Housing Development in Latin America and the Caribbean: its measuring and its economic determinants

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Abstract

This text briefly describes the Housing Development Index (HDI). Following a concise introduction on the reasons for this research, HDI’s methodology, characteristics, properties and databases supporting its calculation are discussed. Next, the third part presents, analyzes and compares the HDI’s figures for Brazil and some other Latin American countries. The part that follows shows HDI figures for all states in Brazil and points out the regional differences and the indicator’s recent growth. Then, this paper analyses the influence of some social and economic variables on the HDI and, finally, it makes some considerations on HDI.

1. Introduction

Since the early 90s, the United Nations Development Program (UNDP) has been keeping track of the performance of several countries based on a new approach: that of human development. According to this approach, human development should be seen as development for the people, of the people, and by the people. That is, human development, from the point of view of development for the people, means the sharing of the fruit borne of economic activity among all members of the population. From the point of view of development of the people, it means the education of the poorer layers of society, aimed at effective integration into the economic, political, social and cultural life of the nation (also defined as equity). Finally, development by the people means the participation of all people in the strategic decision-making process involved in development.

Consequently, human development is a broader and more complete concept: it is a “process to expand the range of options and opportunities of the people”. One of the necessary conditions for human development is economic growth; and since one other essential condition is equity, it highlights the notion of sustainable development, i.e., “the development that in equity satisfies the needs of the present generation without limiting the potential to satisfy the needs of future generations.”

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3 SindusCon-SP, secon@sindusconsp.com.br
5 Idem, page 1.
6 Idem, page 2.
In order to grasp and synthesize the various dimensions of the human development process, the Human Development Index was created. This index is calculated for many countries, and it allows us to examine and rank the present state of human development in the world. Since precise measurement is difficult, the Human Development Index has been through much methodological improvement in the last few years, while keeping its underlying concept. It states that there are three essential conditions at all levels of development, and these conditions help people to attain the opportunities and alternatives in life, namely: “to enjoy a long and healthy life, acquire knowledge and have access to the necessary resources that enable a decent standard of life.”

Within this framework, we have created the Housing Development Index (HDI). Behind this idea is the unquestionable notion that housing conditions play a central role in people’s quality of life, and consequently their development. Decent housing not only guarantees better standards of living but it is also the cornerstone of citizenship. HDI’s purpose is to measure the housing and urban development process and its direct consequences on social welfare; it is a social and economic indicator that, along with the Human Development Index, improves any analyses of a country’s progress. Thus, the HDI is a qualitative index, useful in defining and guiding housing and urban policies, as well as in comparing the success rates of such policies among various countries or regions.

This text briefly presents the HDI. The second part discusses HDI’s methodology, its characteristics, properties and databases supporting its computation. The next part presents, analyzes and compares HDI figures from Brazil and some other Latin American countries. The fourth part shows HDI for all states in Brazil and points out regional differences. The fifth part analyzes some social and economic variables on the HDI and we conclude by making some final considerations on HDI.

2. HDI’s methodology

The Housing Development Index (HDI) embodies three variables:

- An indicator that determines how structurally sound the housing is; it is the difference between the unit (1) and the “qualitative housing deficit”, which is measured by the relative number of condemned homes in comparison with the total number of occupied homes;
- An indicator that gauges housing infrastructure, i.e., the home’s access to safe water, sanitation and electric power; and
- An indicator of accommodation (i.e., the physical living space of the home), which is determined by the inverse of the number of people per home, i.e., the inverse of home density.

It was determined that each of these variables should be assigned a number from 0 to 1, i.e., zero (0) being the variable’s smallest value and one (1) the highest. These values account for each region (country or state):

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7 In Brazil, the Human Development Index is calculated by IPEA, not only for the country as a whole but also for the individual states of the federation.
8 IPEA/UNDP (1996), page 1.
9 Housing, in a broader sense, as seen below.
10 It should be said that the method for calculating the HDI is based on the method for calculating the Human Development Index, of the UNDP.
• To the percentage of proper housing, minimum of 0% and maximum of 100%;
• To the percentage of homes that have access to saferwater, sanitation and electricity, minimum of 0% and maximum of 100%;
• The ratio between the home unit and the minimum and maximum number of people living therein (3 and 8 people, respectively), i.e., 0.333 and 0.125.

To obtain the value for each of the indicators comprising the HDI, the following formula was used:

\[ \text{Indicator} = \frac{(\text{expected value} - \text{minimum value})}{(\text{maximum value} - \text{minimum value})} \]

That is, from the value of each indicator of a certain region (observed value) the minimum acceptable value for that indicator was subtracted and the result of this operation was divided by the range of the corresponding maximum and minimum values.

The formula for the accommodation indicator (physical living space) of the \( i \)-th country \( E_i \) is the result of the inverse of this same country’s density rate \( V_i \) applied to the formula above:

\[ E_i = \frac{(V_i - 0.125)}{(0.333 - 0.125)} \]

The formula for the structural soundness indicator \( A_i \) is obtained in the following way: i) by the estimate of the housing deficit of the \( i \)-th country, resulting from badly-built homes (condemned homes); ii) by the share of this deficit in the total number of occupied homes in this country (notion of qualitative deficit); and finally, iii) by the subtraction of this share of the unit (one), which results in \( D_i \).

\[ A_i = \frac{(D_i - 0\%)}{(100\% - 0\%)} \]

The formula for the infrastructure indicator involves the calculation of other parameters. First, the following is calculated: i) the relative number of homes with access to saferwater \( P_i \); ii) the relative number of homes with access to sanitation \( G_i \); and iii) the relative number of homes with access to electric power \( L_i \). Second, the weighed average of \( P_i \), \( G_i \) and \( L_i \) is taken to obtain the observed infrastructure indicator \( (T_i) \) of the \( i \)-th country \( (P_i \text{ and } G_i \text{ with a weight of 2 and } L_i \text{ with a weight of 1}) \). Finally, the infrastructure indicator in itself of the \( i \)-th country (or region) is calculated:

\[ I_i = \frac{(T_i - 0\%)}{(100\% - 0\%)} \]

The housing development index is the simple average of these indicators:

\[ \text{IDH}_{\text{Hab}} = \frac{(E_i + A_i + I_i)}{3} \]

Following UNDP’s conventions for the Human Development Index, the following ranges were established in the HDI scale:

• HDI > 0.7 means a relatively high housing development index;
• HDI between 0.6 and 0.7 means an average housing development index; and
• HDI < 0.6 means a low housing development index.

For Brazil, HDI’s calculations are based on another database. For this reason, it might be convenient to put forth the steps taken in this computation. The data used are that of Fundação Instituto Brasileiro de Geografia e Estatística (IBGE), more precisely, the micro-data of the National Survey by Household Sample (*Pesquisa Nacional por Amostra de Domicílio* – PNAD) from 1992 to 1997. The first year was chosen because of two reasons. First of all, this year followed shortly after the years in which data for the other countries were available. Secondly, by estimating values for Brazil using PNAD-92, the results obtained would allow for a comparison with those presented to Brazil in the ECLAC report. An important outcome of this decision was that the results obtained in this work were continuously compared to those of ECLAC, in order to obtain compatible figures, as a result of which the housing deficit methodology underwent fine-tuning.

Below are the PNAD variables for Brazil that were used for estimating the indicators that comprise the HDI. The home structural soundness indicator was estimated based on the following variables:

- Type of households: only improvised and collective private homes were chosen – these were called IMPROVISED;
- Predominant material used in the building of outside walls: these were restricted to homes whose walls were made of either non-finished pounded mud or salvaged wood or thatch or other discarded material or any other material not similar to brick or finished lumber – these were referred to as WALL;
- Predominant material used in covering the home: roofs made of finished lumber, galvanized steel, salvaged wood, thatch, discarded material or any other material not similar to ceramic tiles or concrete were all not considered – these were called ROOF;
- Kind of building: those households in tenements were considered structurally unsound – and they were called TENEMENTS.

To give the data consistency, double counting was eliminated among the calculated values of WALL, ROOF, IMPROVISED and TENEMENTS. Finally, unsuitable housing was counted. In order to obtain the home’s structural soundness indicator, the share of suitable housing was taken into consideration, and this figure was obtained through the difference between total homes and unsuitable homes, in the total number of households.

In calculating the second indicator, i.e., the housing infrastructure indicator, the following variables were used:

- Lighting: only homes supplied with electrical power from a utility, a generator or solar source were chosen – this value was called ELETROS;
- The origin of the water used in the household: only homes supplied by a water distribution network were considered – this value was called SAFEWATER;
- The destination of the effluents from the bathroom or toilet: only homes with sanitation were chosen – this value was called SANITATION.

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11 Or approximate, since ECLAC figures for Brazil are for 1991, a year for which there is no PNAD.

12 Please note that the variables chosen are those that show improper housing. This was used to calculate the housing deficit from a qualitative standpoint.
To estimate the infrastructure indicator, the relatives of the values ELETROS, SAFEWATER and SANITATION ($L_i, P_i$ and $G_i$, in the HDI methodology) were calculated as a function of the number of homes occupied in the region and the weighted average of the sum of these relatives was calculated (water and sewer had weight two and electricity had weight one). Thus, the infrastructure indicator mirrored the share of the households with water, sewer and electric power supplied by public or private networks, in the total number of households in each state of the federation.

The living space indicator, the third and last component of the HDI, was calculated based on the average value of households per inhabitant in each state of the federation. According to this calculation, the "acomodation" indicator is being estimated and the inverse thereof provides what is here called housing density.

3. Housing development in Latin America

The aforementioned methodology was used to calculate the HDI of some Latin American countries. Table 1 presents, per country, not only the HDI itself, but also the index of the three variables that comprise the HDI, 1987 GDP per capita in US dollars (considering purchasing power parity), as well as the year that supplied the data contained herein.

It can be seen that only Uruguay, Argentina and Chile can be called countries with a high level of housing development (HDI > 0.7). Countries with an average level of housing development (0.7 > HDI > 0.6) amount to seven: Cuba, Brazil, Costa Rica, Mexico, Venezuela, Panama and Colombia. At the other extreme, we find seven countries with a low level of housing development (HDI < 0.6), namely, Ecuador, Bolivia, El Salvador, Peru, Honduras, Guatemala and Paraguay.

A deeper analysis reveals differences in the ranking of the countries according to the HDI. It can be seen that Uruguay, the country enjoying the highest HDI, has low housing density among families and most of its household have suitable living space. In fact, Uruguay is the country in Latin America with the highest levels for these two indicators. Uruguay’s housing, on the other hand, wants for better access to safewater, sanitation and electrical energy, that is, infrastructural development\textsuperscript{13}. Argentina, with the second highest HDI in the sample, has the best distribution of services regarding housing development. Generally speaking, housing density in Argentina is low and most of its households not only are built from proper materials, but also enjoy safewater, sanitation and electric power services.

Chile is another interesting example. It is the country that has, relatively speaking, the best infrastructure for housing. In other words, Chile is the only Latin American country whose development policies have focused investments in universal access to safewater, sanitation and electric power. The physical structure of most of its homes is also much better than average, although countries such as Argentina, Costa Rica, Colombia and Uruguay have a relatively higher percentage of good quality housing. In Chile’s case, the other side of the coin is a low number of households per inhabitant, or a higher population density per household.

\textsuperscript{13} Please note that Uruguay data refers to 1985.
Table 1: Housing development index of Latin America

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Structural Soundness</th>
<th>Infrastructure</th>
<th>Accommodation</th>
<th>HDI</th>
<th>Per capita GDP in 1987 US$ PPP adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uruguay</td>
<td>1985</td>
<td>0.95</td>
<td>0.68</td>
<td>0.71</td>
<td>0.78</td>
<td>4,013.40</td>
</tr>
<tr>
<td>Argentina</td>
<td>1991</td>
<td>0.93</td>
<td>0.71</td>
<td>0.65</td>
<td>0.76</td>
<td>6,307.30</td>
</tr>
<tr>
<td>Chile</td>
<td>1992</td>
<td>0.88</td>
<td>0.80</td>
<td>0.51</td>
<td>0.73</td>
<td>7,344.20</td>
</tr>
<tr>
<td>Brazil</td>
<td>1992</td>
<td>0.86</td>
<td>0.62</td>
<td>0.56</td>
<td>0.68</td>
<td>4,357.60</td>
</tr>
<tr>
<td>Cuba</td>
<td>1981</td>
<td>0.85</td>
<td>0.66</td>
<td>0.53</td>
<td>0.68</td>
<td>-</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>1994</td>
<td>0.91</td>
<td>0.78</td>
<td>0.34</td>
<td>0.67</td>
<td>3,974.40</td>
</tr>
<tr>
<td>Mexico</td>
<td>1990</td>
<td>0.88</td>
<td>0.70</td>
<td>0.32</td>
<td>0.63</td>
<td>5,933.70</td>
</tr>
<tr>
<td>Venezuela</td>
<td>1990</td>
<td>0.85</td>
<td>0.76</td>
<td>0.27</td>
<td>0.63</td>
<td>6,237.30</td>
</tr>
<tr>
<td>Colombia*</td>
<td>1990</td>
<td>0.90</td>
<td>0.74</td>
<td>0.22</td>
<td>0.62</td>
<td>1,190.00</td>
</tr>
<tr>
<td>Panama</td>
<td>1990</td>
<td>0.84</td>
<td>0.59</td>
<td>0.45</td>
<td>0.62</td>
<td>4,546.60</td>
</tr>
<tr>
<td>Ecuador</td>
<td>1990</td>
<td>0.85</td>
<td>0.56</td>
<td>0.34</td>
<td>0.59</td>
<td>3,616.40</td>
</tr>
<tr>
<td>Bolivia</td>
<td>1992</td>
<td>0.75</td>
<td>0.38</td>
<td>0.52</td>
<td>0.55</td>
<td>2,095.70</td>
</tr>
<tr>
<td>El Salvador</td>
<td>1992</td>
<td>0.75</td>
<td>0.49</td>
<td>0.36</td>
<td>0.53</td>
<td>1,930.30</td>
</tr>
<tr>
<td>Peru</td>
<td>1993</td>
<td>0.80</td>
<td>0.47</td>
<td>0.33</td>
<td>0.53</td>
<td>2,987.10</td>
</tr>
<tr>
<td>Guatemala</td>
<td>1994</td>
<td>0.61</td>
<td>0.51</td>
<td>0.12</td>
<td>0.48</td>
<td>2,684.00</td>
</tr>
<tr>
<td>Honduras</td>
<td>1988</td>
<td>0.86</td>
<td>0.41</td>
<td>0.16</td>
<td>0.48</td>
<td>1,808.00</td>
</tr>
<tr>
<td>Paraguay</td>
<td>1992</td>
<td>0.53</td>
<td>0.27</td>
<td>0.32</td>
<td>0.48</td>
<td>2,789.00</td>
</tr>
</tbody>
</table>

* Data relative to infrastructure in Colombia are from 1992.

Brazil’s ranking in relation to other Latin American countries can be seen in Chart 1. In the fifth position (HDI of 0.68), Brazil (1992 data) is not only behind Uruguay, Argentina and Chile, but it also has lower housing development than Cuba (1981 data).
Chart 1 The ranking of HDI in Latin America

Referring back to Table 1, it can be seen that housing development in Brazil is jeopardized by the low accommodation level, i.e., a high density of families per home. This fact should be stressed, since it shows that the quantitative housing deficit in Brazil is quite significant and should be addressed when formulating housing policy. In relation to Chile, Costa Rica, Colombia, Venezuela, Argentina, Mexico, Uruguay and even Cuba, housing infrastructure, broadly speaking, is worse in Brazil. This means that Brazil should not only foster activities geared towards housing construction, to reduce the quantitative deficit, but it should also invest in infrastructure, to provide safewater, sewer and electricity.

Although this is a countrywide average, it can be said that most Brazilian homes are properly built. It should be pointed out that these numbers include homes that are "salvageable", that is, they can be properly rebuild – according to the definition given here.

Chart 1 also shows that countries with a low housing development index (HDI < 0.7) can be placed into two sub-groups. The first group, with HDI of 0.5, includes Ecuador, Bolivia, El Salvador and Peru. These countries have two traits in common: low accommodation index, i.e., a high number of dwellers per household, and a shortage of housing oriented infrastructure. In fact, Table 1 shows that these indicators have a negative effect in the HDI of all these countries. While the indicator that measures the soundness of households does little to improve the housing welfare of these countries, in two of them – Bolivia and El Salvador – this indicator is particularly low, reflecting very poorly-built homes.
The second sub-group is that comprising Honduras, Guatemala and Paraguay (HDI of around 0.4). Broadly speaking, all the indicators that form the HDI of these countries have lower values – structural soundness indicator of Honduras is an exception. This could mean that these countries have a greater need for housing services. Another peculiarity, that goes hand-in-hand with such want, is the fact that these countries have a low per capita income, in dollars, as seen in the last column of Table 1.

The next part will deal on a state by state basis with housing development in Brazil. This will provide a way to analyze the local and regional characteristics and peculiarities, in addition to draw a map of the Brazilian housing development.

4. Housing development in Brazil

Housing development indicators for the different Brazilian states are shown in Table 2, for 1992 and 1997. The last columns of this Table show the growth of housing development per state, for these two years. However, before analyzing the Table in greater depth, it would be useful to study the maps below, since they provide valuable guidelines for the information contained in the Table.

It can be seen that São Paulo, Rio de Janeiro, Minas Gerais, Espírito Santo and Rio Grande do Sul were the states that in 1992, along with the Federal District, enjoyed the highest levels of housing development (HDI > 0.7). These states were followed closely by Paraná, Goiás, Roraima, Santa Catarina, Mato Grosso do Sul, Sergipe, Pernambuco, Pará, Mato Grosso, Paraíba and Rondônia, that is, eleven states that had a medium housing development index (0.7 > HDI > 0.6). At the other end, were those states with the lowest level of housing development (HDI < 0.6): Bahia, Rio Grande do Norte, Alagoas, Acre, Amapá, Ceará, Amazonas, Tocantins, Piauí and Maranhão.

The 1997 map allows a simple and quick comparison of the changes in housing development in Brazil. Some readily stand out. While the states of Paraná, Santa Catarina, Mato Grosso do Sul and Goiás had a medium level of housing development in 1992, in 1997 they rose to a level of HDI > 0.7. That is, in these states, the housing services were improved on. Other four states also performed favorably during this period, rising from low to medium levels of housing development from 1992 to 1997. They were: Bahia, Ceará, Rio Grande do Norte and Alagoas. The only state where housing services deteriorated in the period of 1992-1997 was Pará. While this state’s HDI was of 0.61 in 1992, in 1997 this figure dropped to 0.56, which placed this state among the group of states with the lowest levels of housing development.

Between 1992 and 1997, Brazil’s HDI increased from 0.68 to 0.74 – as Table 2 shows. It can be seen in the same Table that this results from all states of the federation having improved their own housing development indexes (the only exception being Pará, as previously mentioned). It can also be noticed that HDI variations in many states are quite high, in percentage terms. Generally speaking, this shows that in these states housing services had preferential treatment, which in turn led to improved housing development. However, in some states (all of them in the North region), it should be pointed out that PNAD data refers only to the capital or metropolitan regions. Considering that in these regions the urban development process is fast paced, the growth in HDI can be overestimated. It should also be noticed that the high rate of HDI growth in some states can be attributed to the low housing development rates Brazil had in the early 90s. Piauí gives
ample evidence of this fact – while the state’s HDI rose 25.6% from 1992 to 1997, it still managed to be among the group of states with the lowest levels of housing development.

Table 2 HDI in Brazil

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rondônia</td>
<td>0.60</td>
<td>0.66</td>
<td>10.0</td>
</tr>
<tr>
<td>Acre</td>
<td>0.53</td>
<td>0.57</td>
<td>7.5</td>
</tr>
<tr>
<td>Amazonas</td>
<td>0.51</td>
<td>0.54</td>
<td>5.9</td>
</tr>
<tr>
<td>Roraima</td>
<td>0.66</td>
<td>0.68</td>
<td>3.0</td>
</tr>
<tr>
<td>Pará</td>
<td>0.61</td>
<td>0.66</td>
<td>-8.2</td>
</tr>
<tr>
<td>Amapá</td>
<td>0.52</td>
<td>0.58</td>
<td>11.5</td>
</tr>
<tr>
<td>Tocantins</td>
<td>0.45</td>
<td>0.53</td>
<td>17.8</td>
</tr>
<tr>
<td>Maranhão</td>
<td>0.35</td>
<td>0.42</td>
<td>20.0</td>
</tr>
<tr>
<td>Piauí</td>
<td>0.43</td>
<td>0.54</td>
<td>25.6</td>
</tr>
<tr>
<td>Ceará</td>
<td>0.51</td>
<td>0.60</td>
<td>17.6</td>
</tr>
<tr>
<td>Río G. do Norte</td>
<td>0.57</td>
<td>0.65</td>
<td>14.0</td>
</tr>
<tr>
<td>Paraíba</td>
<td>0.60</td>
<td>0.68</td>
<td>13.3</td>
</tr>
<tr>
<td>Pernambuco</td>
<td>0.61</td>
<td>0.68</td>
<td>11.5</td>
</tr>
<tr>
<td>Alagoas</td>
<td>0.56</td>
<td>0.63</td>
<td>12.5</td>
</tr>
<tr>
<td>Sergipe</td>
<td>0.62</td>
<td>0.67</td>
<td>8.1</td>
</tr>
<tr>
<td>Bahia</td>
<td>0.58</td>
<td>0.65</td>
<td>12.1</td>
</tr>
<tr>
<td>Minas Gerais</td>
<td>0.71</td>
<td>0.79</td>
<td>11.3</td>
</tr>
<tr>
<td>Espírito Santo</td>
<td>0.71</td>
<td>0.77</td>
<td>8.5</td>
</tr>
<tr>
<td>Rio de Janeiro</td>
<td>0.76</td>
<td>0.84</td>
<td>7.7</td>
</tr>
<tr>
<td>São Paulo</td>
<td>0.80</td>
<td>0.86</td>
<td>7.5</td>
</tr>
<tr>
<td>Paraná</td>
<td>0.69</td>
<td>0.76</td>
<td>10.1</td>
</tr>
<tr>
<td>Santa Catarina</td>
<td>0.65</td>
<td>0.73</td>
<td>12.3</td>
</tr>
<tr>
<td>Rio G. do Sul</td>
<td>0.70</td>
<td>0.75</td>
<td>7.1</td>
</tr>
<tr>
<td>Mato G. do Sul</td>
<td>0.65</td>
<td>0.71</td>
<td>9.2</td>
</tr>
<tr>
<td>Mato Grosso</td>
<td>0.60</td>
<td>0.66</td>
<td>10.0</td>
</tr>
<tr>
<td>Goiás</td>
<td>0.67</td>
<td>0.75</td>
<td>11.9</td>
</tr>
<tr>
<td>Distrito Federal</td>
<td>0.75</td>
<td>0.82</td>
<td>9.3</td>
</tr>
<tr>
<td>Brazil</td>
<td>0.68</td>
<td>0.74</td>
<td>8.8</td>
</tr>
</tbody>
</table>


This result shows that there is a degree of convergence in the Brazilian housing development, as illustrated by Chart 2, which compares the variation in the 1992-1997
period with the level seen in 1992 (once again, Pará, not shown in the chart, is the only state that evades the national trend). This means that a higher rate of housing development growth in regions where the HDI is low could eventually lead to a better distribution of welfare in housing services among states in Brazil.

In spite of the growth seen in the last few years, it must be noted that in 1997 Brazil still had not reached the development levels enjoyed by Argentina and Uruguay in the late 80s and early 90s\textsuperscript{14}. This means that notwithstanding the recent good performance, Brazil is still in fourth position in the Latin American ranking.

Tables A.1 and A.2 of the Appendix illustrate the factors that comprise the HDI (structural soundness, infrastructure and accommodation) for all states in Brazil, for both 1992 and 1997. These factors help pinpoint housing development peculiarities in these states. While the focus was concentrated on 1992 figures in the discussions surrounding the Brazilian HDI in comparison with other Latin American countries, now the focus will shift to 1997 figures, as the individual states are analyzed (Table A.2).

First of all, it is necessary to make some general comments regarding HDI components. Compared to the other two indicators (infrastructure and accommodation) the one that measures the soundness of housing structures is the most homogeneous among all states, and it also has the highest figures. For twenty states, the structural soundness indicator falls between 0.90 and 0.98. Pará, Mato Grosso and Piauí are a little below that (0.87, 0.86 and 0.81, respectively). However, the states of Acre, Amazonas and mainly Maranhão is where the highest number of homes can be found with frail structures (walls, roof, etc.) in 1997 – a fact also true back in 1992 (Table A.1). On the other hand, the states whose homes had the best structures in 1997 were São Paulo, Rio de Janeiro and Minas Gerais.

The infrastructure indicator – the third column in Table A.1 – is that which has the greatest variance in 1997. When the data are scrutinized more closely, it becomes evident that most states in Brazil offer limited water, sewer and electricity services to their inhabitants. In fact, the infrastructure indicator is low in most states and, generally speaking, below the two other indicators (structural soundness and accommodation). To cite some examples, infrastructure figures are 0.31 for Maranhão, 0.32 for Piauí and 0.33 for Tocantins. The high variance is easily explained because at the other extreme, a small group of states stands out for having well-developed housing infrastructure: São Paulo, Rio de Janeiro and Minas Gerais, along with the Federal District (> 0.7); Espírito Santo and Paraná also have favorable ratings (between 0.6 and 0.7). In 1997, speaking for the country as a whole, the infrastructure indicator had the lowest figures (0.64) among Brazilian HDI components, that is, it was the indicator that most harmed domestic housing development. It should be pointed out that this was not true back in 1992 (as seen in the last lines of Tables A.1 and A.2).

\textsuperscript{14} In 1996 Chile had already reach an IDHab of 0.80 – calculated based on data supplied by MIDEPLAN (1996).
Finally, accommodation indicator values are also quite low for all Brazilian states in 1997. This means that the average number of homes per inhabitant in each state of the federation is generally low – in other words, there is a high housing density.

Two groups of states in Table A.2 deserve deeper analysis and assessment, namely: (i) São Paulo, Rio de Janeiro, Minas Gerais, Espírito Santo, Paraná, and Rio Grande do Sul, states that enjoy the highest indexes of housing development, along with the Federal District, and (ii) Maranhão, Tocantins, Amazonas, Piauí, Acre, Pará and Amapá, states that have the lowest HDI figures.

First of all, there is a common trait in all states of both group (i) and group (ii): the physical structure (soundness) of the homes in these states is the factor that most contributes to their housing development. Second, regarding the states in group (i), while housing density pushes down the HDI for the states of São Paulo, Minas Gerais and the Federal District, it improves on the other hand the HDI for Rio de Janeiro and Rio Grande do Sul. That is to say that in the last two states, accommodation is better. Table A.2 also shows states in group i) are those with the best housing infrastructure.

Regarding the states of group (ii), it can be observed that all three components of the HDI are low. Generally speaking, infrastructure is the factor that most jeopardizes the social welfare in relation to housing in these states. This is also true for Acre, Amazonas and mainly Maranhão, states where the physical structure of homes is inadequate for most of their population. In conclusion, Table A.2 shows some correlation between per capita income and the HDI, as the next part discusses.
5. Variables determining the HDI

As already pointed out earlier, there are huge differences in housing development among Latin American countries and also among states of the Brazilian federation, although in the second case these differences have with time been narrowing. The time has come to ask which factors drive this development.

From the economic standpoint, it can be said that the degree of housing development measured by the HDI corresponds to the amount of capital used in housing services. This capital can be seen as an accumulated flow, less depreciation, of all investment in homes and housing infrastructure.

Seen from this point of view, it can be said that a higher or lower HDI arises from the variables that influence investment in housing capital. It might be useful to point to studies developed by Rebelo (1998) and Garcia and Rebelo (1998), which show the importance of income and income distribution in determining housing investment.

Chart 3 illustrates the relation between the HDI, average income\(^{15}\) and income distribution\(^{16}\) of different regions in Latin America and Brazil. There is a clear positive association between per capita income and the HDI (both in logarithmic terms), showing that a greater availability of goods and services in a country or region is associated with a higher degree of housing development. The relation between the HDI and the Gini index, on the other hand, is negative, revealing that higher income gaps between rich and poor are also associated to lower housing development. The influence of these variables in determining the HDI was estimated through linear regressions. Table 3 shows the estimated coefficients and the statistics of the HDI regressions in relation to average income, to the inequality index and, in the Brazilian case, a dummy variable that distinguishes between those states in which the survey is conducted only in the capitals and metropolitan regions and those in which the survey covers the whole state\(^{17}\).

\(^{15}\) Average income is measured in constant 1987 dollars, considering purchasing power parity. International data were obtained from the World Bank (1998). In the case of the Brazilian states, average income data refer to household income and were obtained from microdata of the PNDA – IBGE (1998).

\(^{16}\) Income inequality was measured according to the Gini index of the distribution deciles. Data relative to other Latin American countries were supplied by Tabatabai (1996) and data relative to Brazil were calculated based on data supplied by the PNDA – IBGE (1998).

\(^{17}\) For the states in the Brazilian North region, except Tocantins, the PNAD is conducted only in the capitals or metropolitan regions, as we have noted before. One consequence of this is that the IDHab of these states is overestimated, since small towns in the hinterland are not included. The North-BR dummy was created to correct this distortion. So, the states of that region are given a value of 0 and other states a value of 1.
In both regressions, the coefficients associated to income and inequality are significant to less than 5%. The $R^2$ values are high, mainly in the sample of the Brazilian states, and there is neither multicollinearity nor serial auto-correlation. Average income affects housing development positively, showing that the richer the country, the higher the availability of housing capital. On the other hand, concentrated income, i.e., a large gap between rich and poor, has a negative effect on social welfare related to housing services. Comparing the estimated coefficients for Latin America and Brazil, it is seen that the influence of income and income distribution are slightly higher in the latter case, which apparently mirrors a higher HDI dispersion among Brazilian states. Therefore, the regressions estimated in this paper show that in fact housing development is a social issue, since poverty and income discrepancies are determinant causes in the underdevelopment of some regions.
Table 3 Income and inequality as HDI determinants*

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<thead>
<tr>
<th>Variables</th>
<th>Latin America</th>
<th>States of Brazil</th>
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<tr>
<td>Constant</td>
<td>-0.039</td>
<td>-0.643</td>
</tr>
<tr>
<td></td>
<td>(-0.130)</td>
<td>(-1.949)</td>
</tr>
<tr>
<td>Average income (ln)</td>
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<td>0.190</td>
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<tr>
<td></td>
<td>(3.413)</td>
<td>(6.956)</td>
</tr>
<tr>
<td>Gini index</td>
<td>-0.563</td>
<td>-0.665</td>
</tr>
<tr>
<td></td>
<td>(-2.023)</td>
<td>(-2.104)</td>
</tr>
<tr>
<td>Dummy North-BR</td>
<td>-</td>
<td>0.135</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>(5.080)</td>
</tr>
</tbody>
</table>

Statistics

Adjusted R² | 48.1 | 77.7 |
F           | 7.481 | 31.135 |
D.W.        | 1.896 | 2.298 |
Multi-colinearity** | No | No |
Degrees of freedom (total) | 14 | 26 |

(*) Figures in parentheses represent the t values.
(**) Multicolinearity was observed through values of Tolerance and VIF.

Chart 4 HDI and HDI (IPEA/UNDP, 1996 – 1992)

From this point of view, the solution of the problems related to sound structures, housing density and housing infrastructure will necessarily come from proactive government policies that focus on better income distribution in society. This notion
becomes even clearer as the HDI is compared to the Human Development Index (HDI-UNDP) of the various Brazilian states. As shown in Chart 4, there is a close correlation between these two indexes, which stresses the initial discussion in this paper, that is, welfare resulting from housing services is an essential element in a country’s development.

6. Final remarks

The aim of this paper has been to introduce the Housing Development Index (HDI). The fact that housing conditions play an essential role in the quality of the life people enjoy, and consequently in human development, fully justifies the creation of the HDI. The analysis conducted in sections 3 and 4 has placed Brazil in the Latin American scenario and has helped the pace of housing development growth in the Brazilian states during the 90s. The article has also identified two important economic variables that affect the degree of housing development: per capita income and the gap between rich and poor.

We believe that this index will contribute to the analyses regarding housing development and its consequences on social welfare and the creation and evaluation of housing policies in different regions. Our next steps will be to analyze the HDI within broader frameworks, that is, considering mainly the institutional environment of different regions and government policies focusing on housing. For those are certainly the factors that most influence housing development in countries and states.

References


IPEA/UNDP (1996) Relatório sobre o desenvolvimento humano no Brasil, Brasília, DF: UNDP.


### Table A.1 HDI, states and Brazil, 1992

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<td>Infrastructure</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Accomodation</td>
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</tr>
<tr>
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<td></td>
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