

Residential Segregation in São Paulo: Consequences for Urban Policies

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Abstract

This paper aims at presenting the argument that segregation has a relevant impact on the access to public policies, based on the evidence provided by the case of São Paulo, Brazil. We first discuss the Brazilian urban literature on segregation. Next, we present some strategies for measuring and identifying segregated areas, such as the dissimilarity index and the Moran index (both Global and Local). Finally, we employ the data available from the “Survey of access to public services for the poorest population of São Paulo” (CEM-Cebrap/Ibope, 2004) to assess the effect of residential segregation on the population access to urban services, considering the geographic divisions provided by the Local Moran.

Introduction

Brazilian cities are highly segregated in spatial terms. Besides the prevalence of shantytowns, these cities generally present a radial-concentric urban structure, with the rich population concentrated in the center of large cities, and the poor located in peripheral, more distant areas (Santos and Bronstein, 1978; Villaça, 2000; Caldeira, 2000). In spite of its intensity, residential segregation is not a major theme in the Brazilian social debate. On the one hand, academic discussions on social issues focus rather on poverty and income inequalities; on the other, this theme is rarely used as a basis for public policies.

Such a situation may be partially explained by existing conceptual difficulties. Brazilian urban sociology originally mistook the theme of segregation for the concepts of poverty and inequality, as well as for the lack of access to basic public services. Since the 70s, the debate has geared towards the living conditions of the population in peripheral areas and shantytowns – usually composed of low-income migrants who moved to the metropolis in search of better job offers. These people had limited access to those benefits made available by the State (Camargo et alli, 1976; Oliveira, 1977; Kowarick, 1979). In this context, the concept of segregation mixed notions of poverty, inequality, and lack of access to the urban infrastructure and the services generally provided by the

State. According to Sabatini (2001), the same confusion as to the concept of segregation occurs in other parts of Latin America.

This first tradition of the Brazilian urban studies was developed during the 60s and 70s, as part of the debate on the theory of marginality¹. This mainly Marxist literature addressed the urban theme as a consequence of larger economic processes in space, specially highlighting the so-called “production” of peripheral areas as a process required by the “reproduction of the working class” at low cost (Kowarick, 1979; Bonduki and Rolnik, 1982; Maricato, 1982). Such areas would be far from the urban centers, and characterized by lack of infrastructure, precarious housing solutions (i.e., shantytowns, illegal settlements and self-built homes), and illegal land ownership. Real estate brokers and the like would speculate to develop those illegal settlements (Santos, 1979; Vetter and Massena, 1981; Bonduki and Rolnik, 1982; Maricato, 1982; Ribeiro and Lago, 1991), while the State turned a blind eye. The precarious nature of such settlements would indicate a “set of added extortions” – a situation of “urban plunder” according to Kowarick, 1979.

More recently, discussions on socio-spatial segregation have been structured around a different perspective, albeit some conceptual difficulties still persist (Villaça, 2001; Taschner and Bogus, 2000; Ribeiro and Telles, 2000). Following major international studies, issues such as “urban restructuring” and globalization emerged within the debate, returning to the traditional approach of using the urban arena as a locus for addressing “macro issues” and leaving urban studies *per se* at a secondary level. In this perspective, segregation loosely refers to residential separation between different income groups; differently from other debates – especially in the US – it does not consider racial segregation (Massey and Denton, 1993; Mingione, 1999; Jargowski, 1997; Wilson, 1990).² Residential segregation is rarely measured in empirical terms, with few studies discussing the problem from a public policy dimension. As a result, the consequences of segregation for the families and public policies are rarely considered (Torres, 2004).

¹In the 60s and 70s, the concept of “marginality” was central in the Latin American debate, specifically in reference to the issue of exclusion (or marginal integration) of the lower-income share of the population from the so-called dependent and peripheral capitalist system being then developed in Brazil. See Perlman, 1977.

²Telles, E., 2003 is one important exception.

From our point of view, an adequate empirical approach for the segregation should be based on a more detailed analysis of the urban socioeconomic landscape, and encompass at least four relevant dimensions. First, we need a segregation concept that allows for appropriate measurement. Second, criterion must be adopted to identify the most segregated areas in a given metropolis. Third, it is important to understand the phenomena and/or processes that lead to segregation – i.e., land and real estate dynamics and State policies.³ Finally, such an approach requires consideration for the socioeconomic and public policy consequences segregation has for the dwellers of those areas. Here, we attempt at addressing some of these issues by trying to understand the impact of segregation on the access to urban infrastructure services in the city of São Paulo.

1. Segregation: concepts and metrics

When working with segregation, we focus on two major dimensions: the spatial concentration patterns of given social groups in specific areas, and the degree of social homogeneity found in such areas (Torres, 2004; Sabatini, 2001).⁴ Two key issues related to this definition refer to the degree of homogeneity required to identify an area as being segregated,⁵ and the scale of segregation – influenced by area size and number of units of analysis (census tracts, districts, etc.).

Thus, segregation should be understood as the gathering of a particular group in a given area – be it in terms of race/ethnicity, income, or other cleavages relevant to that specific social context. In this more general sense, the population concentration in both shantytowns and gated high-income condominiums, for instance, may be regarded as different aspects of the segregation process. Usually referred to as “residential segregation”, this concept is strongly present in American urban studies, and allows for the development of synthetic segregation indicators that may be used to compare data across regions and time (Massey and Denton, 1993).

³ This specific dimension, which will not be addressed in this paper, is more extensively discussed in the Brazilian literature (see Santos, 1979; Vetter and Massena, 1981; Smolka, 1983 and 1987, Villaça, 2000; Marques, 2003).

⁴ Massey and Denton (1993) also mention other dimensions, such as concentration (measuring the density of poverty) and centralization (measuring its location vis-à-vis the downtown area). We consider such elements to be less relevant for the Brazilian debate.

⁵ For Villaça (2004), the “high concentration” of high-income population in certain areas is the key element that defines segregation.

The dissimilarity index is likely to be the indicator most employed in this field, albeit its limitations (Sabatini, 2004). It measures the share of the population in a given social group that would have to move in order to create a distribution of social groups within an area similar to the distribution existing in the city as a whole. Other metrics – such as the “isolation indexes” – are also used to achieve similar results (Sabatini, 2001; Massey and Denton, 1993). In addition to the dissimilarity index, we will use here the Moran index, which estimates the degree of homogeneity or difference between neighboring urban areas (Bichir, Torres and Ferreira, 2005).

In this paper, we work mainly with the geographic unit of analysis of “survey areas” employed by the Brazilian Demographic Census of 2000,⁶ corresponding to an intermediate area between census tracts and districts. However, we will be attentive to other geographic scales to consider the problems regarding micro and macro segregation.⁷ Survey areas refer to spatial divisions based on groups of census tracts, employed to run the longer, more detailed survey for the Demographic Census (Fundação IBGE, 2002). Data from the 1991 Census were also built following the same approach and unit of analysis.⁸ The results obtained through the dissimilarity index and the Global Moran Index are presented below.

1.1. Poverty and segregation in São Paulo

When we discuss the evolution of socioeconomic indicators for the heads of household in the urbanized region of São Paulo between 1991 and 2000, we can observe a significant improvement in social conditions.⁹ For instance, the share of heads of household with 0-3 minimum wages/month decreased substantially, going from 41.8 to

⁶ The Demographic Census is based on two questionnaires: the shorter one covers all the population, while the longer one focuses on a sample corresponding to 10% of the population.

⁷ Macro segregation refers to a wider spatial scale, such as neighborhoods or districts. Micro segregation is related to a detailed geographic scale, such as blocks or census tracts as unit of analysis. An important distinction may be observed between the two phenomena in empirical terms: macro segregation may be reduced in a given urban area, while the micro one increases, as it was recently the case in Santiago, Chile (Sabatini, 2001).

⁸ Data from the 1991 Census have been reconstructed for the 2000 Census survey areas through GIS overlays.

⁹ Due to data availability, we have taken into consideration the 21 cities that make up the urbanized region of São Paulo and account for more than 91.4% of the total population of the Metropolitan Area. In general, we have excluded small cities of a more rural nature – i.e., Santa Isabel, Juquitiba, Salesópolis. All large cities have otherwise been considered (São Paulo, Osasco, Guarulhos, Santo André, São Bernardo, etc.).

35.4%, while that of heads of household with 15+ and 20+ minimum wages per month slightly increased (Table 1).

Table 1
Income breakdown of heads of household in the urbanized region of São Paulo, 1991 and 2000

Income of head of household	Total	Breakdown (1)	Breakdown (2)
1991			
0 to 3 minimum wages	1457507	39,09	41,82
3 to 10 minimum wages	1438649	38,58	41,28
10 to 15 minimum wages	262094	7,03	7,52
15 to 20 minimum wages	115282	3,09	3,31
20+ minimum wages	211556	5,67	6,07
No income/ Not available	243561	6,53	-
Total	3728649	100,00	100,00
2000			
0 to 3 minimum wages	1457854	31,44	35,43
3 to 10 minimum wages	1839584	39,67	44,71
10 to 15 minimum wages	269950	5,82	6,56
15 to 20 minimum wages	205548	4,43	5,00
20+ minimum wages	341990	7,37	8,31
No income/ Not available	522384	11,26	-
Total	4637310	100,00	100,00

Source: IBGE, Demographic Censuses of 1991 and 2000.

(1) Including heads of household with no income.

(2) Excluding heads of household with no income.

This comparison should be carefully considered due to the different criteria employed to gather information on the “no income” individuals in the censuses of 1991 and 2000.¹⁰ Additionally, the minimum wage has shown a small increase in real terms after 1994.¹¹ Therefore, the share of heads of household with monthly income below 3 minimum wages would be even smaller if the 2000 data had considered the value of the minimum wage of 1991. In other words, despite data distortions, it becomes clear that the share of heads of household with a monthly income of less than 3 minimum wages significantly decreased within the period.

Likewise, census data also indicate that the share of heads of household with less than 3 years of schooling decreased from 24.5 to 19.3% during the 1990s. The share of heads of household with 11+ years of schooling (secondary school) went up from 24.7 to 31%, even though the share of those with university degree remained virtually stable –

¹⁰ When considering data from the Employment and Unemployment Survey (PED-Seade/Dieese) – for which there is no variation in the information gathering for the “no income” individuals – the share of heads of household with 0-3 minimum wages dropped from 44.4% in September 1991 (Census date) to 31.0% in July 2000.

¹¹ Brazilian minimum wage has varied between 80 and 120 dollars in the past 10 years.

from 10.61 in 1991 to 11.32% in 2000. In this context, during that decade, the low-income, low-schooling population seems to have decreased in relative terms in the urban region of São Paulo. Such data is consistent with more general educational and income indicators available from other sources and based on sample data (i.e., PED, PNADs and PME).¹²

Unfortunately, a reduction in the proportion of poor people, or the improvement in the quality and coverage of public services, does not always imply a decline in segregation. Massey and Denton (1993) have pointed out to the paradox of having increased social segregation in parallel with substantial improvements in social conditions: between 1910 and 1940, residential segregation increased sharply in the US, in spite of much better living conditions and income levels.

To discuss this issue, we have used the dissimilarity index, which measures the share of the population of a given social group that would need to move so as to have its distribution per area similar to its distribution within the city as a whole.¹³ In general, a 0-30% index indicates light segregation; a 30-60% moderate segregation; and a 60% + severe segregation (Massey and Denton, 1993; Briggs, 2001).¹⁴ In the case of São Paulo, it is possible to observe a substantial increase in segregation when considering income dissimilarity indexes between heads of household with 0-3 and 20+ minimum wages per month (scale of survey areas), as we can see in Table 2 below. If we consider a scale of census tracts, the income dissimilarity index goes up from 70.4 to 74.4%.¹⁵ In other words, the dissimilarity index between these two groups is not only very high, but has also substantially increased in the past decade.

¹² Such sources indicate an impressive increase in income between 1994 and 1997 as a result of the 1994 stabilization plan (Plano Real), with levels drooping since then.

¹³ Formally, the dissimilarity index may be described as $ID = 0,5 \sum | X_i - Y_i |$, where X_i refers to the share of X group members living in i district (in relation to the total of the X group population in the city), and Y_i refers to the share of Y group members living in i district (in relation to the total of the Y group population in the city).

¹⁴ This indicator is rather limited and may be criticized for a number of reasons. First, it does not capture segregation within the regions used as units of analysis. Second, this indicator varies according to the size of the unit of analysis, causing the so-called grid problem (Sabatini, 2001) and increasing the complexity of inter-area comparisons. Third, this is a non-spatial indicator; it does not identify whether all segregated individuals are concentrated in specific places within the city, or rather spread across it, a problem known as the “checkers’ board” dilemma (Sabatini, 2004). In spite of such difficulties, this index has been widely employed, indicating the high level of residential segregation between black and whites in all large American cities, for instance, with its highest peaks found in Chicago, Detroit and Kansas City (Massey and Denton, 1993).

¹⁵ The number of census tracts is not identical in the two Censuses, thus leading to some degree of distortion in this comparison. Data for comparable census tracts (1991 and 2000) are presented in a different article (Torres, 2004). The trends observed were very similar, pointing out to the same direction.

Table 2
Residential segregation index (dissimilarity) by income and education. Scale of survey areas of São Paulo’s urbanized region, 1991 and 2000.

Dissimilarity index	1991	2000
Dissimilarity between heads of household with 0 to 3 and 20+ minimum wages	62.80	67.55
Dissimilarity between heads of household with 0 to 3 and 15+ years of schooling	61.91	61.56

Source: IBGE, Demographic Censuses of 1991 and 2000.

Contrary to the situation of Santiago (Sabatini, 2001), where macro segregation fell while the micro one improved, the segregation has increased in São Paulo for the scales of both census tracts and survey areas. Such indicators suggest a growing social isolation between different income groups in the comparison of large areas, and even locally, within the survey area. Results also indicate the extension and depth of this phenomenon: poorer families live spatially isolated from others groups – especially in urban peripheries – and their degree of isolation has stepped up in the past 10 years. The data for São Paulo also shows low level of segregation between blacks and whites in the scale of survey areas for 2000: a dissimilarity index of 23.7, which is very low vis-à-vis that of American cities. Generally speaking, such a low level of race segregation occurs because poor areas tend to be ethnically mixed, while rich areas are mainly white.

Data regarding education, on the other hand, imply a relatively stable segregation level when comparing families whose head of household had 15+ years of schooling (university level) to those with 0-3 years. However, by comparing individuals that completed high school but did not enter university, it is possible to observe a small decrease in segregation levels (Torres, 2004) – a result consistent with high-school education expansion of the past decade (ALESP, 2000).

In summary, these results indicate there is an important residential segregation in São Paulo, determined above all by a socioeconomic component. This conclusion is also consistent with the existing literature on the subject. The key new factor refers to the rise in segregation levels during the 1990s – a decade characterized by slightly improved income distribution and strong progress in other social indicators, such as education and sanitation.¹⁶

¹⁶ PNAD data for São Paulo’s Metropolitan Area indicate that in 2003 an average of 99.20% households had access to water, 99.7% had bathrooms, 83.20% had sewage collection, and 92.50% had garbage collection. In terms of education, the same source indicates that literacy was achieved by 93.80% of 10+ year-olds in São Paulo’s Metropolitan Area.

1.2. Other segregation measures: the Moran Index

The Global Moran Index (I) can also be employed to measure segregation through spatial self-correlation. This index identifies whether spatial clusters for a given variable exist, pointing out to the presence of “survey areas” with similar values among neighbors of an interest indicator. Such indicator is more often used as a summary of the spatial distribution of a variable, acting as an alternative metric for segregation.

When compared to those indicators more commonly used in segregation studies – i.e., the dissimilarity index – Moran incorporates a rather innovative dimension: testing the degree to which the level of a variable for a given area is similar to that of neighboring areas. In areas without segregation, for instance, poor people (or any other variable of interest, such as the concentration of blacks) will be evenly distributed in a given area and in its neighboring ones, for all areas of the city, with a Global Moran near 0. In cases with segregation, areas with high concentration of poor people will be close to others of the same kind (likewise, areas with a high concentration of non-poor individuals will have neighboring non-poor areas), with a Global Moran of near 1.¹⁷

Graph 1 below shows the results obtained when the Moran Index was applied to data on years of schooling for the city of São Paulo in the scale of survey areas.¹⁸ With such a unit of analysis, the results obtained capture mainly a macro segregation dimension, without reference to scenarios in shantytowns and smaller gated communities. This graph shows the crossing between the indicator value for a given area and the average of its neighbors; in this case, it shows a high correlation between them.

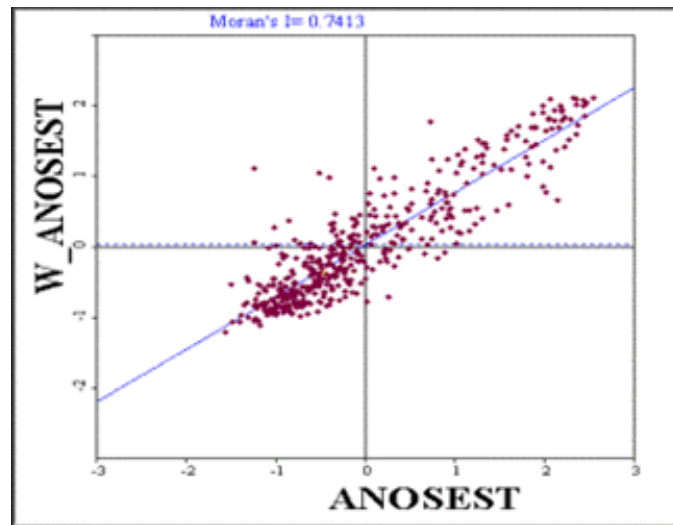
¹⁷ Similarly to other segregation indicators, the Global Moran Index tends to be affected by the geographic scale adopted (Anselin, 1995). This index is described as:

$$I = (N/S_o) \sum_i \sum_j w_{ij} x_i x_j / \sum_i x_i^2 \quad (1)$$

where w_{ij} is an element of the spatial neighboring matrix \mathbf{W} , which indicates if areas i and j are adjacent. A neighboring matrix was employed, with w_{ij} assuming a value of 1 if i and j are bordering each other and 0 if otherwise. S_o is a normalizing factor equal to the sum of all weights $(\sum_i \sum_j w_{ij})$ and x_i corresponds to the indicator value to be tested for the area i and N to the number of observations. A significance level of 5% was used for the testing of hypotheses, where a nil hypothesis means *the observed value of the index for each of the four indicators equaled zero*.

¹⁸ Contrary to the discussion for the dissimilarity index, we will work here with data only for the city of São Paulo. This option was chosen because of the data available for the survey, used in the next section.

Graph 1
Global Moran matrix for head-of-household' average years of schooling.
São Paulo, 2000.



Source: IBGE, Demographic Census, 2000.

As in the case of the dissimilarity index, results indicate high levels of residential segregation for 2000. The Global Moran index shows high spatial correlation among survey areas – 0.74% for the variable of “average years of schooling” of the head of household. Overall, areas of low schooling are close to other similar areas, thus suggesting a high degree of social homogeneity in schooling levels at that region. These elements are next presented in detail.

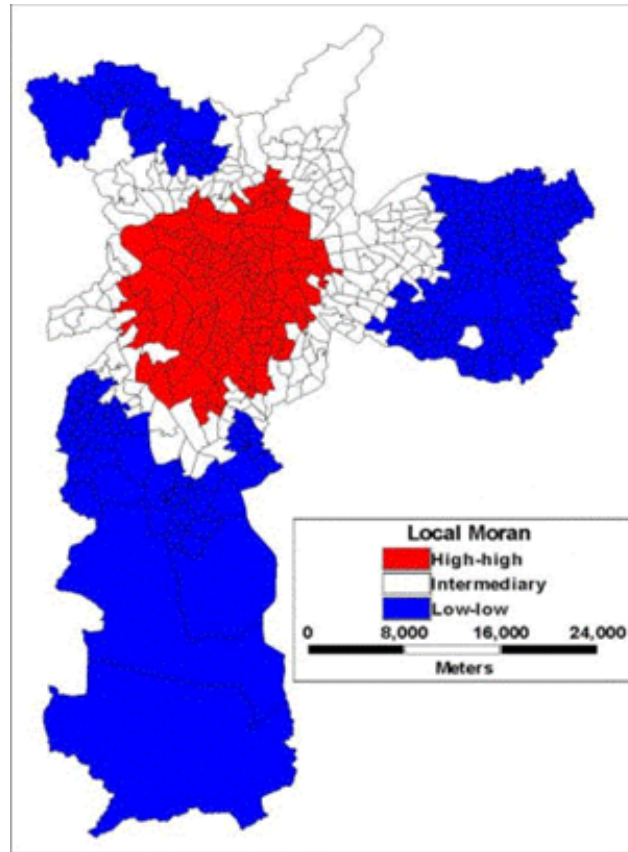
2. Strategies to identify segregated areas in the city of São Paulo

Besides defining strategies to measure segregation, such as those suggested by the dissimilarity and Global Moran indexes, it is also important to identify those places in which segregation occurs more strongly. To that effect, we have employed the so-called Local Moran index, which identifies spatial clusters according to a given variable of interest. Because it gives a specific value per region, the Moran index allows the identification of spatial patterns and the definition of the major clusters that represent them.¹⁹

¹⁹ The Local Moran index may be expressed as follows:

The local Moran provides an excellent strategy for identifying macro-segregated areas; however, it cannot precisely identify micro-segregated ones, such as shantytowns, due to their small size. In order to run the local Moran through a LISA map²⁰, we have used a second order queen contiguity matrix.²¹ Map 1 below shows the results obtained.

Map 1
Local Moran for Average Years of Schooling of the Head of Household. City of São Paulo, 2000.



Source: IBGE, 2000.

$$I_i = \frac{\sum_j w_{ij} z_j}{\sum_{i=1}^N z_i^2} \quad (2)$$

where $z_i = (x_i - \bar{x})$

²⁰ LISA (Local Indicator of Spatial Association) maps present correlations for a given variable between each survey unit and its neighbors.

²¹ This kind of spatial contiguity was chosen for operational reasons: its distribution fits best to the data presented in the survey with low-income families, employed to analyze urban infrastructure policies. Geographical coding identified the survey's 1,500 cases according to the areas defined by the local Moran with a second order contiguity matrix: 516 high-high cases (high schooling survey area, similar to its neighbors); 492 intermediary ones; and 445 low-low cases (low schooling survey area, similar to its neighbors).

The local Moran results indicate the existence of highly segregated areas in terms of schooling, especially in peripheral areas of the city: the extreme East and South and some specific areas of the North – a distribution well known and consistent with the literature on the subject for the city of São Paulo. Such areas are identified in blue on Map 1. The red areas, along the South-East vector of the city, indicate spatial concentration of high schooling – these are also the richest areas of São Paulo. White identifies transition areas, with intermediary levels of schooling.

In general, it is possible to conclude that the blue areas, located in the peripheries of the city, are segregated in terms of years of schooling, concentrating a continuous share of the population with low-education levels. In the next section, we investigate to which extent living in such areas influences the population's access to urban infrastructure policies.

3. Segregation and public policies: access to urban infrastructure

Once we identified the most segregated areas in the city of São Paulo (macro segregation), we can discuss the consequences of living in these areas for the access of poor people to urban infrastructure policies. This section is based on results from a survey performed on November 2004 by the *Center for Metropolitan Studies* (CEM-CEBRAP) with the technical support from IBOPE. The survey focused on the poorest 40% of the city of São Paulo, and aimed at verifying several aspects of their living conditions, including access to public policies – i.e., education, health, urban infrastructure, and income transference programs (see Appendix 1).

We discuss here the key determinants of urban infrastructure policies, chosen due to the frequent association present in the literature between lack of urban services – i.e., water, sewage, energy, and garbage collection – and segregated areas. As discussed in Section 1 of this paper, this association is quite frequent in the Brazilian literature on urban studies, often leading to the idea that lack of infrastructure (especially in the periphery) is the same as segregation (Vetter et al., 1979 and 1981; Vetter and Massena, 1981; Marques, 1998 and 2003; Lago, 2002; Ribeiro, 2002, among others). However, other social dimensions must also be considered.

Taking into account different variables from the survey's questionnaire, we developed an indicator of access to urban services: water supply – including frequency of supply

so as to verify intermittent service, since it is virtually universal within the city²² –, sewage, garbage collection, public lights, road pavement, green and leisure areas, and public transport conditions. As we can see in Table 3, below, the coverage of these services is generally high, even among the poorest people of the city of São Paulo, with the exception of green areas, public lights and sewage system, which are less frequent in the low-low areas of the periphery.

Table 3
Coverage of some public services among the poorest population, according to types of areas (%). São Paulo, 2004

Indicator	Type of area (Local Moran)			Total
	Low-Low	Intermediary	High-high	
Water	96.1	98.0	96.8	96.7
Daily water supply	88.8	98.4	95.7	92.0
Energy supply	96.6	98.6	99.2	97.4
Sewage system	71.1	80.6	87.9	75.0
Garbage collection	91.8	94.3	94.6	92.7
Road pavement	80.0	90.4	90.8	83.7
Public lights	71.4	84.1	85.2	76.0
Public transport	89.1	90.0	92.7	89.6
Green and leisure areas	39.6	56.9	71.0	46.8

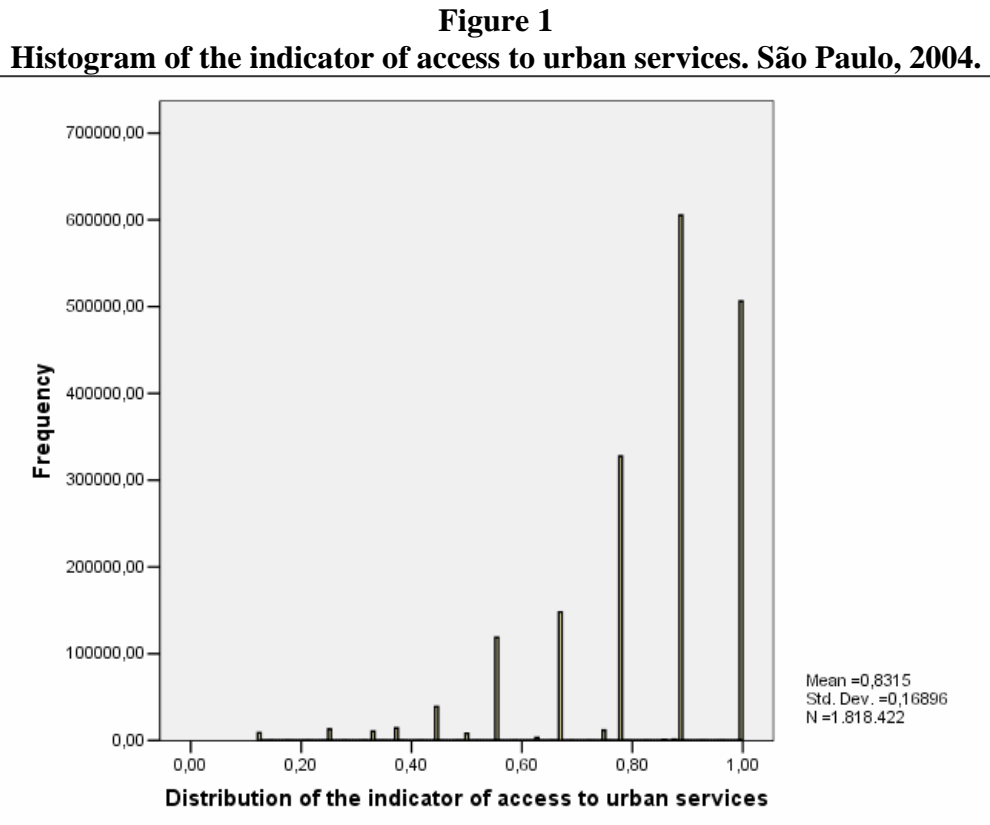
Source: CEM-Cebrap/Ibope. Survey of public service access of the 40% poorest population in São Paulo. November, 2004.

In view of the high coverage, we developed a more restrictive indicator by aggregating all these dimensions, which should allow us to verify potential differentiations of access in areas apparently well served. It should be noted that such variables are highly correlated in statistical testing using factor analyses, thus indicating their provision is not an isolated occurrence, but rather part of a more general dynamic of urban services. Such services contribute to the so-called production of the “built environment”: they have to be delivered at the door of the population, and sometimes even inside their homes, as opposed to health and education equipment, which imply population commuting. These dimensions significantly impact the interpretations on conditions of access and the consequences of residential segregation.

Two situations were considered for each of the nine variables comprising the indicator of access to urban services: adequate and inadequate, the former valuing 1 and the latter

²²Data from the *Pesquisa Nacional por Amostra de Domicílios* (PNAD) indicate that water coverage for the Metropolitan Area of São Paulo was 99.2% in 2003.

0. The final indicator corresponds to the average of such variables, varying along a scale from zero (0) to one (1), where zero is the worst situation and one is the best. Figure 1, below, present the histogram of this indicator.



Source: CEM-Cebrap/Ibope. Survey of public service access of the poorest population in São Paulo. November, 2004.

Note: The frequencies presented here refer to the total number of poor households in the city, since the database of the survey was weighted.

The next step was to aggregate this indicator in three different groups so as to measure the access levels for the lowest income population of the city. The results are shown in Table 4. According to such a restrictive indicator, a significant share of the poorest population of the city (38.4%) still receives inadequate urban infrastructure. Generally speaking, the less served households have no sewage collection, are distant from green areas and/or with no public lights and daily water supply. However, almost all of them have access to water and energy, and garbage collection.

Table 4
Urban infrastructure access levels according to segregated areas.
São Paulo, 2004.

Categorized indicator of urban infrastructure	Type of area (Local Moran)			Total
	High-High	Intermediary	Low-Low	
Inadequate services (0 to 0.88)	27.0%	33.6%	44.3%	38.4%
Insufficient services (more than 0.88 to 0.89)	29.6%	33.6%	33.4%	33.1%
Adequate services (more than 0.89 to 1.0)	43.3%	32.7%	22.3%	28.5%
Total	100.0%	100.0%	100.0%	100.0%

Source: CEM-Cebrap/Ibope. Survey of public service access of the poorest population in São Paulo, November, 2004.

When de-aggregating this information by type of area, it is possible to observe significant differentials: in the central area (high-high), 27.7% of poor households have inadequate access, whereas the intermediary and peripheral (low-low) areas total 36.6% and 44.3%, respectively. As we can see, the access to urban infrastructure in more segregated areas of the city remains a substantial problem. Still, these results do not prove *per se* the relation between residential segregation and inadequate access to urban services. There could be other intervening factors, such as the lack of social capital in suburban areas, or the legal conditions of access to the land, just to mention other two competing theories on the reasons for different access to public services (Putnam, 2000; World Bank, 1999).

In other words, it is also critical to assess whether the access to urban services is a consequence of other variables included in different models – i.e., family income, education, years living in the neighborhood, political preferences and participation in associations. This argument is further explored by using a CHAID statistical model, which identifies population segments with more or less access to urban services (indicator presented above) according to different independent or predicting variables.²³ Such a method is useful for exploratory analyses, and allows for the creation of groups

²³ The CHAID (Chi-squared Automatic Interaction Detector) technique, based on the chi-square association, allows for the hierarchical classification of individuals through a log-linear model. It is used to study the relation between a dependent variable and a series of predicting variables that interact among themselves. From a double-entry table between the predicting and the dependent variables, the model is able to test all possible partition categories for the predicting variable, looking for the one that presents the highest statistical χ^2 value. From the resulting partition, it is possible to group data accordingly and conduct a new analysis within each subgroup, repeating the whole procedure for the dependent variable and the remaining predicting ones.

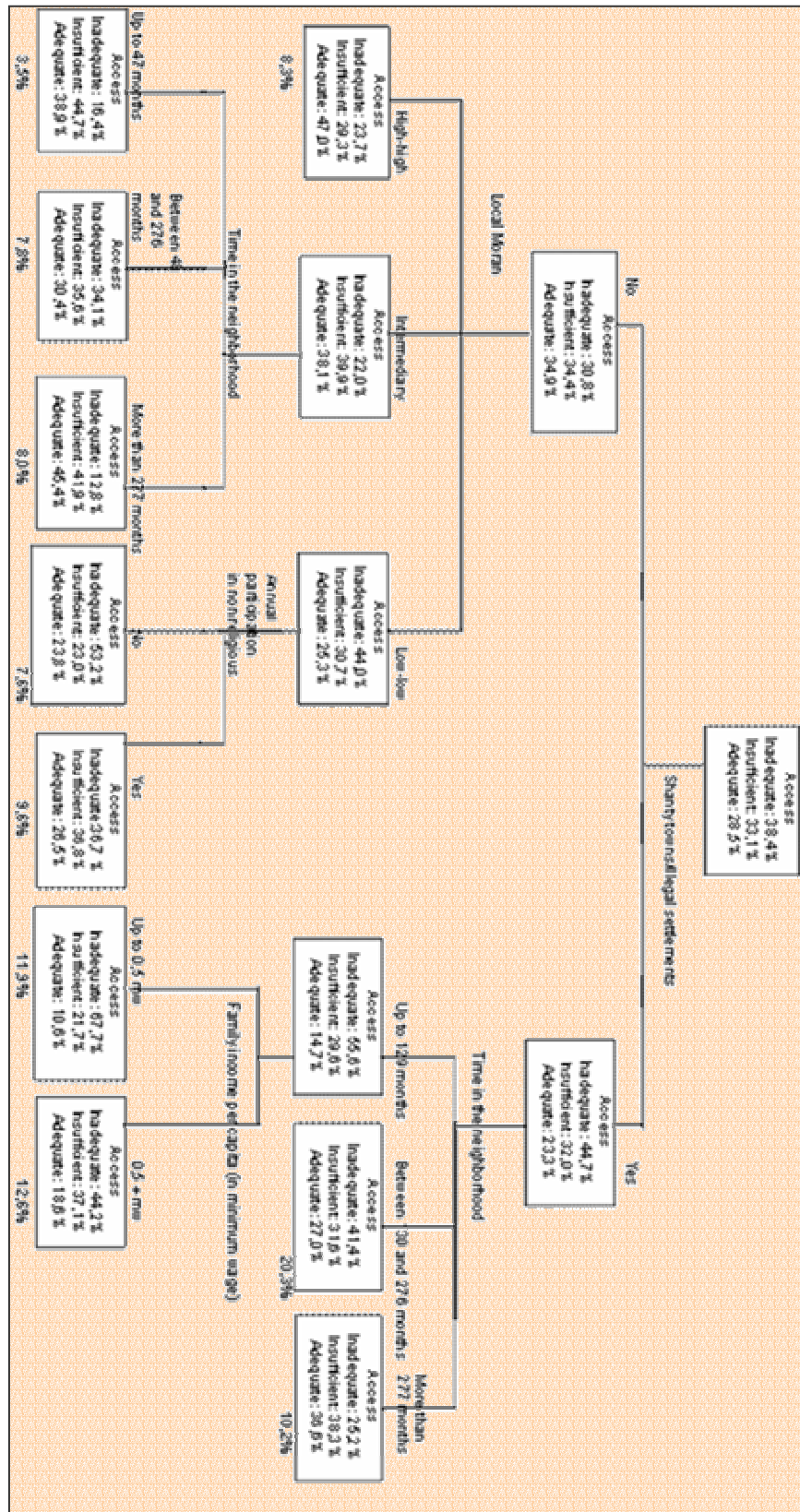
according to the types of interactions observed; at the same time, it can be used to verify the influence of different types of variables. The predicting variables tested are shown in the table 8 (Appendix 2).

A substantial range of variables was tested as drivers of access to urban infrastructure policies, consistent with the different hypotheses on access to urban services – from the legal status of land (institutional dimension), residential segregation and social participation, to political behavior and individual characteristics. The CHAID model is represented in Figure 1 below, summarizing the variables included and their order of importance. Those variables presented first are more likely to explain the situation observed. Each cell presents the levels of access to urban infrastructure measured by each specific group. It also presents the size of the group vis-à-vis the total population and the value of chi-square for each association. The model's significance level is 5%.

First of all, this model indicates the role the legal status of the place of residence – households located in shantytowns or illegal settlements – plays as a differential for the access to urban services among the poorest population. While only 30.8% of households not located in such areas have inadequate access to urban infrastructure, 44.7% of those located in shantytowns and/or illegal settlements have inadequate access to these services. This result probably indicates the difficulties faced by the State to expand services to illegal areas that do not comply with urban regulations.

Many of these areas are not included in the city's official maps, nor are they present in the major information systems used by town hall officers – i.e., real estate register upon which urban taxes are based and collected. On the one hand, this seemingly “inexistence” reduces the administrative visibility of such areas; on the other, even when visible, urban service providers do not have legal backing to operate in such areas (Maricato, 1996; World Bank, 1999; Torres, 2002). The State refuses to make investments for fear of losing them should the land be repossessed by its legal owners, or of being sued by the Public Prosecution Office (Maricato, 1996), thus leading to low-quality services, or none at all. In view of that, it is important to consider those micro-segregated areas as being different from other macro-segregate ones in terms of public policies: there seems to be several barriers – including institutional ones – to public investment in such places.

Figure 2
CHAID model for the indicator of access to urban services

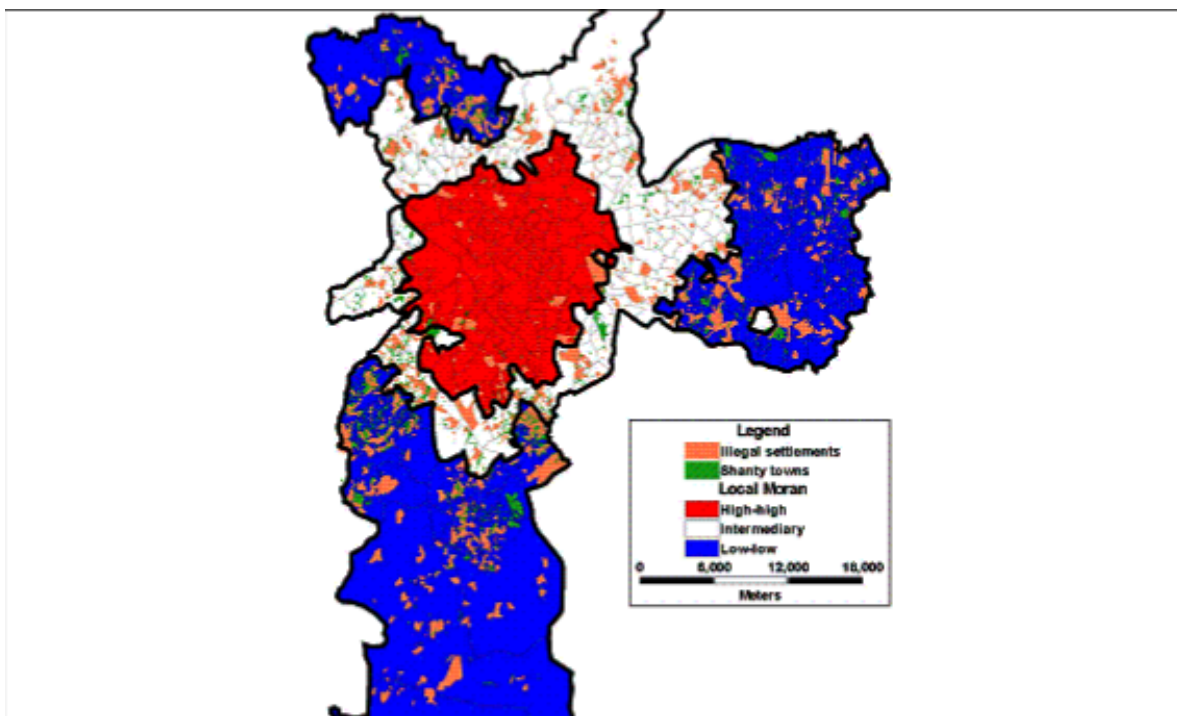


Source: CEM-Cebrap/Ibope. Survey of public service access of the poorest population in São Paulo. November, 2004.

Note: Significance level of 5%.

Map 2 below overlays data for the education clusters defined in Section 3 and those for the location of shantytowns and illegal settlements. It is possible to clearly observe that areas with low education levels (low-low) concentrate the highest share of such urban situations. Thus, the distribution of those urban services considered here is not necessarily explained by the distribution of more or less segregated areas; alternatively, however, it may be explained by the presence of shantytowns and illegal settlements.

Map 2
Local Moran for years of schooling and presence of shantytowns and illegal settlements. São Paulo, 2000.



Source: IBGE, 2000, Demographic Census and CEM-CEBRAP.

Secondly, the model indicates that the amount of time living in the neighborhood is also a key element to determine access levels among those households located in shantytowns and illegal settlements. Those that have been in the neighborhood for longer periods present better access levels, which seems to indicate a continuous access to urban improvements – a result consistent with the ethnographic literature (Almeida and D’Andrea, 2004). For those who have not been around for long, family income plays an important role in ensuring better access.

For those households not located in shantytowns and illegal settlements, macro-segregation – defined by the local Moran according to years of schooling, as shown in Section 2 – seems to be the element that best explains the conditions of access to urban infrastructure. This result points out to the impact of segregation itself on the access to public policies, since access levels are far worse in more segregated regions. Some studies in the Brazilian literature point out to the same outcome. Marques (2000 and 2003), for instance, highlights the relation between State bureaucracies and city officials in decisions about public investment – in certain cases restricting the money spent on poor areas to prioritize richer ones. From this perspective, State investment patterns may be explained by both politicians’ political priorities and the set of ideas, beliefs and visions of society shared by bureaucrats, either explicitly or implicitly (Marques, 2003).²⁴

Thirdly, the model shows that, among those households not located in shantytowns and illegal settlements, and in areas with a high proportion of low education heads of household (low-low), the key variable to explain access differentials is annual participation in non-religious associations. Those who participate in them have better access levels, which seems to indicate a kind of “network effect”: participation in associations provide different contacts and information, influencing the access to public services (Gurza Lavallo and Castello, 2004).

Finally, for the group of households not located in shantytowns and illegal settlements, and in “intermediary” areas regarding education, those who have been living longer in the area present better access levels. As previously noted, this result seems to indicate a history of urban consolidation in such places.

Table 9 presented in Appendix 2 synthesizes the information from the CHAID diagram, highlighting the share of individuals from each group with inadequate access levels to urban infrastructure, and its representation vis-à-vis the city’s total population. In brief, the results discussed so far lead to a number of general conclusions:

- a. Households located in shantytowns and illegal settlements present the most significant variations in urban access levels. Such places characterize micro-segregation situations that were not observed through the local Moran model, since it is structured in a different unit of analysis. Considering the

²⁴ This was called by Marques (2003) “hierarchical selectivity” of bureaucratic officials

institutional literature, we believe that this result cannot be explained solely by residential segregation hypotheses, also reflecting institutional dimensions – especially that of land use regulation and its impact on service offer (World Bank, 1999);

- b. The macro-segregation variable (provided by the local Moran) is important for those households that are not located in shantytowns and illegal settlements. They have worse access to urban infrastructure despite living in “legal” areas – i.e., those areas included in the town hall’s information systems, for which land taxes have to be paid. Our major hypothesis here is that political decisions and internal bureaucracy from both the town hall and utilities companies have created a “discriminatory” dynamic over time for those low-income areas, as suggested by Marques (2003);
- c. The significance of the income variable in defining the access to urban infrastructure of households is surprisingly limited. Although the survey focused on the poorest 40% of the population, the income levels observed are substantially heterogeneous and could theoretically differentiate levels of access.²⁵ The reduced importance of this variable implies the existence of an imperfect real estate market, as sometimes mentioned by economy-derived models;
- d. The variable related to time of residence in the neighborhood also plays an important role, even though it is less stressed in the literature on the subject. Ethnographic descriptions show increasing improvements in migrant households (Almeida and D’Andrea, 2004). Low-income urban areas, such as the shantytowns considered in this study, gradually improve their organization capabilities and access levels to government representatives over time, ensuring better services (Perlman, 2002).
- e. Finally, the secondary relevance of variables related to association and political participation comes as a surprise. The literature has long stressed the fundamental significance of the so-called “social capital” to guarantee better access to goods and public services (Putnam, 2000; Gurza Lavallo and

²⁵ Survey data indicate that in 39% of cases family income is between 0 and 0.5 minimum wages; in 35.9% of cases it varies from 0.5 to 1 minimum wage; in 19.5% the range is between 1 and 2 mw; in 5.1% it goes from 2 to 5 mw.

Castello, 2004). Similarly, pork barrel politics have also been used to explain differences in services access (Ames, 1995). However, this does not mean they would not be relevant for policies other than those analyzed here.

Although results from the model employed here to determine urban services are in line with our expectations for given areas, they also show that overall the interpretation of the access low-income individuals have to public services is rather complex, involving variables derived from different analytical perspectives. Similar analytical exercises for other metropolitan regions are likely to indicate key elements that will allow us to develop a more general model for the city as a whole.

4. Discussion

The arguments presented here were structured based on three key elements. The first one refers to the definition of segregation and the development of indicators for residential segregation (dissimilarity and global Moran), so as to determine the levels of residential segregation found in the city of São Paulo. We showed that segregation is high, and has increased for income and remained stable for education.

The second element regards the identification of those areas in which segregation is stronger – i.e., locations with clusters of individuals of high and low education, as defined by the local Moran. The most segregated areas are located in the periphery areas of the city, consistent with the literature. Due to the unit of analysis adopted, such results did not capture the micro-segregation dimension.

Third, we have organized the data from the “Survey of access to public services for the poorest population of São Paulo” (CEM-Cebrap/Ibope, 2004) around the geographical divisions indicated by the local Moran to assess the effect of residential segregation on the population access to public services. Such an analysis allowed us to observe that the segregation dimension is related to the worse access to public services presented by some groups, regardless of family income. Although this association is widely discussed in the literature, it is often addressed differently from the perspective presented here. Both segregated families and low-income ones can have some access to urban infrastructure, especially to those services already “universalized” in the city, such as water and energy supply.

In most cases, it is both the type of place of residence and the number of years living in the neighborhood that most strongly determine the chances a given family has of improving its access to urban services, including street lights, sewage collection and green areas nearby. On the one hand, the illegal status of the land (e.g., shantytowns and illegal settlements) seems to significantly impact service access – a micro-segregation dimension also apparently related to the institutional conditions of service provision. On the other, macro segregation – as defined by the Moran approach – also implies a lower level of access in “legal” areas.

In view of these arguments, it would make sense for public policies to consider a spatial or territorial perspective – in other words, to consider shantytowns, illegal settlements and other segregation areas as special interest places. To this effect, a number of operational initiatives would be required:

- Giving municipal administrations access to information systems that systematically capture and register the existence of informal and illegal areas. Information systems are important to both substantiate policy decisions and bring the issue to the public debate (Torres, 2005);
- Reducing institutional barriers to public investment in irregular areas, including changes in land regulation;²⁶
- Identifying and fighting against bureaucratic practices and policies that discriminate segregated areas within the government. Bureaucrats should be specially trained in order to ensure recent, poorly educated migrants received adequate treatment.

Although the above propositions may seem rather straightforward and simple, their implementation implies overcoming substantial problems. Peripheral areas are often invisible for decision makers. Additionally, the demand for urban investments include powerful interests from different stakeholders: high-income families, the media, as well

²⁶ “Only well functioning land markets can provide an adequate supply of housing, and maintaining these markets is another task that deserves attention from the public sector. Providing universal registration and establishing clear property rights to all urban land will require strengthening existing institutions. Ill-defined land rights render land useless and discourage the redevelopment of entire portions of a city. But simply providing security of tenure creates incentives to improve housing and infrastructure dramatically. To avoid adding to the backlog of problem housing and neighborhoods, new development must meet basic – but not excessive – compliance standards” (World Bank, 1999: 146)

as construction and real estate companies compete for public resources to be invested in their priority areas (Marques, 2003). Handling such pressures and providing a territorially homogeneous urban policy is the major challenge currently faced by urban administrators in Brazil.

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Appendix 1: Survey

The Center for Metropolitan Studies (CEM-CEBRAP/CEPID-FAPESP) conducted a survey of the poorest 40% population of the city of São Paulo with the technical support of IBOPE. Its objective was to verify several aspects pertaining to the living conditions of this population – particularly in relation to the conditions of access to public policies for education, health, income transference, and urban infrastructure – and elements related to the inclusion of those individuals in the job market, their political behavior, and social participation. The survey comprised detailed questions covering each of these aspects and elements, so as to produce a snapshot and general understanding of their living conditions and access to specific public policies, as well as their own perspective on them. All registers produced by the survey were geographically coded, contributing to the knowledge on how public policies are spatially distributed.

Sample

The survey focused on the low-income population living in different areas of the city of São Paulo. This population included the poorest 40% of the city, which corresponded to those families with a monthly income of up to R\$ 1,100 (less than 4.1 minimum wages; values of November 2004). This threshold value was adopted to allow for a comparison with a survey of the 40% poorest population conducted by CEBRAP in 1991.

The city of São Paulo was divided into three layers: survey areas mostly inhabited by poor individuals; survey areas of middle-class population; and survey areas mostly inhabited by high-class individuals, based on social the composition defined to them (see Marques and Torres, 2005).

A sample of individuals was selected from each layer in two different stages. In the first stage, survey areas with probability proportional to their size were randomly selected; whereas in the second one, households were chosen within the previously selected survey areas. Sample size was defined at 1,500 interviews, in 500 randomly selected households from each layer, including a quota sample for the variables presented in Table 5. It was also established that a maximum of 20 questionnaires were to be conducted per survey area.

Table 5

Distribution of the interviews among layers, according to position in the household, age and monthly family income.

Position in the household	% of interviews
Head of household male	50
Head of household female	50
Age	
18 to 29 years old	30
18 to 29 years old	45
50 + years old	25
Monthly family income	
0 to 519 reais	40
520 to 1.100 reais	60

In order to expand the sample, post layers were developed based on variables employed to establish quotas to which population totals were known. By using the data from the 2000 Demographic Census (IBGE), it was possible to obtain the population totals for the universe of the survey. Within each layer, the population of heads of household and spouses (universe of the survey) were divided into three groups according to gender, age, and monthly family income (Table 6).

Table 6
Groups of gender, age and monthly family income inside each layer.

Group	Sex	Age	Income (reais)
1	Male	18 to 29 years old	0 to 370
2	Female	18 to 29 years old	0 to 370
3	Male	30 to 49 years old	0 to 370
4	Female	30 to 49 years old	0 to 370
5	Male	50 + years old	0 to 370
6	Female	50 + years old	0 to 370
7	Male	18 to 29 years old	371 to 784
8	Female	18 to 29 years old	371 to 784
9	Male	30 to 49 years old	371 to 784
10	Female	30 to 49 years old	371 to 784
11	Male	50 + years old	371 to 784
12	Female	50 + years old	371 to 784

The end product from this methodology is an expansion factor for each questionnaire of the survey, whose value is determined by:

$$P_{jk} = \frac{N_{jk}}{n_{jk}},$$

where

$$j = 1, 2, 3$$

$$k = 1, 2, \dots, 12$$

P_{jk} = weight attributed to the k -eth group of the j -eth layer

N_{jk} = total number of people in the k -eth group of the j -eth layer

n_{jk} = total number of interviews of the k -eth group of the j -eth layer

Table 7 shows the values of N_{jk} and n_{jk} for each group within the layers.

Table 7

Values of Njk and njk according to gender, age and monthly family income within each type of area.

Group	Layer 1		Layer 2		Layer 3	
	Njk	njk	Njk	njk	Njk	njk
1	55976	20	15827	24	4022	23
2	80162	36	23665	33	5743	36
3	107080	49	34954	31	8105	45
4	126669	55	44796	61	9951	54
5	47310	23	26810	25	6619	19
6	74518	18	51514	27	16565	25
7	81469	39	29588	56	8212	48
8	110295	56	38586	37	9962	43
9	170417	61	63569	76	13678	69
10	184332	60	76192	58	16283	57
11	62216	59	42699	37	11311	40
12	74443	24	62311	35	22573	41

Appendix 2: Data from the CHAID Model

Table 8
Independent indicators employed in the CHAID Model

Variables tested in the model	Categories	Remained in the model
<i>Individual</i>		
Gender of head of household	Male Female	No
Color of head of household	White Black and non-white	No
Age of head of household	18 to 29 years old 30 to 49 years old 50+ years old	Yes
Average years of schooling of head of household	0 to 3 years 4 to 7 years 8 to 10 years 11+ years	No
Family income per capita in minimum wages	Up to 0.5 mw 0.5+ to 1 mw 1+ to 2 mw 2+ to 5 mw 5+ mw	Yes
<i>Area</i>		
Local Moran for years of schooling of head of household	High-High Intermediary Low-Low	Yes
Households in shantytowns or illegal settlements	Yes No	Yes
<i>Migration</i>		
Years in the neighborhood	Up to 47 months 48 to 129 months 130 to 276 months 277+ months Born in the neighborhood	Yes
Born outside the State of São Paulo	Yes No	No
Northeastern migrants	Yes No	No
<i>Participation</i>		
Bimonthly participation in religious associations	Yes No	No
Annual participation in non-religious associations	Yes No	Yes
<i>Political preferences</i>		
Preference for a specific political party	Yes No	No
<i>Conditions of employment</i>		
Key job conditions	Inactive (retired, student, Unemployed Non registered, self employed) Registered	No

Table 9
Summary of Urban Services Access Indicator

Group	% of inadequate access	Participation of each group in the analyzed population (%)
Resident in shantytowns or illegal settlements, newcomer to the neighborhood (up to 129 months), and with family income per capita of up to 0.5 mw.	67,7	11.9
Non-resident in shantytowns or illegal settlements, resident in areas defined as low-low in local Moran, and without participation in non-religious association.	53,2	7.6
Resident in shantytowns or illegal settlements, newcomer to the neighborhood (up to 129 months), and with family income per capita of more than 0.5 mw.	44,2	12,6
Resident in shantytowns or illegal settlements and in the neighborhood between 130 and 276 months.	41,4	20.3
Non-resident in shantytowns or illegal settlements, resident in areas defined as low-low in local Moran, and with participation in non-religious association.	36,7	9.6
Non-resident in shantytowns or illegal settlements, resident in areas defined as intermediary in local Moran, and in the neighborhood between 48 and 276 months.	34,1	7.8
Resident in shantytowns or illegal settlements and in the neighborhood for more than 277 months.	25,2	10.2
Non-resident in shantytowns or illegal settlements and resident in areas defined as high-high in local Moran.	23,7	8.3
Non-resident in shantytowns or illegal settlements, resident in areas defined as intermediary in local Moran, and in the neighborhood for up to 47 months.	16,4	3.6
Non-resident in shantytowns or illegal settlements, resident in areas defined as intermediary in local Moran, and in the neighborhood for more than 277 months.	12,8	8.1
Total	38,4	100,0

Source: CEM-Cebrap/Ibope. Survey of public service access of the poorest population in São Paulo. November, 2004.