Brazilian National Housing Policy:

Institutional capacity and housing deficit

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Abstract

Regarding the National Housing Policy in Brazil, this paper aims to identify how institutional capacities vary into municipalities, and if this variation is related to housing deficit rates. Specific literature explains that the supply of housing services depends on the existence of agencies and resources to plan and execute public policies. This paper tests the hypothesis that there is a negative correlation between the level of institutional development and housing deficit – so that higher institutional development implies lower rates of housing deficit. An institutional development index (IDI) was created, based on the existence (or not) of Municipal Housing Fund and Municipal Housing Council. The research design combined the methods of principal component analysis, ANOVA and a regression model of ordinary least squares (OLS). Using descriptive and multivariate analysis, the main finding was that higher institutional development is associated with lower housing deficit rates in most of Brazilian municipalities.

Keywords: Brazil; Housing Deficit; Housing Policy; Institutional Capacity; Institutions; Public Policy.

1. Introduction

In the last decades, Brazil has undergone a process of fast and unplanned urbanization, motivated by migration from rural areas to cities and by changes in family characteristics (Caixa Econômica Federal 2011). One of the problems caused by this process is the high rate of housing deficit, which is a result of housing wear and tear, and also the lack of housing stock.

Housing problems impact on families' well-being and quality of life, increasing, for example, their vulnerability to economic and social problems (Inter-American Development Bank 2012).

The National Housing Policy, established in 2004, defined as main guidelines facing housing deficit and encouraging institutional development of states and municipalities – to promote better management and decentralized implementation of housing policies.

The importance of institutional capacity within municipalities is guided by the idea that the regular supply of housing services is directly dependent on the existence of agencies, resources and bureaucracies able to plan and execute public policies (Arretche 2000).

According to Bengtsson (2009), it is uncommon for researchers to analyze the housing field through a political perspective, taking under consideration relevant institutions to the provision of housing and rules of decision-making game. According to the author, housing studies have a descriptive nature and also an orientation to public policy, but, paradoxically, political science has a modest contribution in both empirical and theoretical studies on the subject.

The main purpose of this paper is to analyze the relationship between the institutional capacity and housing deficit in all the Brazilian municipalities.

2. Literature review

This section discusses Brazilian federal arrangement and its relation to the implementation of social policies, and also the importance of local institutional capacities in the management of public policies. This approach will be useful for understanding later, how is the coordinating process of the National Housing Policy by the federal government, and how its decentralized implementation of plans and programs is organized.

Literature defines federalism in different ways. It can be understood as the separation of government activities between central and local governments, in which each level has specific areas of autonomy (Riker 1964; Norris 2008), also as the distribution of

power among multiple centers or non-centralization of power **(**Elazar 1987), and a mechanism that divides functions and decisions of government (Grodzins 2013).

Decentralization is not a requirement of federalism, but it is common that these two concepts emerge together. This can be exemplified in Lijphart's (2003) definition of the consensus model of democracy, which consists in the division of power between central and non-central levels of government, in which the non-central governments exert a substantial portion of the total power. Federalism and decentralization lead to vertical sharing of power between the multiple levels of government. Therefore, decentralization can be understood as the distribution of power and responsibilities from national to subnational levels of government (Norris 2008).

Classical literature points to the advantages of a decentralized government, such as administrative efficiency, public services enhancement, greater democratic participation and better representation of citizens. These authors believe that the spread of decision-making units at local and regional level also strengthens public policy. That is possible because the regulation and provision of services could be adapted to meet the particularities of each community (Norris 2008).

On the other hand, some authors argue that the establishment of other levels of government can produce higher expenses, lower efficiency in service delivery, reduced coordination, macroeconomic instability and inequality between the administered areas (Norris 2008).

Regarding to decision-making, Weaver and Rockman (1993) point out that federal governments may have authority to intervene in a policy area without the permission of another level of government. Thus, there are risks that the different levels of government may impose conflicts in the definition of programs and policies. Tsebelis (1997) states that the greater the number of veto players within a political system the greater the difficulty to promote change in public policies.

In the specific case of Brazilian federalism, Stepan (1999) emphasizes the disproportion of representation in the Upper House and, to some extent, in the Lower House, which contributes to the structural maintenance of the *status quo*. Difficulties in decision making and governance are also explained by Norris (2008):

> As a result of divided government and the weaknesses of parties, Brazilian democracy has frequently experienced legislative-executive stalemate and logjams policymaking, generating what has been termed 'deadlocked democracy', or a crisis of governability (Norris 2008, 167).

Contrary to this literature, Arretche (2002) explains that state and local governments do not represent an insuperable veto point in Brazilian federal government's reform agenda for certain policies[1] (Arretche 2002). The design of the 1988 Constitution combined federal government's broad jurisdictional authority and limited veto opportunities for the subnational governments (Arretche 2009).

Melo (2005) explains that social policies' pattern changes – through second generation reforms[2] – were proof that the Brazilian Executive would be able to sanction its reforms in Congress and restrict subnational fiscal behavior (Melo 2005).

The democratic transition and the 1988 Constitution allowed a major change in vertical intergovernmental relations nature – the interaction between the federal government, states and municipalities. The new Constitution was responsible for decentralization in the distribution of fiscal resources and political power in Brazil (Melo 2005; Souza 1998, 2004).

During military dictatorship (1964-1985), intergovernmental relations were comparable to an unitary state. Only in the mid-1980s, with the resumption of direct elections for all levels of government and fiscal decentralization established by the constitution, Brazil has returned to a democratic federal structure (Arretche 2000).

In this context of democratization, decentralization was seen as an alternative to hyper-centralized model of social protection implemented during the authoritarian regime. Social policies' decentralization came to be seen as a way to reduce inequalities, universalize access to services and increase control of beneficiaries on public policies (Almeida 1995). Abrucio (1998) points out that the defense of decentralization in the Constituent Assembly assumed a "municipalist" feature.

The expression decentralization, according to Almeida (1995), has been used in studies of intergovernmental relations with different meanings. In general, this concept is used to represent processes of reallocation of functions and resources to subnational governments. To Arretche (2000), decentralization means the institutionalization of technical conditions in local governs for the implementation of management tasks on social policies (Arretche 2000, 16) and involves, by definition, intergovernmental relations. Based on the analytical purposes of this study, Arretche's definition seems more appropriate.

[1] The social policies evaluated by the study are: basic education, health, housing and sanitation.

[2] According to Melo (2005), two major reforms were implemented simultaneously during the two terms of Fernando Henrique Cardoso: first-generation reforms, referring to economic issues - privatization, liberalization and monetary stabilization, and the second-generation reforms, related to the social sector. The second type have, according to the author, characteristics which make difficult their adoption and implementation.

Even though 1988 Constitution has encouraged decentralization, the federal government used different mechanisms to maintain its ability to coordinate social policies. The autonomy granted to the states and municipalities did not involve its total freedom of action, nor meant less ability to control and coordinate the policies by the federal government (Arretche 2004; Gomes 2009).

As the 1988 Constitution conferred political and fiscal autonomy not only to states but also to municipalities[3], both assume the role of local management of public policies – whether on its own initiative, by adherence to a program of a more wide-ranging level of government, or constitutional obligation (Arretche 2000).

The responsibility for management of public policies has been the subject of federal bargain. Due to the high levels of poverty and the size of the target population, the implementation costs of social policies in Brazil are extremely high. Subnational entities need to assess positively the gains to take responsibility for local management and implementation of a specific policy (Arretche 2000).

2.1 Local institutional capacities

To understand the implementation of public policies in Brazil, it is important to know that they depend on: 1) the Union's, states' and municipalities' coordination capacity, 2) the institutional instruments that the policy has to encourage subnational levels to follow its overall objectives, and 3) local institutional capacity, which has a direct impact on the quality of provision and outcomes of policies (Bichir 2011).

Weaver and Rockman (1993) define capacity as the standard of government influence within the environment, producing similar results in different areas of public policy over time. They explain that possessing a high level of an specific capacity – increases – but does not guarantee a high level of government performance in the environment which this government is related.

In the study of housing policy, institutional capacity is the set of instruments to help the municipality to manage housing programs, such as: specific local agency, registration of families in need of housing; intermunicipal consortium, opportunities for citizen participation in planning housing policies (municipal housing councils or similar) and municipal housing fund (Arretche et al. 2012).

[3] "Art . 1 The Federative Republic of Brazil, formed by the indissoluble union of States and Municipalities and the Federal District, constitutes a democratic rule of law "(BRAZIL, 1988) Thus, the 1988 Constitution gave the municipalities a unique status in the world.

Souza (2004) argues that despite the varying ability of local governments to provide universal social services, many municipalities are taking on new roles in local governance as a result of federal and local policies. So, analyzing the institutional capacities that municipalities have is an important way to understand its performance on implementation and management of housing policy.

The degree of institutionalization of a public policy is associated with the possibility of maintaining a regular supply, over time, of a continuous flow of services. Therefore, it is necessary that municipalities have an agency responsible for its implementation, an specialized bureaucracy in services to be offered and a permanent source of funding (Arretche 2000). Gibbs et al., support that "[...] local and regional economic development success is linked to the presence of 'institutional capacity' or 'institutional thickness' within the region" (Gibbs et al. 2001, 103).

The "*federal induction"* is responsible for influencing the expansion of institutional capacity into municipalities, as provided by the National Housing System. In the National Housing Policy, decisions and policy formulation are made by the federal government, and local levels are responsible for the management of these programs through the institutional capacities they have (Arretche et al. 2012).

Almeida and Carneiro (2003) argue that few studies have focused on the local level of politics, although this is an aspect of extreme importance. Brazilian federation tends to be quite decentralized, and commonly, it is in the municipal level that innovative forms of policy management and citizen participation arise.

Arretche (2000) explains that there are deep inequalities between Brazilian states and municipalities, which may be economic, social, fiscal, etc. Gibbs et al. point out that

> [...] there is a growing view that economic performance is directly related to institutional capacity in particular places (Evans and Harding 1997). It has been argued that 'institutions provide the basis for localised social and economic networks and contacts and that strong institutional relations may act as a prelude to regional economic success' (Raco 1999a, 951). From a policy perspective this has frequently been taken to mean that institutional capacities are poorly developed in 'lagging' regions and that public policy should attempt to replicate – or at least facilitate – the forms of capacity found in 'successful' regions (Garmise and Rees 1997) (Gibbs et al. 2001,107)

So, investing in the adoption of local institutional capacity is considered one way to reduce inequalities between states and municipalities.

3. The National Housing Policy

The Ministry of Cities'[4] foundation in 2003, was an important step in Brazilian's urban reform. The institution of the National Department of Housing, linked to this ministry, aimed to centralize housing policies within the same body and allow its long-term planning.

The National Housing Policy (NHP), established in 2004, has defined as main goal to promote conditions of access to decent and urbanized housing, to all segments of the population, especially with low-income[5].

The National Housing System (NHS) is the main instrument of this policy, as it lays the foundations for a participatory and democratic institutional design; provides integration between the three levels of government and with public and private actors involved in the issue of housing, and defines the rules that ensure financial articulation necessary for the implementation of the National Housing Policy. To face housing deficit, the National Housing System (NHS) was divided into two subsystems: the Social Housing and the Housing Market.

These subsystems combine: 1) enlarged access to the private market for the middle classes who cannot find alternative housing and 2) providing housing for the poorer sections of the population (Maricato 2006). That makes sense, since most of the Brazilian housing deficit[6] – 81.1% – is related to families that have income of up to five minimum wages.

The National Housing Policy has also the axis of Institutional Development, which is a support plan with the following objectives: 1) strengthening the institutional, administrative and technical capacity of states and municipalities, so that they can solve housing problems and 2) assist in decentralized policy implementation.

Decentralized implementation of the National Housing Policy is based on the presence of institutional capacity within municipalities, which are responsible for local management and policy implementation. This paper creates an institutional development index (IDI) for all Brazilian municipalities. The hypothesis is that higher institutional

[4] The Ministry of Cities grouped housing policies, sanitation, traffic and transport within the same body, so that the resolution of urban problems could be integrated.

[5] The National Housing Policy has the following main components: integration of urban slums, urbanization, land regularization, insertion of slums and housing provision.

[6] This value was calculated from the sum of the housing deficit for households without income (3.95%), households of 0-3 minimum wages (62.7%) and households with income of 3-5 minimum wages (14.5 %), based on data from the João Pinheiro Foundation – FJP (2013).

capacity of the municipality is associated to better management and local performance of housing policy. Therefore, lower rates of housing deficit are expected.

4. Methodology

In order to facilitate replicability[7] of the research findings (King 1995), this section describes the methodological procedures used in this study. Table 4.1 below summarizes this information:

Table 4.1 – Research Design and variables description

Research unit	Municipalities (n = 5.565)		
Research techniques	Descriptive statistics, principal component analysis (PCA), analysis of variance (ANOVA) and ordinary least squares regression (OLS)		
Variables	**Name**	**Description**	**Source**
Dependent	Housing Deficit	The total deficit consists of four components: 1) substandard housing, 2) family cohabitation, 3) excessive burden on rent and 4) increased density in rented properties.	Institute for Applied Economic Research (2013)
Independent	Local agency to manage housing policy (V_1)	Refers to the existence of specialized bureaucracies to manage housing programs.	Survey of Municipal Basic Information (2009)
	Municipal Housing Plan (V_2)	Definitions of housing policy at the municipal level.	Survey of Municipal Basic Information (2009)
	Municipal Housing Council (V_3)	Supervise and sets the guidelines and priorities of housing policy and housing projects. It is a public arena – advisory and/or deliberative, responsible for supervising housing policy. The council consists of public agencies, the private sector and representatives of civil society.	Survey of Municipal Basic Information (2009)
	Municipal Housing Fund (V_4)	Source of funds to finance housing programs.	Survey of Municipal Basic Information (2009)
	Registration of families interested in housing programs (V_5)	Register or source of information about families that need housing.	Survey of Municipal Basic Information (2009)
	Public Intermunicipal Consortium (V_6)	Public association between two or more municipalities for the implementation of projects and services of common interest to promote regional development.	Survey of Municipal Basic Information (2009)
	Public State Consortium (V_7)	Public association between municipalities and states for the implementation of projects and services of common interest to promote regional development.	Survey of Municipal Basic Information (2009)
	Public Consortium with the Federal Government (V_8)	Public association between municipalities and the federal government for the implementation of projects and services of common interest to promote regional development.	Survey of Municipal Basic Information (2009)
	Geographic Region	Brazilian territory is officially divided into five regions: North, Northeast, Midwest, Southeast and South	Brazilian Institute of Geography and Statistics
	GDP per capita	Shows the economic output in a territory, in relation to their population quota. It is calculated by dividing the Gross Domestic Product (GDP) by the total resident population.	Brazilian Institute of Geography and Statistics (2010)
	Urbanization rate	Reflects the percentage of the population living in urban areas.	Atlas of Human Development (2013)
	Gini Index	Reflects inequality in income distribution, ranging from 0 to 1 - zero being the complete equality of income, and one the complete inequality.	Atlas of Human Development (2013)

Source: Author.

[7] "The replication standard holds that sufficient information exists with which to understand, evaluate, and build upon a prior work if a third party could replicate the results without any additional information from the author […] The most common and scientifically productive method of building on existing research is to replicate an existing finding – to follow the precise path taken by a previous researcher, and then improve on the data or methodology in one way or another. This procedure ensures that the second researcher will receive all the benefits of the first researcher's hard work" (King 1995, 444-445).

The choice of housing deficit as the dependent variable is that this is the official indicator used to guide housing policies in Brazil (Furtado, Lima Neto and Krause 2013). The formulation of the concept and calculation methodology has been adapted over the years by João Pinheiro Foundation, and was adopted by the Ministry of Cities[8].

The variables of institutional capacity – V_1, V_2, V_3, V_4, V_5, V_6, V_7 e V_8 – were taken from the Survey of Municipal Basic Information (2009)[9]. Based on the responses (yes or no) to each of these questions it is possible to affirm the presence or absence of institutional capacities within the municipal administration. Operationally, the variables were coded with one – when the municipality has an specific institutional capacity, and zero otherwise.

Principal component analysis (PCA)[10] was used in order to measure the Institutional Development Index (IDI). Afterward, the indicator has been standardized from 0 and 1, and the municipalities were organized into groups of low, medium or high IDI. The analysis of variance (ANOVA) defined whether there was significant difference between the means of housing deficit for the three groups above. Finally, the ordinary least squares regression (OLS) was used to verify the relationship between the dependent variable – housing deficit – and the independent variables, in particular institutional development index (IDI). The hypothesis tested is that the higher the index of institutional development, the lower is the housing deficit (HD).

One last important aspect to be mentioned is about the number of cases. This study works with all 5,565 Brazilian municipalities. Thus, the presentation of the results will focus on the magnitude of the effect of IDI on the housing deficit, and not on the significance[11] of results. This position is based on the idea that it does not make sense to estimate the p-value when analyzing the population (Figueiredo Filho et al. 2013). For Hair

[8] For the official calculation methodology, see João Pinheiro Foundation (2011).

[9] The Brazilian Institute of Geography and Statistics is an entity of the Federal Government, under the Ministry of Planning, Budget and Management and is the leading provider of data and information in the country. Its Survey of Municipal Basic Information has as research unit the municipality, and the main informant is the City Hall of each city. The basic questionnaire's information collection is performed by personal interview. Data is available at:
http://www.ibge.com.br/home/estatistica/economia/perfilmunic/2009/default.shtm.

[10] To perform PCA it is recommended to use numeric variables, but this does not exclude the possibility of using categorical ones. In such cases, Hair et al. (2010) suggest that they should be transformed into dummy variables coded in 0 and 1. The variables used in this study to compose the IDI are from Municipal Basic Information Research (2009), and they are all categorical. Therefore, it was necessary to recode them into dummy variables.

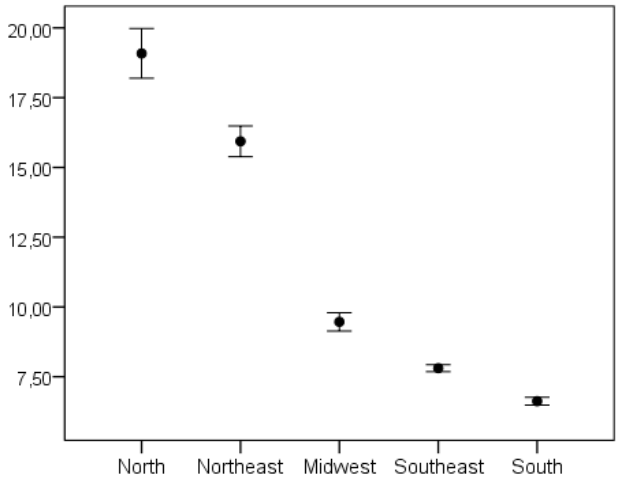
[11] "[...] the automatic use of a significant/non-significant binary decision rule is that it encourages practioners to ignore observed potentially important differences in support of the usually less interesting null hypothesis" (Gelman and Stern 2005, 2).

et al. (2010), the use of the population turns statistical inference unnecessary, since any relationship, however small, exists in reality. This is because the observed result already represents the value of the population parameter, and there is no need of statistical significance tests.

5. Results[12]

This section emphasizes the graphical display of results (Kastellec and Leoni 2007) since they use less space than the original tables and facilitate substantive understanding of the observed results (Gelman, Pasarica and Dodhia 2002). The first step is to analyze the distribution of the dependent variable: housing deficit[13].The graph 5.1 summarizes this information:

Graph 5.1 – Housing deficit (%) by region



Source: Author.

The error bar chart illustrates the variation of housing deficit in Brazil by region, at a confidence interval of 95%. The black balls represent the average of each region and the stems represent the upper and lower limits of this range.

Large inequalities among Brazilian regions can be easily noticed by the graph. The northern region has the highest deficit rate, 19.08%, while the southern region has a 6.62% mean, the lowest of the distribution. The North and the Northeast regions are those that

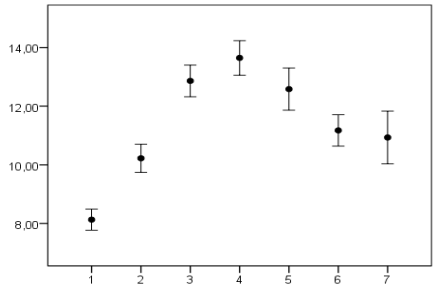
[12] Database available at: http://thedata.harvard.edu/dvn/dv/br_housing_policy.

[13] The housing deficit variable was standardized, and values exceeding three standard deviations from the mean were classified as outliers (Paulo and Rodrigues 2007) and removed from the analysis. The population decreased from 5,565 to 5,499 cases, after excluding 66 municipalities. The command used in SPSS to standardize the variable was: analyze> descriptive> descriptive statistics. After choosing the variable to be standardized, you must select the option *save standardized values as variables.*

need the most urgent focused actions, because they have much higher averages than the others.

The graph 5.2 shows the distribution of housing deficit through the population sizes[14] of municipalities.

Graph 5.2 – Housing deficit (%) by population size

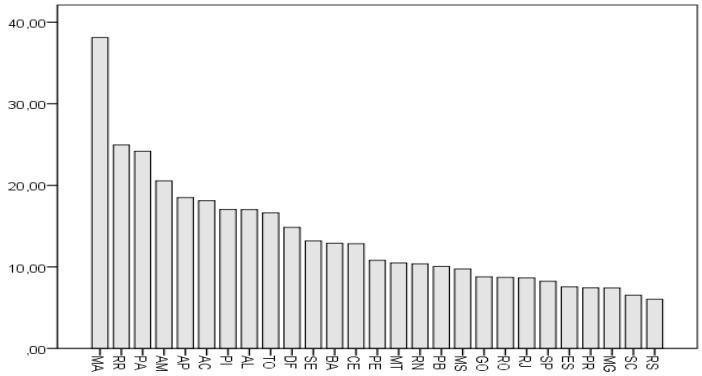


Source: Author.

In this graph, we notice that the housing deficit means exhibit an upward trend until the size 4 – point at which values start to diminish. The municipalities of size 4, with population from 20,001 to 50,000 inhabitants, have the highest rates of deficit, 13,64%. One option to reduce the national housing deficit mean would be, for example, promoting housing policies specifically to the districts of sizes 3, 4 and 5, since these have the highest averages of housing deficit in comparison to the others.

The graph 5.3 represents the distribution of housing deficit through the states.

Graph 5.3 – Housing deficit (%) by states



Source: Author.

[14] The Brazilian Institute of Geography and Statistics officially defines seven population sizes for municipalities: 1 - up to 5,000 inhabitants, 2-5001 to 10,000, 3-10001 to 20,000, 4-20001 to 50,000 5 - 50,001 to 100.00 6 - 100,001 to 500,000 and 7 - more than 500,000.

The state of Maranhão (MA) is the case that most deviates from the others, with an average of 33.11%. This state is the one that needs more urgent attention from public policies. Except the Federal District (DF), the ten states with the highest housing deficit rates are situated in the North and Northeast regions, reinforcing the tendency found in Graph 5.1. Rio Grande do Sul (RS) has an average of 6.02%, and is the state with the lowest housing deficit rate in Brazil.

After presenting the distribution of the dependent variable, the next step is to demonstrate how was the construction of the institutional development index[15] (IDI), the independent variable. This may help the use of this tool by students, researchers and managers/evaluators of public policies. The reduction method chosen was the principal component analysis (PCA), which was done in an exploratory way[16] to assess the pattern of correlation between the original variables and the extracted components (Figueiredo Filho and Silva Jr. 2010). Initially, eight variables were chosen to compose the index. All of them were taken from the Survey of Municipal Basic Information, (2009), and are related to housing. The list of selected variables was:

(V_1) municipal agency for housing management;
(V_2) municipal housing plan;
(V_3) municipal housing council;
(V_4) municipal housing fund;
(V_5) registration or survey of families interested in housing programs;
(V_6) intermunicipal public consortium;
(V_7) state public consortium,
(V_8) public consortium with the federal government.

It would be too arbitrary to assume that these variables have the same importance in reality (e.g. the local body has the same weight of municipal housing plan). The principal component analysis seems like an alternative to this problem, since it allows grouping the information of the original variables into a smaller set, the component, with minimal loss of information. In addition, it helps identifying which variable contributes most to extract the component itself (communalities).

[15] As explained Jannuzzi (2005) "the good practice of social research recommends that procedures for constructing the indicators are clear and transparent, that methodological decisions are justified, that subjective choices - invariably frequent - are explained objectively" (JANNUZZI 2005: 141).

[16] According to the authors, the exploratory factor analysis is used in the earliest stages of research and "[...] can be used to create independent or dependent variables that can be subsequently used in regression models " (Figueiredo Filho and Silva Jr 2010,v165).

In this procedure, one of the criteria defined by Hair et al. (2010) is that the variables should have a minimum correlation of 0.3. The correlation matrix[17] demonstrated that only four variables met this criterion: V_3 (municipal housing council), V_4 (municipal housing fund), V_7 (public state consortium) and V_8 (public consortium with the federal government).

The first principal component analysis was performed based on the variables V_3, V_4, V_7 and V_8. However, this set of variables violated the assumption of the simple structure of components[18] (Hair et al. 2010). This is because a variable cannot contribute simultaneously to the construction of different factors. The acceptable limit of a variable's contribution in the factor creation, in order to avoid the problem of indeterminacy is 0.40 (Figueiredo Filho and Silva Jr 2010).

There was no theoretical reason to justify the distribution of these variables in two different factors, so it did not make sense to rotate the component matrix. It is very possible that the data structure – dummy variables – has hindered the union of the variables in an unidimensional construct. After numerous attempts, the most parsimonious and representative (Hair et al. 2010) model included only two variables: V_3 (Housing Council) and V_4 (Housing Fund)[19]. And it is based on these two that the institutional development index (IDI) was created.

For more accurate results, the principal component analysis[20] was performed for each of the seven population sizes[21] established by the Brazilian Institute of Geography and Statistics. This way, municipalities were divided according to their population, providing more similarities with each other.

Hair et al. (2010) recommended at least five cases for each variable included in the model. As two variables are used, this recommendation was reached for all sizes, as we can see in table 5.1 below:

[17] See Appendix 1.

[18] See Appendix 2.

[19] As the number of variables used in the principal components analysis is reduced, it is necessary to be cautious in interpreting the results (Hair et al. 2010).

[20] The principal component analysis was performed using SPSS. The commands are: analyze > reduction > factor. In descriptivs, select the option *Bartlett's sphericity test and KMO*. On extraction, select *principal components*. In scores, choose the option *save as variables* and in method select *regression*.

[21] The division of the file in SPSS was done by: data> split file> compare groups. In *groups based on,* the variable "population size" was selected.

Table 5.1 - Number of cases per variable

Population size	N	Reason case / variable
1	1276	638
2	1196	598
3	1387	693.5
4	1034	517
5	324	162
6	244	122
7	38	19

Source: Author.

The Kayser-Meyer-Olkin test (KMO) varies between 0 and 1 and indicates if the factors found in the principal component analysis can satisfactorily describe the variations in the original data (Bezerra and Corrar 2006). Hair et al. (2010) considered 0.5 as the minimum acceptable value, and this requirement was fulfilled by the seven population sizes. The Bartlett's sphericity test reveals if there is sufficient correlation between the variables to continue the procedure (Hair et al. 2010). This test was significant for the seven population sizes[22].

Hair et al (2010) define communality as the variance shared by variables in the analysis. In general, the commonality is the fraction of the variance of a variable included in the analysis which is explained by the extracted components. Although there are no set parameters, usually the minimum acceptable value is 0.5 (Figueiredo Filho and Silva Jr 2010). The communalities for each of the seven population sizes are listed in Table 5.2 below:

Table 5.2 - Communalities

Population size	Variable	Initial	Extraction
1	$\mathbf{V_3}$	1,000	0,822
	$\mathbf{V_4}$	1,000	0,822
2	$\mathbf{V_3}$	1,000	0,818

[22] See Appendix 3.

	$\mathbf{V_4}$	1,000	0,818
3	$\mathbf{V_3}$	1,000	0,815
	$\mathbf{V_4}$	1,000	0,815
4	$\mathbf{V_3}$	1,000	0,827
	$\mathbf{V_4}$	1,000	0,827
5	$\mathbf{V_3}$	1,000	0,825
	$\mathbf{V_4}$	1,000	0,825
6	$\mathbf{V_3}$	1,000	0,745
	$\mathbf{V_4}$	1,000	0,745
7	$\mathbf{V_3}$	1,000	0,762
	$\mathbf{V_4}$	1,000	0,762

V_3 = municipal housing council

V_4 = municipal housing fund

Source: Author.

For population size 1, for example, 82.2% of "municipal housing council" and "municipal housing fund" variance is explained by the extracted component, while for the population size 7 this value is 76.2%.

The *Eigenvalue* was the first criterion used for extraction, which suggests that only factors/components with values bigger than one should be extracted (Figueiredo Filho and Silva Jr 2010). This is because in the PCA, each variable contributes in one (1) to the total value of the *eigenvalue,* then only the components with a value higher than one will be significant (Hair et al. 2010). For each of the seven population sizes, only one component was extracted.

The second criterion was the percentage of explained variance. For Hair et al. (2010), in Social Sciences, since information is generally less accurate, the minimum of 60% is considered satisfactory. For all population sizes, the percentage of variance explained by only one component exceeded that threshold. Table 5.3 summarizes this information:

Table 5.3 – *Eigenvalue* and *%* of variance

Population Size	*Eigenvalue*	% Of variance
1	1,645	82.248
2	1,636	81.778
3	1,630	81.510
4	1,655	82.745
5	1,651	82.547
6	1,490	74.520
7	1,524	76.197

Source: Author.

Finally, we will examine the component matrix[23], which contains the factor loadings for each variable within a component[24]. Factor loadings are the correlation between the variable and the factor, so, they are values that define the role of each variable in defining that specific factor/component (Hair et al. 2010).

Table 5.4 – Component Matrix

		Component
Population Size	**Variable**	**1**
1	V_3	0.907
	V_4	0.907
2	V_3	0,904
	V_4	0,904
3	V_3	0.903
	V_4	0.903
4	V_3	0,910
	V_4	0,910
5	V_3	0,909

[23] The reliability analysis was performed using the Cronbach's alpha for the seven population sizes. The minimun value acceptable by Hair et al. (2010), in case of exploratory analysis, is 0,6. The results, for population sizes, were respectively: 1) 0,784, 2) 0,777, 3) 0,773, 4) 0,791; 5) 0,788, 6) 0,652 and 7) 0,644.

[24] Since only one factor was extracted in each of the seven models, there was no need to rotate the matrix to assess the significance of variables within the factor/component.

	V_4	0,909
6	**V_3**	0,863
	V_4	0,863
7	**V_3**	0,873
	V_4	0,873

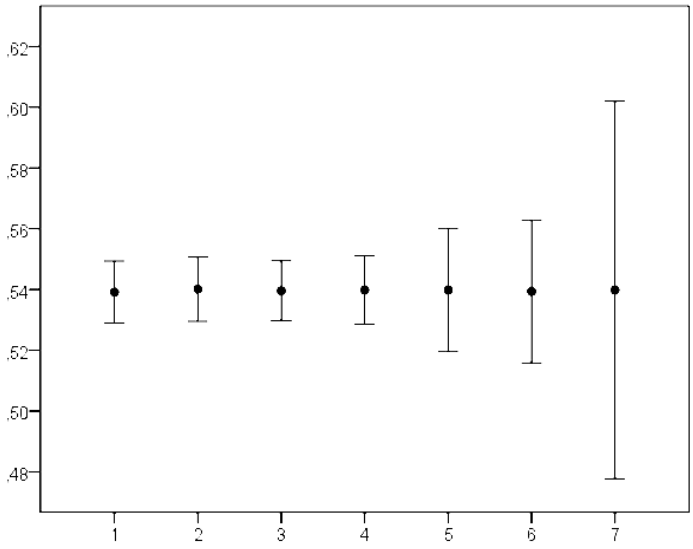
V_3 = municipal council housing

V_4 = municipal housing fund

Source: Author.

After explaining the steps to the composition of the institutional development index (IDI), the next step is to make a descriptive analysis of its distribution. The values were recoded from 0 and 1 to facilitate interpretation[25] . The closer to one, the higher the institutional development. The graph 5.4 shows that there are insignificant differences between the means of institutional development index (IDI), when comparing by population size of the municipality.

Chart 5.4 - IDI by population size



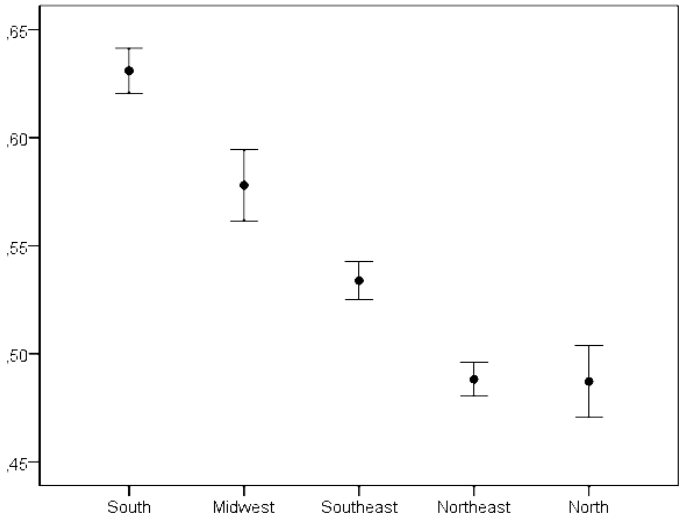
Source: Author.

In this distribution, the difference between the highest and lowest average of institutional development index (IDI) is practically equal to zero (0.0009). The differences between the means may be seen more clearly by analyzing IDI by regions. The southern

[25] Standardization of the index was made by the following steps: 1. transforming> calculate variable. The original values of the indicator were added to the minimum value of its distribution (-2.899). This way, the variation became completely positive, ranging from 0 to 4.37. 2. The positive values were divided by (1 + 4.37), producing a new variable (*recoded institutional development index*).

region has an average of 0,631, the highest of the distribution, followed by the Midwest, with 0,578. Northern and Northeastern have almost the same mean, 0.487 and 0.488, respectively. The graph 5.5 shows this information:

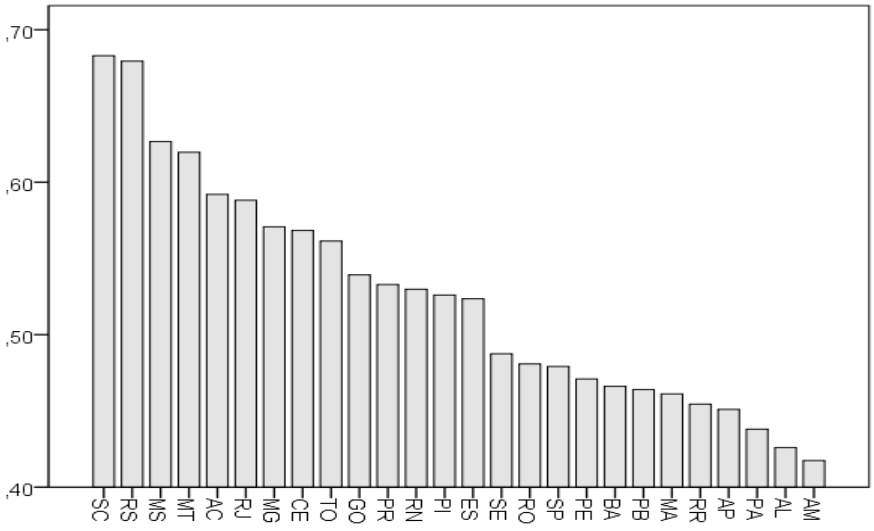
Graph 5.5 - IDI by region



Source: Author.

The national average of institutional development index (IDI) is 0.5397. The state of Santa Catarina (SC) is the one with the highest means in the country, 0,683 - followed by Rio Grande do Sul (RS), with a mean of 0.679. These two states, as we saw previously, are those with the lowest means of housing deficit in Brazil. Graph 5.6 below shows the IDI distribution by states:

Graph 5.6 - IDI by states



Source: Author.

The lowest IDI means belongs to Amazonas (AM), 0,417, followed by Alagoas (AL), 0.426. Curiously, the six states with the lowest means of institutional development index (IDI) in Brazil compose the list of the ten states with the highest means of housing deficit.

Municipalities were also grouped[26] according to their institutional development index (IDI). We opted to split them into three groups: 1) low (0,00 to 0,45), 2) medium (0,46 to 0,68) and 3) high (0,69 to 0,81) institutional development. Group 1 consists of 2,730 municipalities, 1,084 for group 2, and group 3 has 1,684 municipalities.

Through the analysis of variance[27] (ANOVA), we verified if there were mean differences among the three groups of IDI. ANOVA is an univariate procedure that evaluate differences between groups simultaneously, using a continuous dependent variable. This procedure revealed a significant difference of means between at least one of the groups.

The analysis of multiple comparisons (table 5.5) has shown that there are differences between the three groups of IDI when the low group is taken as the reference category:

Table 5.5 - Multiple Comparisons

IDI groups (I)	(J)	Mean difference (IJ)	Standard error	Sig.
Low	Medium	1.47	0,313	0,000
	High	2.36	0,271	0,000

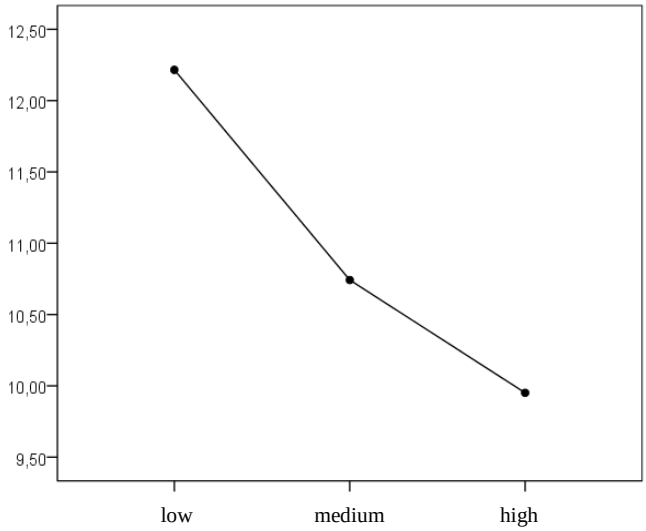
Source: Author.

The difference of means between low and medium IDI groups is approximately 1.47, and between the low and high group is approximately 2.36. The graph below facilitates the visualization of these differences:

[26] Initially, the attempt was to organize the municipalities through cluster analysis, using the non-hierarchical k-means method. This procedure divided municipalities into three clusters, with a huge difference in the number of municipalities per group. Group 1 had 32 municipalities, while groups 2 and 3 had 2,932 and 2,535 municipalities respectively. The alternative option was to analyze the frequency distribution of values for the index, and establish arbitrary division between low, medium and high IDI, composing each group with a similar number of municipalities.

[27] The comparison of averages in SPSS is done by: analyze> compare means> one factor ANOVA. "Housing deficit" was chosen as the dependent variable, and "index recoded into three groups" was chosen as factor. In *Post-Hoc* it was selected the option *Tukey* and in options *graph of means*.

Graph 5.7 - Graph of means



Source: Author.

Based on this, we can say that higher institutional development is associated with lower means of housing deficit, which reinforces the hypothesis of this paper.

The last step is to measure the magnitude effect of institutional development index (IDI) on housing deficit, through the ordinary least squares regression model.

The multiple regression analysis is used to estimate the relationship between a dependent variable (Y) and a set of independent variables (X_1, X_2, X_3...), also called predictive (Hair et al. 2010). The function[28] of OLS looks for the best fit of the data in a straight line – to minimize the sum of squared residuals. Which means that OLS regression "[...] minimizes the error to understand/explain/predict Y values from the values of X" (Figueiredo Filho et al 2011, 51). The residuals are the difference between the estimated and observed values – and the smaller these values, the better the fit of the model to the reality.

In this study, ordinary least squares regression was performed, as well as principal component analysis, for the seven population sizes. So, it is possible to estimate the magnitude of the results for groups of municipalities which have similar population. In the final model, housing deficit[29] was selected as the dependent variable and the independent

[28] This is a multiple regression because there is more than one independent variable. The model can be described by the following equation: $y = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + ... + \varepsilon$. Where y = dependent variable, X = independent variable, α = constant (does not depend on x), b = independent variable coefficient or regression coefficient and ε = error, i.e. the variation of y that is not explained by the model.

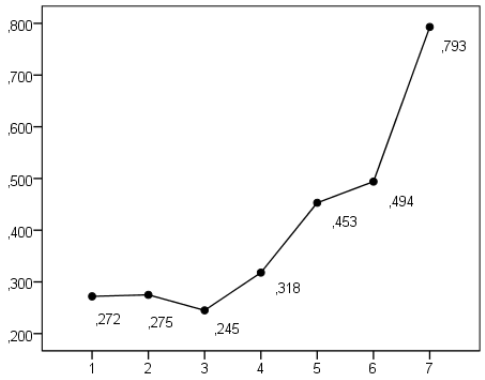
[29] This variable is quantitative and continuous, as the model predicts (Figueiredo Filho et al. 2011)

variables were: institutional development index (IDI), urbanization rate, GDP per capita, the Gini index, and geographic region[30].

Because this method assumes a linear relationship between variables, it was necessary to transform[31] the urbanization rate and the GDP per capita, because of their asymmetric distribution. The geographical region, as a categorical variable, also needed to be transformed. Hair et al. (2010) explain that to represent L categories ($L-1$) dummy variables are needed. Since there are five Brazilian regions, the North was taken as reference category and four dummy variables were created (e.g. the municipality belongs to the Northeast? Yes = 1, No = 0).

The first coefficient of interest is the R^2 (coefficient of determination)[32], which ranges from 0 to 1, and measures the proportion of the variance in the dependent variable which is explained by the independent variables. The values of R^2 may be seen in Figure 6.8 below:

Graph 5.8 - R ² by population size



Source: Author.

In population size 1, for example, 27.2% of the variance in the dependent variable is explained by the independent variables of the model. In population size 7, the explained variance is the highest: 79.3%. It is important to remember that the concern of the analysis should not be in the production of a bigger[33] R^2. The focus should be on the magnitude of the coefficients and their relationship with the working hypothesis (Figueiredo Filho et al. 2011).

[30] The estimated model was exactly the same for all population sizes, i.e. the same variables were used in all of them.

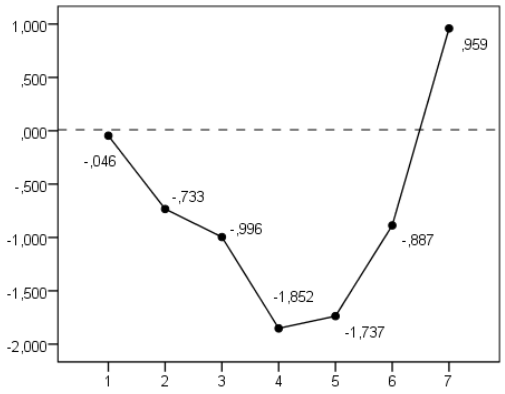
[31] The alternative chosen was a logarithmic transformation (Gelman and Hill 2007). To run it on SPSS the commands are: transform> calculate variable. In "Special Functions and Variables" select the option *Ln* .

[32] See Appendix 4.

[33] See Gary King (1986) " *How not to lie with statistics: Avoiding common mistakes in quantitative Political Science".*

The α, constant or intercept, is the value expected in the dependent variable when all the independent variables assume the value of zero. This coefficient will not be analyzed, because in this case, it has no substantive interpretation. The analysis will be based on the regression coefficient (β), checking its relationship to what is theoretically expected. The hypothesis of this study is that higher levels of institutional development are associated with lower rates of housing deficit. Thus, it is expected to find a negative correlation between IDI coefficients and housing deficit. Graph 5.9 illustrates the value of the (β) for the variable IDI:

Graph 5.9 - Regression coefficient (β) by population size



Source: Author.

The relationship theoretically expected – x (IDI) exerting a negative effect on y (housing deficit) – was observed in six of the seven population sizes. So, the null hypothesis could not be rejected only for population size 7, which municipalities have population above 500,000.

The value of β can be interpreted in two ways[34]: 1) the observed change in y when we elevate one unit on x, maintaining everything else constant (Hair et al. 2010) and 2) the average change on the dependent variable, when comparing two groups that differ in one unit in the independent variable analyzed, keeping the others constant (Gelman and Hill, 2007). The first approach may be considered counterfactual, while the second is called predictive (Gelman and Hill, 2007).

For the first populational size, the regression coefficient of the variable IDI was – 0.046. This implies, for example, that an increase of 100 units in the IDI reduces by 4,6% the mean of housing deficit in these municipalities, keeping constant the other

[34] Note that as the analysis takes into account the population, the significance of the variables was not taken into consideration. However small, the effects found in reality exist and cannot be ignored. This discussion is better presented in the *methodology* section of this paper.

variables. That is, the mean difference of housing deficit in municipalities that differ by one unit of IDI is – 0,046, keeping all other variables constant.

For the municipalities of population size 4, the increase of one unit in the IDI, maintaining everything else constant, is associated with an average reduction of approximately 1.9% on housing deficit. Thus, municipalities that have one more unit of IDI, have housing deficit means 1.9% lower, compared to municipalities that do not have it – keeping other variables constant.

The same interpretation works for sizes 2, 3 and 5, except for population size 7. In the latter, although β is positive, it makes no sense to claim that the increase of one unit in the IDI was associated with an increase of 0.96% in housing deficit. So what explains this result?

The population size 7 is composed by the cities of population over 500,000 – which are capitals or cities that belong to metropolitan areas. In this case, it is possible that the enormous complexity of social, economic, political, urban, etc. relations has not been sufficiently explained by the specified model, although the R^2 has had a relatively high value. This is an interesting finding of this study, which needs further research and explanation.

6. Conclusion

In this paper it was possible to know a little better the latest tendencies of housing policy in Brazil. We saw that decentralization and institutionalization of public policies at the municipal level have been stimulated since the promulgation of the 1988 Constitution. Although policy definitions and distribution of the National Housing Policy resources are made by the federal government, municipalities are largely responsible for its implementation.

Descriptive and multivariate data analysis has led to some important conclusions. As the literature predicted, the results of public policies vary between regions and states. The southern states have the highest means of institutional development, and the lowest means of housing deficit. In the opposite situation we have the North region, whose states generally have high means of housing deficit and low IDI means.

Through the variance analysis and multiple comparisons it was possible to conclude that there are differences between the means of housing deficit for groups of low, medium and high IDI. This implies that the low IDI group has, on average, higher means

of housing deficit. Hence, having higher institutional development makes the difference for a better performance in housing policy.

This tendency was also confirmed by ordinary least squares regression. For most population sizes, the relationship between IDI and housing deficit was negative, reinforcing the hypothesis tested on this paper. The unexpected behavior of population size 7 municipalities still needs to be further studied.

Therefore, invest and encourage institutional development in Brazilian municipalities seems to be an alternative to promote housing deficit reduction.

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Appendix

Appendix 1 – Correlation matrix

	V_1	V_2	V_3	V_4	V_5	V_6	V_7	V8
V_1	1							
V_2	0,136**	1						
V_3	0,226**	0,240**	1					
V_4	0,228**	0,230**	**0,653****	1				
V_5	0,202**	0,148**	0,214**	0,215**	1			
V_6	0,032*	0,018	0,038**	0,029*	0,016	1		
V_7	0,106**	0,062**	0,070**	0,060**	0,125**	0,067**	1	
V_8	0,132**	0,092**	0,084**	0,111**	0,159**	0,034*	**0,515****	1

** Correlation is significant at the level 0,01.

* Correlation is significant at the level 0,05.

(V_1) local agency to manage housing policy
(V_2) municipal housing plan
(V_3) municipal housing council
(V_4) municipal housing fund
(V_5) registration of families interested in housing programs
(V_6) public intermunicipal consortium
(V_7) public state consortium
(V_8) public consortium with the federal government

Appendix 2- Component matrix

	Component	
	1	**2**
V_3	0,780	-0,467
V_4	0,786	-0,456
V_7	0,497	0,717
V_8	0,537	0,684

Appendix 3 – Bartlett's sphericity test and KMO

Population size	KMO	Bartlett's sphericity test (sig.)
1	0,500	0,000
2	0,500	0,000
3	0,500	0,000
4	0,500	0,000
5	0,500	0,000
6	0,500	0,000
7	0,500	0,001

Apendix 4 – Model summary

Population size	R	R^2	Ajusted R Square	Standard Error of the Estimate
1	0,522	0,272	0,268	5,60838
2	0,525	0,275	0,270	7,23838
3	0,495	0,242	0,241	8,94034
4	0,564	0,318	0,312	7,98988
5	0,673	0453	0,439	4,92906
6	0,703	0,494	0,477	3,07037
7	0,891	0,793	0,734	1,38982