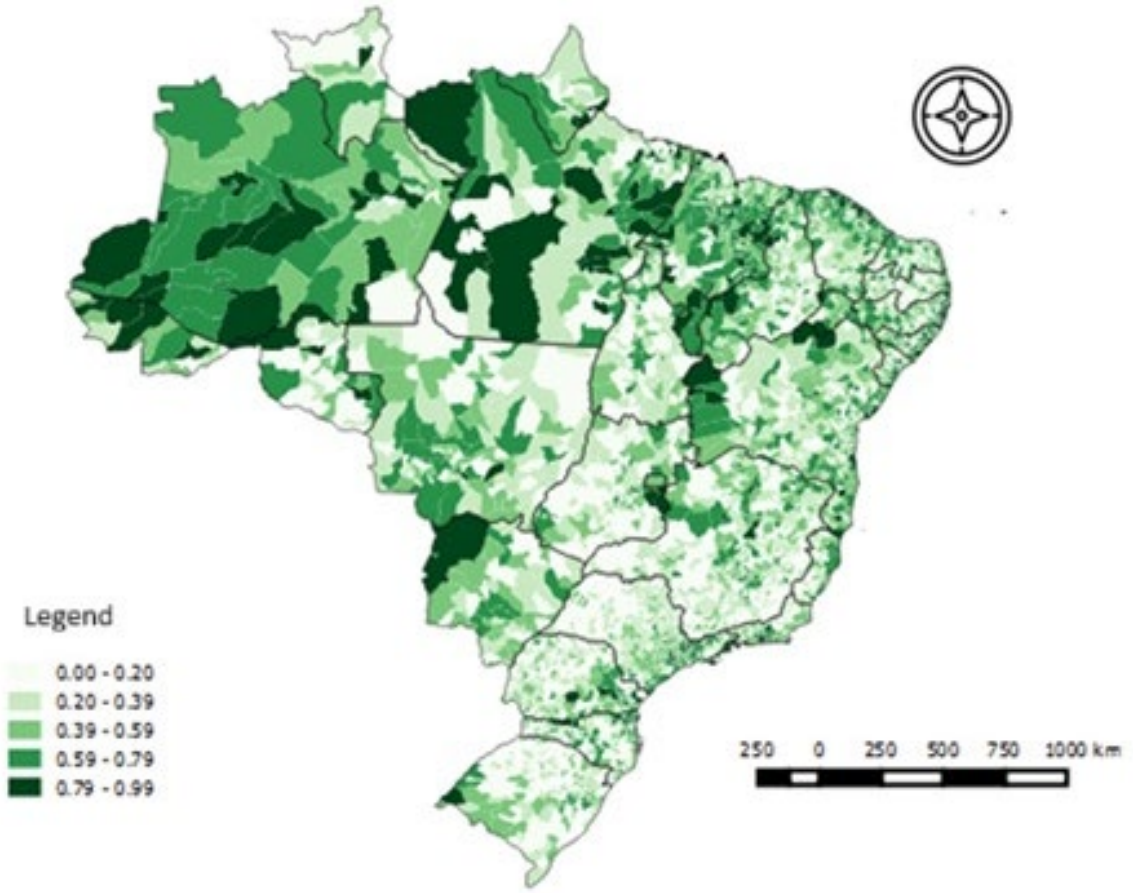



Source: Own elaboration.

This finding reinforces that low infrastructure in conjunction with low development, or low infrastructure associated with high urban growth, prevails in regions with the greatest housing deficits, in accordance with data from Fundação João Pinheiro (FJP, 2013). Persistent underinvestment in areas characterized by limited development may intensify regional disparities, with certain municipalities accumulating a disproportionate share of resources, thereby exacerbating social inequalities.

The *iU* configuration exhibited a consistency of 0.896—approximately 90%—and a raw coverage of 0.591, corresponding to nearly 60% regarding the high housing deficit index. Thus, municipalities characterized by limited Infrastructure (i) and pronounced Urban Growth (U) tend to display elevated relative housing deficits. However, its unique coverage reaches only 12.4%, indicating that this configuration accounts for 12.4% of observed cases.

**Figure 3** | Logical combinations iU




Source: Own elaboration.

It is important to emphasize that, within the fsQCA framework, high consistency scores are often accompanied by lower coverage values; consistency, however, remains the primary criterion for validating results. This observation aligns with the methodological standards advocated in the literature—particularly by Ragin—underscoring the analytical rigor and interpretive clarity required for robust configurational research.

## FINAL REMARKS

The present study provides valuable insights into the relationship between housing deficit and the socioeconomic and structural dimensions of Brazilian municipalities. Drawing on latent indices derived from the 2010 Demographic Census (IBGE, 2010), the research employed a two-stage methodological approach—namely, Exploratory Factor Analysis and fuzzy-set Qualitative Comparative Analysis (fsQCA)—to identify specific configurations associated with both high and low housing deficit across urban centers in Brazil.

The initial results from the Exploratory Factor Analysis enabled the identification of three latent indicators encapsulating shared characteristics among variables: socioeconomic development, infrastructure provision, and urban growth. fsQCA revealed that elevated socioeconomic development, robust infrastructure, and constrained urban expansion are collectively linked to a reduced housing deficit among municipalities. Conversely, two alternative pathways emerged as significant contributors to the prevalence of high housing deficit: either limited infrastructure paired with accelerated urban growth, or the intersection of low socioeconomic development and deficient infrastructure.

Consequently, these findings offer clear policy implications. Brazilian municipalities that prioritize enhancements in socioeconomic indicators and urban infrastructure are more likely to mitigate housing deficit—a pattern observed nationwide in 2010. The configurational approach (fsQCA), aligned with Ragin's methodological standards, emphasizes that such relationships may exhibit asymmetry; interventions targeting both socioeconomic development and infrastructure provision tend to reduce housing deficit in a reciprocal fashion. However, high housing deficit is also associated with rapid urban growth and insufficient infrastructure, suggesting that deficits often

arise in contexts of unregulated urban expansion, where housing density surpasses the capacity of available urban services.

Furthermore, future research should pursue improvements in the latent indices applied, aiming to construct more comprehensive factors that capture the diverse characteristics of municipalities. Additional analysis focusing on Brazil's North region is warranted, given its notably high relative housing deficit. Methodological advancements through statistical inference for housing deficit, as well as the inclusion of more recent IBGE and census data, are also recommended.

It must be acknowledged that the limitations of this study include the relatively high consistency, yet moderate coverage achieved by the QCA methodology. While logical combinations yielded robust consistency scores, the total proportion of municipalities encompassed by the identified solutions did not reach optimal levels.

## REFERENCES


ALAWADI, K.; KHANAL, A.; ALMULLA, A. Land, urban form, and politics: A study on Dubai's housing landscape and rental affordability. **Cities**. Abu Dhabi, Dubai, vol. 81, p. 115-130. 2018.

ALBOUY, D.; EHRLICH, G**. Housing productivity and the social cost of land-use restrictions**. Journal of Urban Economics, ed. 107. p. 101-120. 2018.

ALONSO, W. **Location and land use**. Cambridge: Harvard University Press, 1964.

ALVES D. R.; **Modelos espaciais aplicadas ao mercado habitacional um estudo de caso para cidade do Recife**. 2003. Tese (Doutorado). Programa de Pós-Graduação em Economia, Universidade Federal de Pernambuco, Recife, 2003.

ALVES, J.; CAVENAGHI, S**. Domicílios e Déficit Habitacional.** Instituto Brasileiro de Geografia e Estatística, Escola Nacional de Ciências Estatísticas**,** 2006.

ARANTES, O.; MARICATO, E.; VAINER, C. **A Cidade do Pensamento Único: desmanchando consensos**. 2. ed. Petrópolis: Vozes, 2000.

AZEVEDO, S. **A crise da Política Habitacional: dilemas e perspectivas para o final dos anos 90**. In: RIBEIRO, L. C.; AZEVEDO, S. (Org.). A questão da moradia nas grandes cidades: da política habitacional à reforma urbana. Rio de Janeiro: UFRJ,1996.

BARTHOLOMEW, D. J., STEELE, F., GALBRAITH, J., MOUSTAKI, I. **Analysis of multivariate social science data**, second edition, Analysis of Multivariate Social Science Data, Second Edition. https://doi.org/10.18637/jss.v029.b13, 2008.

BARTLETT, M. **The statistical conception of mental factors**. Br. J. Psychol. Gen. Sect. 28(1), 97–104, 1937.

BETARELLI JUNIOR, A. e FERREIRA, S. **Introdução à análise qualitativa comparativa e aos conjuntos *Fuzzy* (fsQCA)**. Ed. 1. Brasília: Enap, 2018.

BICHIR, R. Determinantes do acesso à infraestrutura urbana nos municípios de São Paulo. **Revista Brasileira de Ciências**

**Sociais**, São Paulo, v.24, n.70, p. 75-89, jun. 2009.

BLOZE, G.; SKAK, M. Housing equity, residential mobility and commuting. **Journal of Urban Economics**, v. 96, p. 156-165, 2016.

BONDUKI, N. **Origens da Habitação Social no Brasil**. 4. ed. São Paulo: Estação Liberdade, 2004.

BOTELHO, A. **O Urbano em Fragmentos: A produção do espaço e da moradia pelas práticas do setor imobiliário**. São Paulo: Annablume; Fapespe, 2007.

BRANDÃO, A. B. **Problemas de teoria e metodologia na questão da habitação**. Projeto: arquitetura, planejamento, desenho industrial, construção. São Paulo, n. 66, p. 102-108, ago. 1984.

BRUECKNER , J. The structure of urban equilibria: A unified treatment of the muth-mills model. In: MILLS, E. S. **Handbook of regional and urban economics: urban economics**. Amsterdam: North Holland, vol. 2, cap. 20, 1987.

CAMARGO, C. et al. (orgs.). **São Paulo, 1975: Crescimento e pobreza**. São Paulo, Loyola, 1976.

CASTRO, G. M. C. DE. **O impacto dos componentes da infraestrutura pública sobre o crescimento das cidades brasileiras: uma análise espacial do período de 1970 a 2010.** Ribeirão Preto: Universidade de São Paulo. 2014

CORRÊA, R. L. **O Espaço Urbano**. São Paulo: ed. Ática, 2000

ERMISCH, J. F., FINDLAY, J. e GIBB, K. **The Price Elasticity of Housing Demand in Britain Issues of Sample Selection**, Journal of Housing Economics, vol. 5, p. 64-86, 1996.

FARIA, W.; BETARELLI JÚNIOR, A.; MONTENEGRO, R. Multidimensional characteristics and deforestation: an analysis for the Brazilian Legal Amazon, **Quality & Quantity: International Journal of Methodology**, v.51, n.2, 27 mar. 2019.

FLYNN, B.; SAKAKIBARA, S.; SCHROEDER, R.; BATES, K.; FLYNN, E. **Empirical research methods in operations management**. J. Oper. Manag. 9(2), 250–284, 1990.

FUJITA M. **Urban Economic Theory**. Cambridge: Cambridge University Press, 1989.

FUJITA, M.; OGAWA, H. Multiple equilibria and structural transition of nonmonocentric urban configurations. **Regional Science and Urban Economics**, vol. 12, n. 2, 1982.

FUNDAÇÃO JOÃO PINHEIRO. **Déficit Habitacional Municipal no Brasil 2010**. Belo Horizonte: Fundação João Pinheiro, 2013**.**

FUNDAÇÃO JOÃO PINHEIRO. **Déficit Habitacional no Brasil / 2013 – 2014**. Belo Horizonte: Fundação João Pinheiro, 2016**.**

FUNDAÇÃO JOÃO PINHEIRO. **Déficit Habitacional no Brasil 2009**. Belo Horizonte: Fundação João Pinheiro, 2012**.**

FUNDAÇÃO JOÃO PINHEIRO. **Déficit Habitacional no Brasil**. Belo Horizonte, 2000.

FURTADO, B.; NETO, V.; KRAUSE, C. Brasília**: Estimativas do déficit habitacional brasileiro (2007-2011) por municípios (2010)**, 2013.

GALINARI, R. **Retornos Crescentes Urbano-Industriais e *Spillovers* Espaciais: Evidências a partir da taxa salarial no estado de São Paulo**. 2006. 2006.

GARREAU, J. **Edge city**: life on the new frontier. Doubleday, New York, 1991.

GLAESER, E.; KAHN, M. Sprawl and urban growth. In: HENDERSON, H.; THISSE, J. **Handbook of regional and urban economics**. Amsterdam: North Holland, vol. 4, cap. 56, 2004.

GLAESER, E. L. et al. **Economic growth in a cross-section of cities**. Journal of monetary economics, v. 36, n. 1, p. 117–143, 1995.

GLAESER, E. L. *et al.* Growth in Cities. **Journal of Political Economy**, v. 100, n. 6, p. 1126–1152, 1992.

GOLOB, T. F. **Structural equation modeling for travel behavior research**. Transp. Res. Part B Methodol. 37, 1–25. https://doi.org/10.1016/S0191-2615(01)00046-7, 2003.

HAIR JR., J. *et al.*. **Multivariate Data Analysis (MVDA)**, 17th ed, Pharmaceutical Quality by Design: A Practical Approach. Pearson. https://doi.org/10.1002/9781118895238.ch8, 2014.

HAIR, J.; BLACK, W.; BABIN, B.; ANDERSON, R. **Multivariate Data Analysis**, 5th edn. Prentice Hall International, New York, 1998.

HARVEY, D. A Liberdade da Cidade. São Paulo: **Espaço e Tempo**. Nº 26, pp. 09 – 17. GEOUSP 2009.

HARVEY, D. **A Produção Capitalista do Espaço**. São Paulo, Editora Annablume, 2005.

HENDERSON, V. **Marshall's economies**. Cambridge: NBER, 1999. 38p. (Working paper series; 7358).

HENDERSON, V.; MITRA, A. The new urban landscape: developers and edge cities. **Regional Science and Urban Economics**, vol. 26, p. 613-643, Dec. 1996.

HOOVER. E. M. **Location theory and the shoe and leather industries**. Cambridge, MA: Harvard University, 1936.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA (IBGE). Censo Demográfico 2010 **IBGE**, 2010. Disponível em: https://www.ibge.gov.br/estatisticas/sociais/habitacao/9662-censo-demografico-2010.html?=&t=microdados. Acesso em: Acesso em: 30 out. 2016.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA (IBGE). REGIC: Regiões de influência das cidades (2007). **IBGE**, 2008. Disponível em: http://www.ibge.gov.br/home/geociencias/geografia/geografia_urbana/areas_urbanizadas/default.shtm . Acesso em: 30 out. 2016.

JACOBS, J. **The economy of cities**. . New York: Vintage Books. , 1969.

JOHNSON, A.; WICHERN, W. **Applied Multivariate Statistical Analysis**. 6th edn. Prentice-Hall, Englewood Cliffs, 2007.

KAISER, H. **The varimax criterion for analytic rotation in factor analysis**. Psychometrika 23(3), 187–200, 1958.

KOWARICK, L. **A espoliação urbana**. Rio de Janeiro, Paz e Terra, 1979.

LEFEBVRE, H. **A Revolução Urbana**. Belo Horizonte: Editora UFMG, 1999.

LEFEBVRE, H. **O Direito à Cidade**. São Paulo: Centauro, 2008.

MARICATO, E. **Brasil 2000: qual planejamento urbano?** Cadernos IPPUR, Rio de Janeiro, Ano XI, n. 1 e 2, p. 113-130, 1997.

MARICATO, E. Contribuição para um plano de ação brasileiro. In. BONDUKI, N. Habitat: **As práticas bem-sucedidas em habitação, meio ambiente e gestão urbana nas cidades brasileiras**. São Paulo, Studio Nobel, 1997. P. 39.

MARICATO, E. **Habitação e cidade**. Série Espaço & Debate. 3°ed., São Paulo: Atual Editora, 1997.

MARSHALL, A. **Principles of Economics**. Londres: Macmillan, 1890.

MCCANN, P. **Modern urban and regional economics**. Second ed. Oxford: Oxford University Press, 2013.

MILLS, E. An aggregative model of resource allocation in a metropolitan area. **American Economic Review**, vol. 57, p. 197-210, 1997.

MORAIS, M. Breve diagnóstico sobre o quadro atual da habitação no Brasil. **Políticas Sociais: Acompanhamento e Análise**. Brasília, n. 4, p. 109-118. 2002.

MOTTA, L. D**. A questão da habitação no Brasil: políticas públicas, conflitos urbanos e o direito à cidade**. Belo Horizonte: Universidade Federal de Minas Gerais, 2011.

MUTH, R. **Cities and housing**. Chicago: University of Chicago Press, 1969.

NADALIN, V. Economia Urbana e Mercados de Habitação. In: CRUZ, B. *et al.* (Orgs). **Economia Regional e Urbana**: Teorias e Métodos com Ênfase no Brasil. Brasília: Ipea, 2011. cap.7, p. 221-260.

NOAL, E.; JANCZURA, R. A política nacional de habitação e a oferta de moradias. **Textos & Contextos**, Porto Alegre, 10(01), p. 157-69, 2011.

O`SULLIVAN. **A Urban Economics**. 2 Ed., Irwin Editors, 1993.

PEREIRA, F. M.; LEMOS, M. B. Cidades médias brasileiras: características e dinâmicas urbano-industriais. **Pesquisa e Planejamento Econômico**, v. 33, n. 1, 2003.

PLANO DIRETOR DE DESENVOLVIMENTO URBANO DE JUIZ DE FORA. Prefeitura Municipal de Juiz de Fora. Juiz de Fora: FUNALFA Edições, 2004.

RAGIN, C. C. **The comparative method: Moving beyond qualitative and quantitative strategies**. Berkeley, CA: University of California Press, 1987.

RAGIN, C. **Fuzzy-Set Social Science**. Chicago: University of Chicago Press, 2000.

RAGIN, C. **Redesigning Social Inquiry: Set Relations in Social Research**. Chicago: University of Chicago Press, 2008.

RAGIN, C. Set Relations in Social Research: Evaluating Their Consistency and Coverage. **Political Analysis.** v. 14 n. 3, 2006.

REBOUÇAS, L. M. **O Planejado e o Vivido: o reassentamento de famílias ribeirinhas no Pontal do Paranapanema**. São Paulo: AnnaBlume/FAPESP, 2000.

RIBEIRO, A.; VIANA, R.; AZEVEDO, S. Déficit habitacional municipal em Minas Gerais. **Caderno de Geografia**, Belo Horizonte, vol.25, n.43, p. 144-162. 2015.

RIBEIRO, L. C. de Q.; AZEVEDO, Sérgio. **A Crise da moradia nas grandes cidades: da questão da habitação à reforma urbana**. Rio de Janeiro: Editora UFRJ, 1996.

RIBEIRO, L.; RIBEIRO, M. **IBEU: índice de bem-estar urbano**. 1a ed. - Rio de Janeiro: Letra Capital, 2013.

RODE, P.; FLOATER, G. Accessibility in cities: transport and urban form. New Climate Economy Cities, Paper 03**. LSE Cities**, London School of Economics and Political Science, London, UK, 2014.

ROSEN, S. **Hedonic Prices and Implict Markets: Product Differentiation Perfect Competition**. Journal of Political Economy 82, p 34-55, 1974.

SCHNEIDER, C. Q., GROFMAN, B. It might look like a regression equation… but it's not! An intuitive approach to the presentation of QCA and FS/QCA results. In, **Conference on Comparative Politics: Empirical Applications of Methodological Innovations**, Sophia University (pp. 15–17), 2006.

SCHNEIDER, C. Q.; WAGEMANN, C. **Standards of Good Practice in Qualitative Comparative Analysis (QCA) and Fuzzy-**

**Sets**. *Comparative Sociology*, v. 9, n. 3, p. 397 418, 2010.

SILVA, M.; BETARELLI Jr, A.; PEROBELLI, F. Socioeconomic Factors, Income Transfer Program, and the Presidential Election of 2014: Regional Voting Patterns in Brazil, **Latin American Business Review**, Teresina, 12 ago. 2019.

SOTO, H. **O mistério do capital**. Rio de Janeiro: Record, 2001.

SPEARMAN, C. **"General intelligence", objectively determined and measured**. Am. J. Psychol. 15(2), 201–292, 1904.

TIWARE, P.; PARICH, K. e PARIKH, J. **Effective Housing Demand in Mumbai (Bomday) Metropolitan Region**. Urban Studies, vol. 36, n. 10, 1783-1809. 1999.

VARIN, H. **Microeconomia: Princípios básicos**. Rio de Janeiro: Campus, 1994.

VON THÜNEN, J. H. **Der isolierte staat in beziehung auf landwirtschaft und nationalokonomie**. Hamburgo: F. Perthes, 1826.

YANG, C.S. **An analysis of institutional pressures, green supply chain management, and green performance in the container shipping context**. Transp. Res. Part D Transp. Environ. 61, 246–260. https://doi.org/10.1016/j.trd.2017.07.005, 2018.

ZHANG, F.; ZHANG, C.; HUDSON, J. **Housing conditions and life satisfaction in urban China**. Cities, vol. 81. p. 35-44. 2018.

ZHOURI, A.; TEIXEIRA, R. Paisagens Industriais e Desterritorialização de Populações Locais: conflitos socioambientais em projetos hidrelétricos. In. ZHOURI, A.; SIANO, D. B. P.; LASCHEFSKI, K. (Org.). **A Insustentável Leveza da Política Ambiental**: desenvolvimento e conflitos socioambientais. Belo Horizonte: Autêntica, 2005.

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