Primary Education and Residential Segregation in the Municipality of São Paulo – A Study Using Geographic Information Systems

Haroldo da Gama Torres[1]
Gustavo Coelho de Oliveira[2]

1. Introduction

The unequal access to school has been an important issue in the public debate on social policies in Brazil. Until the beginning of the 90s, a significant share of the lower income population had no access to schools. Whenever they did have access, the quality of the education provided was poor, with a high rate of drop-outs (Haddad and Pierro, 2000). Recently, the coverage of the basic education system has substantially increased. According to the latest PNAD (1999),[3] 96% of the Brazilian children ranging from 7 to 14 years of age were in school. In key metropolitan areas, such as São Paulo´s, this survey has shown levels close to 99% (Seade 2000).

Universal coverage, however, has not put an end to the segregation in the provision of public services. In terms of education, the problem of low public school quality still remains, particularly for those institutions attended by non-white and lower income individuals (Gouveia, 2000). Going beyond the classical issues of prejudice and the lower educational level of poor people, we seek here to discuss educational segregation as a result of inadequate housing conditions and lack of access to urban land.

Our hypothesis is that the serious problems of land regularization occurring in most Brazilian large cities significantly affect the provision of public services. In order to discuss

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[1] Demographer, consultant from Seade Foundation, and researcher of Cebrap. hgtorres@uol.com.br
[2] Geographer, coodinator of Seade Foundation´s GIS division. gcoelho@seade.gov.br
[3] National Survey of Household Samples, carried out annually throughout the country by the Brazilian Institute of Geography and Statistics (IBGE).

it, we use a case study on the provision of elementary education in the city of São Paulo.[4] The data sources employed are heterogeneous: census tracts of the Population Census of 1996, Municipal Real Estate Registration Database of 1996 and School Census of 1998 (from the State Secretariat for Education). All data were organized within a single Geographic Information System (GIS) for the city of São Paulo.[5]

2. The Metropolitan Context

The metropolitan area of São Paulo is one of the largest urban concentrations in the world, with 17.8 million individuals according to the preliminary results of the 2000 Census. São Paulo, its main city, totaled 10.4 million people living within 1,509sqkm, following a radio-centric occupational pattern (Map 1).

Occupation in the past had been dispersed following religious missions in the old native Indian settlements of that time. However, the conurbation of such isolated centers generated the intense urban scattering that could be perceived in the city in the second half of the 20th century. The building of large private land developments to house the labor class in the periphery[6] also strengthened this dispersed and radio-centric growth of the city (Marcilio, 1973; Bonduk and Rolnik, 1979; Maricato, 1996).

In general, such developments were neither regulated nor controlled by the State, therefore lacking urban, service and leisure infrastructure (Kowarick, 1975). This process was in effect from the mid 50s to the 80s, but is still valid for some unoccupied areas in the Southern and Northeastern regions of the city.[7] The illegal character of most peripheral

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[4] The elementary (or primary) school in Brazil represents the first eight years of schooling, corresponding to children from 7 to 14 years old.
[5] This GIS is being structured for the project of the Metropolitan Study Center, supported by FAPESP. For an overview on GIS, see Demers (2000).
[6] We adopt here the expression periphery, which is a free translation from the word *periferia*, in order to highlight the fact that the periphery in Brazil is in no way related to the American suburbs. Peripheries are areas surrounding the largest cities in Brazil, presenting high concentration of poor people and lacking urban infrastructure and social services.
[7] The development of large housing estates away from the city center also helped strengthening the "peripheral growth pattern" of the city of São Paulo (Bonduk, 1980, Veras, 1980, Damiani, 1991).

land developments in the city led to a corresponding irregularity – as far as the City Council is concerned – of the housing built on them. Therefore, there is relatively little official information on such constructions, including their number and built area.[8] However, with the re-democratization process of the 80s, this very Council has been requested to provide urban infrastructure, sanitation, schools, and primary health care in the periphery (Rodrigues and Seabra, 1986; Marques, 2000; Abers, 2000).

Map 1

Streets of São Paulo City in 2001

O

Legend
Streets
Distrits

0   8   16   24

Kilometers

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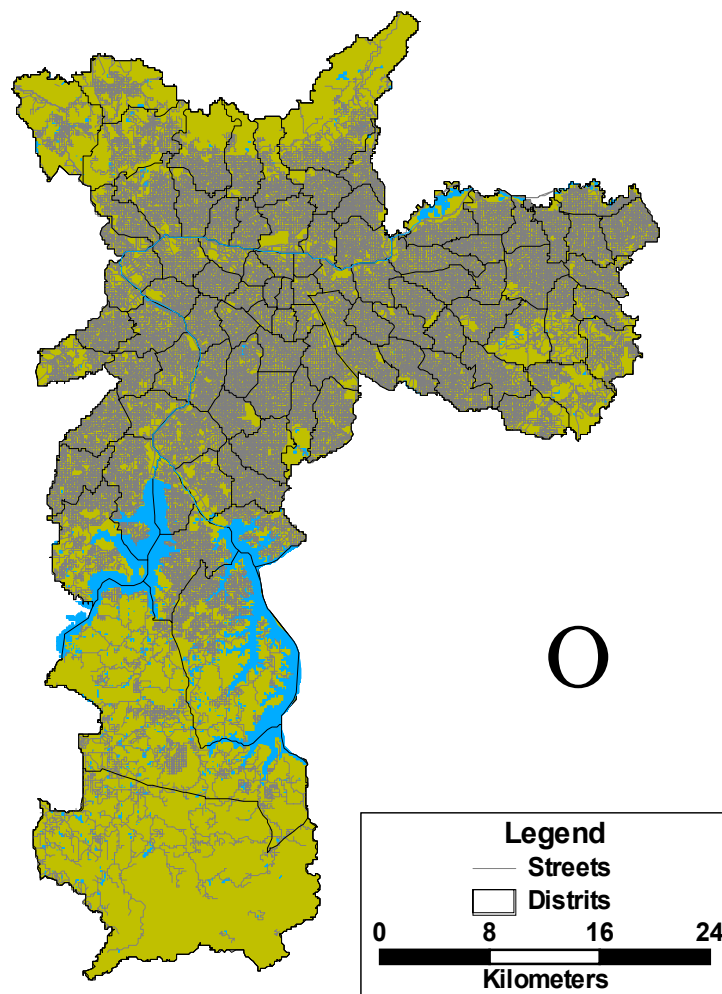
[8] The same phenomenon may be verified in shantytowns (*favelas*) due to the direct invasion of private and public land. Despite controversies as to the concept of shantytowns in urban terms, more comprehensive

In other words, the attempt at providing universal social policies is being carried out in very complex urban contexts within the Brazilian metropolitan areas, including the provision of utility and infrastructure coverage in illegally occupied and irregular areas. The difficulties inherent to this process not only impose important barriers to the provision of such services, but also to generate a significant decrease in the quality and regularity of the service offer. The challenge becomes even greater in areas that still present demographic expansion or large concentration of lower income population (Jacob, 1991). These arguments are further detailed in the following sections.

3. Access to Public Schools

Even when educational coverage borders 100%, the conditions of school access may vary substantially in the intra-urban context. We have thus developed here two different indicators that show the persistent heterogeneous character of access conditions:

a. To analyze school access, we have used a first variable that measures the physical distance between home and school. This indicator generated by the GIS was developed as referring to the distance between the centroids of the 10,000 census tracts of the city to the nearest public school.[9] This is a relevant synthetic indicator, since in Brazil school transport is incipient, and car ownership is restricted to middle and high classes (Map 2);[10]

b. The second indicator used here refers to the variable of students per class for children enrolled from first to fourth grade of elementary school. Those children
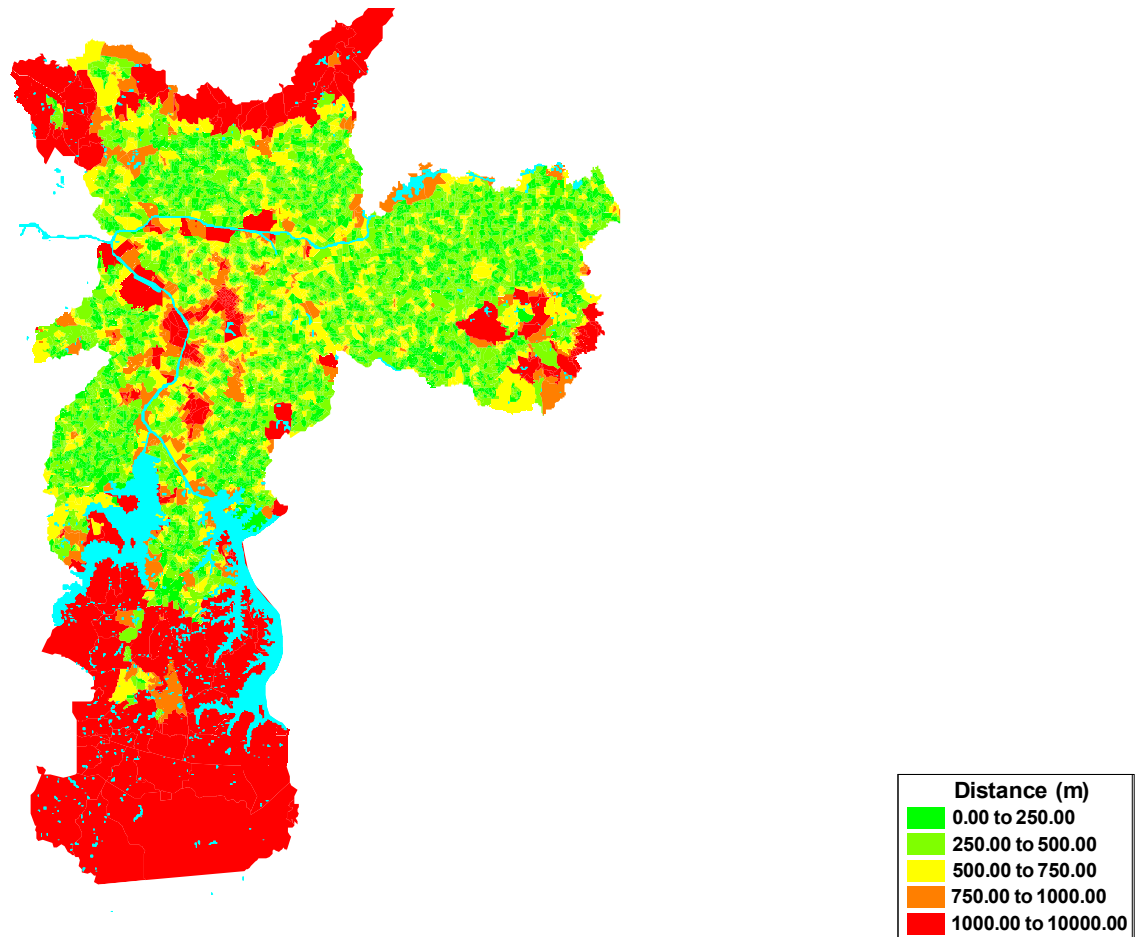
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estimates indicate a shantytown population of up to 20% of the total population of the city of São Paulo, which would amount to 2 million dwellers (Taschner, 2000).

[9] A census tract is the smallest geographic division of the Brazilian census. On average, each tract corresponds to a population of 1,000 individuals.

[10] Primary education in Brazil is provided both by State and City governments. In São Paulo, 70% of the students in the public system attend State schools.

usually range from 7 to 10 years of age, and have greater difficulty to move around the city. In other words, this indicator shows how crowded a school is (Map 3).

Map 2: Distance from Centroid of Census Tract to the Nearest Public School, 1996

Distance (m)
- 0.00 to 250.00
- 250.00 to 500.00
- 500.00 to 750.00
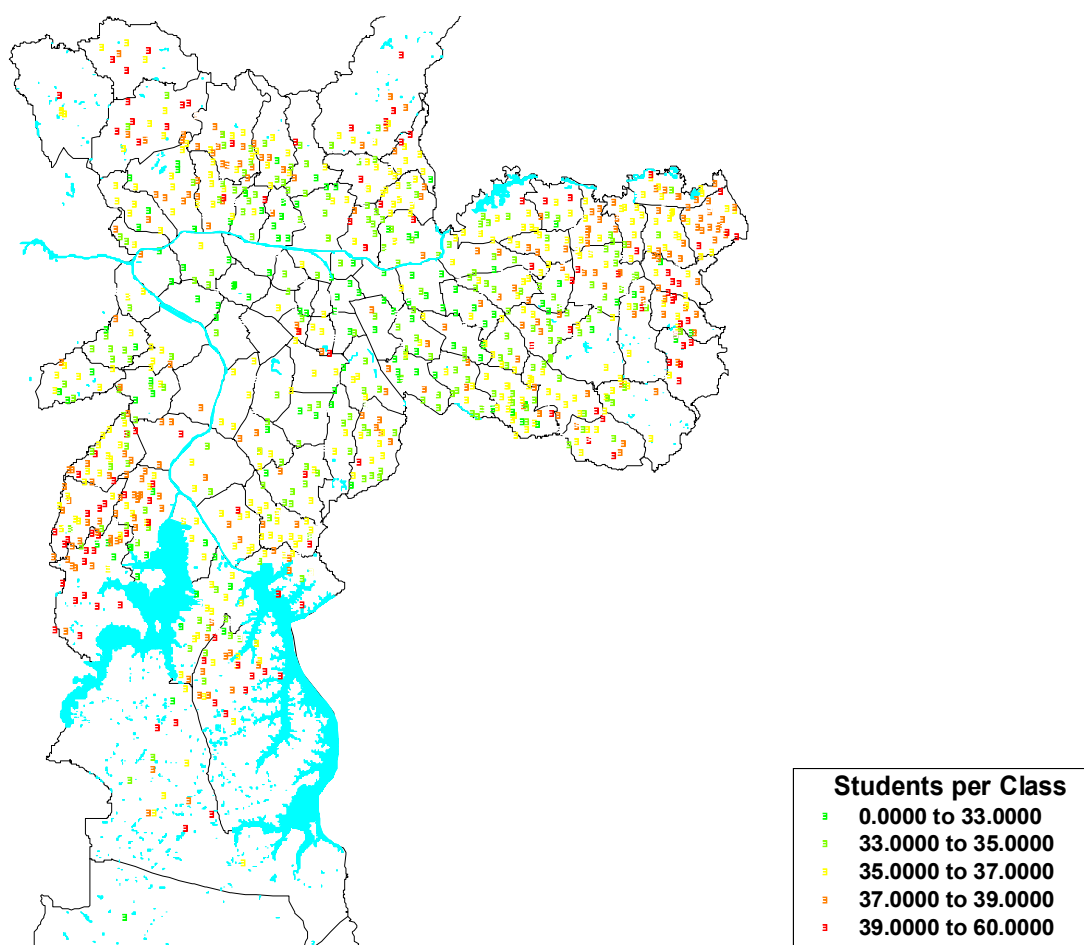- 750.00 to 1000.00
- 1000.00 to 10000.00

Map 2 clearly shows that there is greater difficulty of access for those living in more distant and peripheral areas, despite a relatively adequate distribution of public schools in spatial terms.[11] Although this fact may be explained by the lower demographic density of some of these areas, the comparison between Maps 1 and 2 shows that most of them have already

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[11] According to the School Census of 1998, private schools represent approximately 20% of the offer for elementary education in São Paulo.

been urbanized and inhabited, indicating that schools are simply still "physically" lacking. The lack of schools in some central areas may be explained by the low demographic density of regions along the rivers Tietê and Pinheiros, as well as by the low demand for public schools in high-income areas, such as the neighborhood of Jardins.[12]

Map 3: Students per Class from 1st to 4th Grade of Elementary Public School, 1998

Students per Class	
	0.0000 to 33.0000
	33.0000 to 35.0000
	35.0000 to 37.0000
	37.0000 to 39.0000
	39.0000 to 60.0000

This situation may be partly due to the dynamic growth of the population in the periphery, whose increasing demand has not been matched by public services and the State. On the

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[12] See Map 4.

other hand, it may also be due to the comparatively less developed skills for self-organization and mobilization of the lower income residents of such places in order to demand public services (Jacobi, 1989; Torres e Marques, 2001).

However, the worst access conditions for residents of peripheral areas may be also verified when considering the indicator of students per class (Map 3). In general, in schools at the periphery – particularly in the Southern, Northern, and Eastern regions – classes from 1st to 4th grade are extremely crowded, some of which with an average of more than 40 students, even though the focus is on children ranging from 7 to 10 years of age. This indicator dramatically shows the strong demand existing in such areas, as well as the problems of access.

In other words, Maps 2 and 3 indicate that children living in peripheral areas typically travel longer to get to public school, and that in such schools, they study in overpopulated classes. Even with universal coverage, the conditions of the offer remain quite heterogeneous in São Paulo. We shall return to this discussion in the following sections.


4. Access to Urban Land

One of the key ways of showing urban segregation and inequalities is to observe the houses in which people live. To verify this dimension we have conceived an indicator of residential built area per inhabitant for each census tract. The indicator was developed from data on square meters of residential built area, which is available in the Municipal Real Estate Registration Database (TCPL) and organized by blocks (55,000). These blocks have been aggregated by census tract (10,000 of them), from which we collected the demographic information required. This indicator helps capture two different phenomena:

    a. The residential heterogeneity derived from income levels, with poor residents living in quarters smaller than those of the middle and high classes;

b. The existence of important urban segments that have not been recorded in the Municipal Real Estate Registration Database. We have assumed that this is the case of those areas for which the indicator is of less than 10sqm per inhabitant.

In São Paulo, there is a high correlation between average income and number of square meters of residential area (R2 = 87.7%), as it can be seen in Figure 1 below. While in more central areas such as Moema square meters for residential use may reach very high levels, this indicator substantially decreases towards most peripheral areas. In Anhanguera (Northeastern region), São Mateus (Eastern region) and Marsilac (Southern region), for instance, levels are close to zero.

Figure 1: Residential Built Area per Inhabitant and Family Income. Districts of São Paulo, 1996 and 1997.
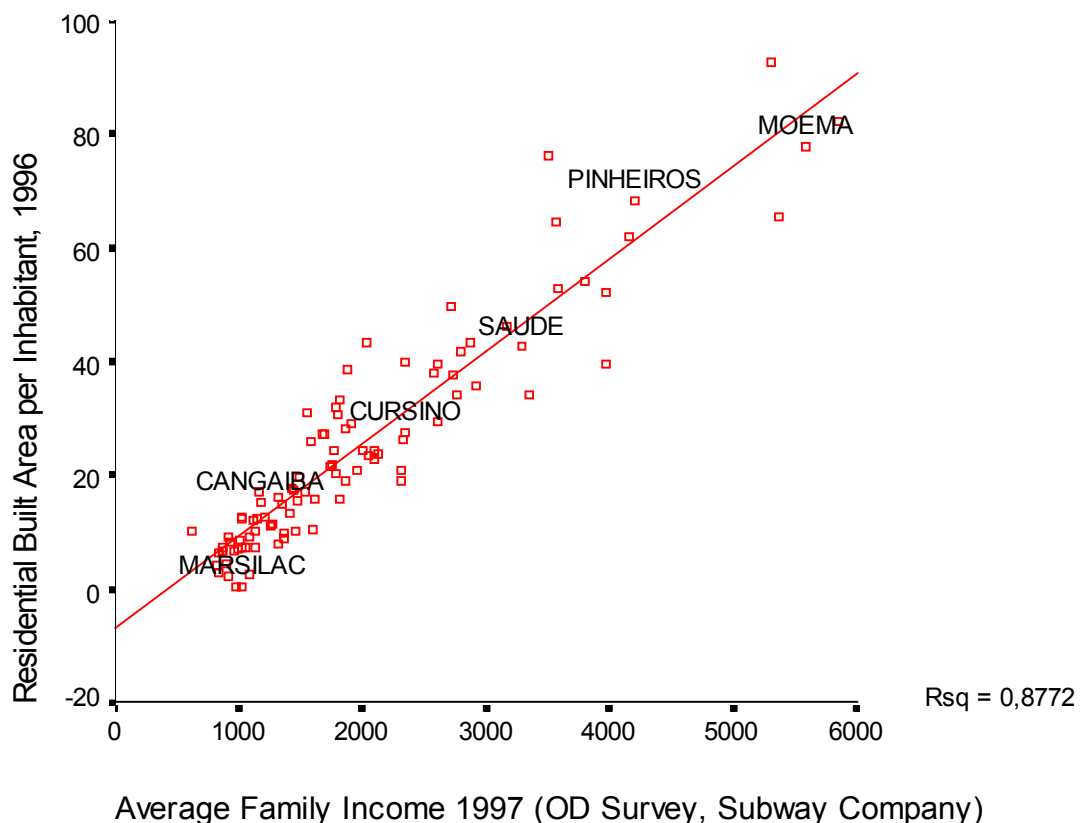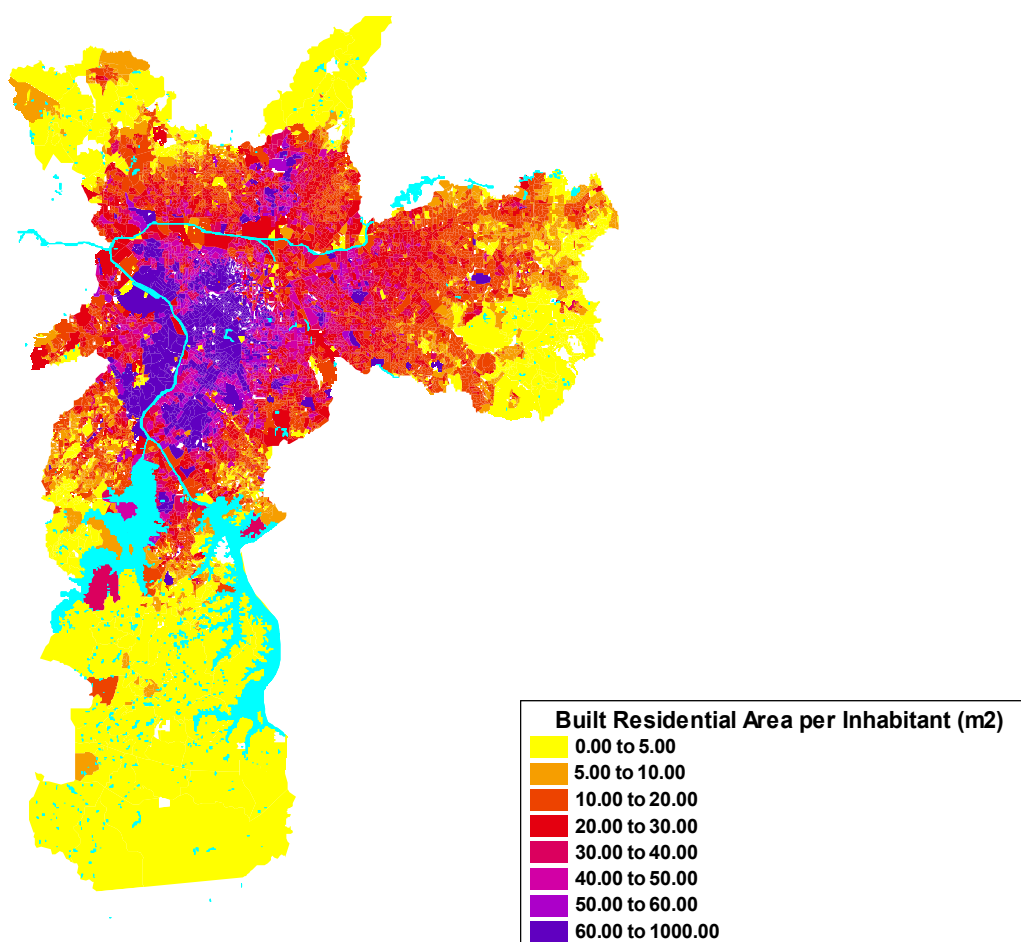
In the periphery of the city, part of the existing households is not officially registered at the City Council. Therefore, some city districts show a substantial population and an effective income, albeit low, while their average residential area is near zero per inhabitant. Such cases indicate a non-registered household, which cause such areas to be called the "illegal or unofficial city" (Gronstein, 1987).

Through Map 4, it is possible to observe that important areas of the city presented Real Estate Records of less than 5sqm per inhabitant in 1996 – especially around the Southern, Northern and Eastern borders, which have expanded most in recent years. Some areas in the interior of the city, however, also present features similar to those observed in peripheral regions, indicating the existence of shantytowns and other subnormal housing formats.

Map 4: Residential Built Area per Inhabitant. Census Tracts, 1996.

Built Residential Area per Inhabitant (m2)
0.00 to 5.00
5.00 to 10.00
10.00 to 20.00
20.00 to 30.00
30.00 to 40.00
40.00 to 50.00
50.00 to 60.00
60.00 to 1000.00

The comparison between Maps 1 and 4 shows that the city as perceived by Real Estate Records is significantly smaller than the actual one. In reality, as far as the official data is concerned, several people from the periphery live in "non existent" housing. In terms of public policies, this has serious implications. Since such housing estates and land developments do not exist for the State, it more difficult to have basic infrastructure services and social equipment. Services that are provided depend on the pressure exercised by the organized population living in such areas (Jacobi, 1991).

The actual size of this population, or the number of irregular homes, is in fact difficult to be measured. Different situations may occur – from originally regular land developments that have been subdivided without official avail, to irregular building and expansions in areas already recorded by the City Council. Also, there may be cases of new peripheral land occupation, which have yet to be incorporated into the City Council Database.

To produce alternative estimates, we have aggregated the population living in census tracts with less than 5sqm (1) and less than 10sqm (2) of build area per inhabitant. Group 1 has presented an expressive population of 1.6 million people – approximately 16% of the São Paulo´s population in 1996. Groups 1 and 2 together showed 3.0 million people living in areas of less than 10sqm per inhabitant, or about 30% of the total population.

It would be important to notice that since a single bed occupies 2sqm, either such households are diminutive – of a clearly subnormal standard – or the residential areas observed have not been properly recorded. Both options most probably apply here.

5. Access to Land and School

In general, it is possible to observe in the maps shown above that regions with greater problems of access to school are also areas with lower indicators for built area per inhabitant. The problem of access to public school for children in poor areas should nevertheless be better qualified, since its mere representation on a map may be delusive: many peripheral areas are not occupied, thus justifying the inexistence of schools. At the

same time, there is an expressive number of schools in areas with high concentration of poor people.

In fact, when observing groups of census tracts aggregated according to residential area, it is possible to notice that the group from 0 to 10sqm is the only one that presents a significantly higher average distance to school. The remaining groups show a progressive trend: tracts that greater concentrate families with low residential area are closer to schools (Figure 2).[13]

Figure 2: Average Distance from the Census Tracts to the Nearest School According to Groups of Residential Area per Inhabitants, 1996.

Groups of Tracts According to Residential Area per Inhabitant (sqm)
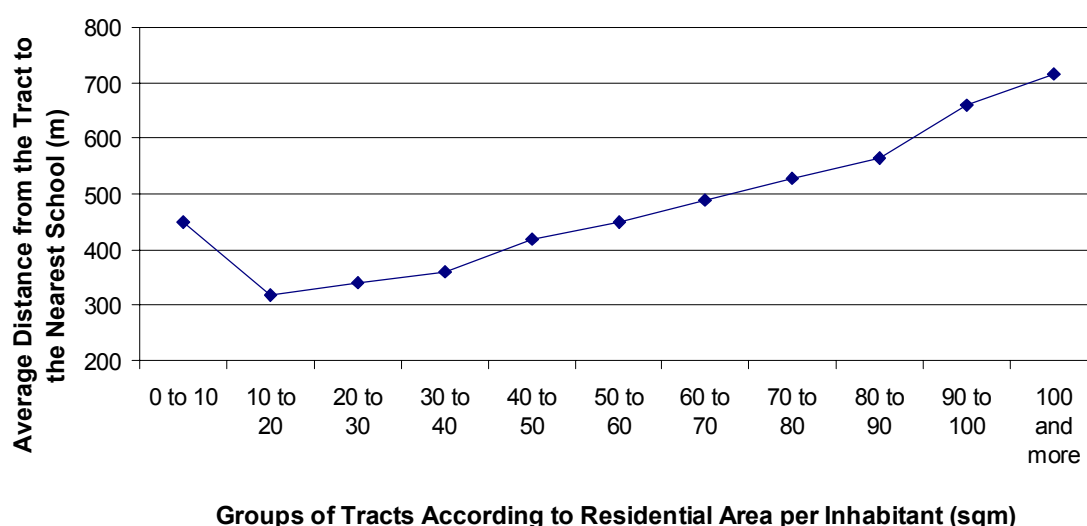
It is nevertheless important to stress the situation of the group with 0 to 10sqm of average built area. This group has been focused before here because it represents shantytowns and the most peripheral areas of the city. Children from these tracts have to travel longer to reach school – 450m on average. Since they typically belong to lower income families, journeys are on foot as no other means of transport (i.e., car or bus) is available to them. Usually, this group of census tracts with 0 to 10sqm of built area per inhabitant also

features the most congested public schools. On average, this group concentrates more children per class in the first years of elementary school (Figure 3).

Figure 3: Students per Class in Public Elementary School (1st to 4th grade) According to Groups of Residential Area per Inhabitants, 1998.

Groups of Tracts According to Residential Area per Inhabitant (sqm)
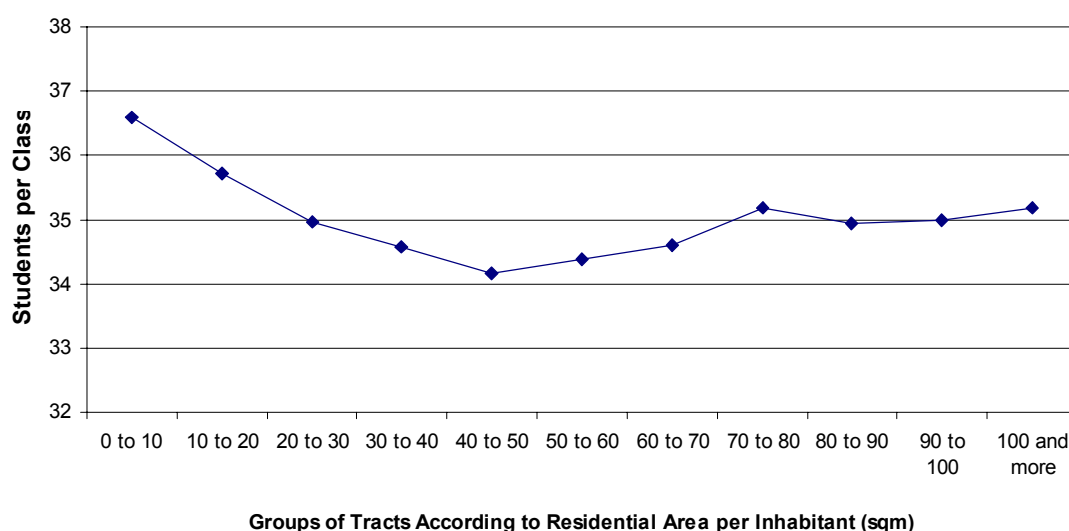
The size of the child population living in very bad housing conditions is another important element. Despite representing 30% of the city´s total population, the tracts with an average area per inhabitant below 10sqm registered a significant concentration of children at school age. In fact, of the total of 1.4 million children in the city of São Paulo ranging from 7 to 14 years of age, around 45% (647,000) lived in tracts whose average registered area per inhabitant was lower than 10sqm (Figure 4).

In other words, in demographic terms, the child population living in census tracts with residential built area per capita below 10sqm is quite significant. On average, this great infant contingent not only studies in more congested and distant schools but also lives in worse housing conditions, as shown by the data on the average residential area per

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[13] The high average distance between public schools and census tracts with large residential area per capita is logical, since higher income groups have cars and do not enroll their children in public schools.

inhabitant.[14] This conjugation of poor residential and educational conditions is typical of the Brazilian periphery, and may also be a reference for other social policies, such as sanitation and health (Torres e Marques, 2001).

Figure 4: Population from 7 to 14 years of Age According to Groups of Residential Area per Inhabitants, 1996.

**Groups of Tracts According to Residential Area per Inhabitant (sqm)**
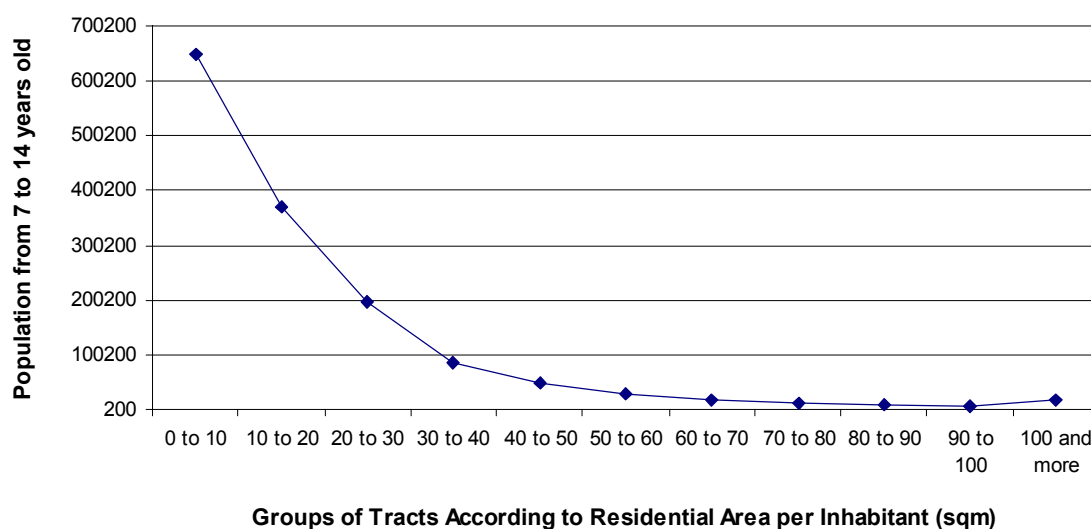
Similarly, when we take in aggregated terms the distance traveled by children of each of these census tracts – considering they all study at the nearest school – and the size of this population in each group of built residential area, it is possible to capture another important dimension of the educational and housing inequality (Figure 5). Such distances are likely to be underestimated. Since schools closer to tracts with low levels of residential area per inhabitant have more congested classes, children tend to study in educational institutions farther away.

With this kind of information, it is possible to understand that transportation costs are implicitly imposed on different social groups due to the location of educational equipment vis-à-vis their homes. Greater global costs especially fall on those families living in census

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[14] It should be noted that such data refer to the universe of public schools, and not to a sample.

tracts with lower average of residential built area per capita. As noted before, these families are typically those worse off.

Figure 5: Total Distance Traveled by All Children from 7 to 14 Years Old to Reach the Closest Elementary School, According to Groups of Residential Area per Inhabitants, 1996.

Groups of Tracts According to Residential Area per Inhabitant (sqm)
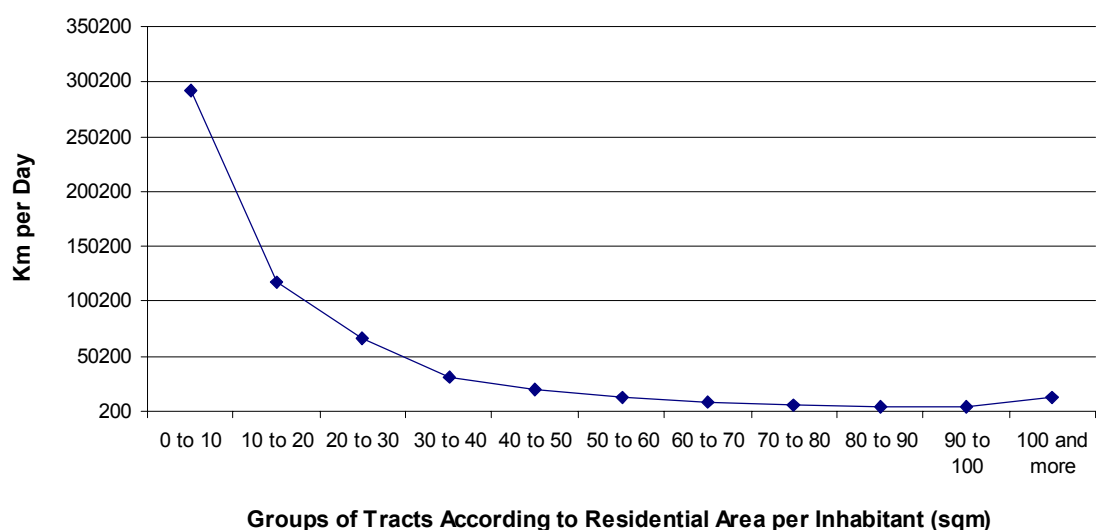
In summary, we have tried to show here that still remains a strong relationship between locations with very few average residential built area per capita and locations with worse access to public schools, even after universal coverage for primary school has been accomplished in São Paulo. Typically, the worst situations are in the irregular settlements in the urban periphery: the home of the low-income population. In the following section we briefly discuss the reasons behind this scenario.

6. Discussion

In general, the literature on social policies in Brazil present four different – and to some extent complementary – explanations for the precarious access to public services of the population living in urban areas of irregular occupation:

    a. The population living in the periphery is less educated and organized, therefore less capable of demanding public services from the government (Jacobi, 1989). Since the decision-making process regarding where to locate new schools greatly depends on the direct demands of the population – stated either individually, or through councilmen or other community representatives – less educated and illiterate groups have more difficulty to express their needs. This difficulty can be due to the lack of the appropriate contacts and connections in the public sphere, or because they are unaware of the possibility of directly demanding for such services.[15] Moreover, this population is largely formed by recent migrants with a thin connection with systems of collective representation (Torres e Marques, 2001). Recent migrants usually do not vote in their new adoptive city, which makes access to councilmen and other representatives even more complicated.[16]

    b. There seems to be a circular causality system between the political and economic powers, leading to heavier public investment in areas of greater concentration of high-income individuals (Vetter, 1975). This is an important hypothesis for public policies such as sanitation and urban structure. In terms of the public elementary school, however, it seems to be less relevant, since higher classes in Brazil have

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[15] In the three cities of the Metropolitan Area of São Paulo already surveyed (Guarulhos, Mauá and Embu), the major information source on locations of higher demand was the direct claim by the population. In the case of the State Secretariat for Education, the main information source is school enrollment, which happens up to six months before the beginning of the school year.

[16] Peripheral areas typically present fast demographic expansion. The public sector is not always capable of providing services to areas of stronger demographic pressure, not only for lack of information on growth rhythms between two censuses, but also due to operational inertia.

moved out of public schools in the 70s for quality reasons (Haddad and Pierro 2000);

c. Lower-income population from peripheral regions would be victims of the prejudices of high and middle class public managers, and are not perceived as preferential subjects for public policies (Marques 2000). This argument seems to be more significant when applied to specific right-wing political parties than to the public servants of the educational segment, which has been since the 80's expanding its services to more marginal groups, as previously mentioned. In any case, this possibility deserves to be further analyzed;

d. The public sector usually does not build infrastructure in locations that have been invaded, especially due to the risk of losing the public money invested in such areas and of lawsuits against public administrators (Maricato, 1996).[17] On the other hand, Real Estate Databases, which are used for fiscal purposes, are also the main information system employed by City Councils in Brazil. To some extent, a resident of invaded areas "does not exist" to the City Council because – among other things – he or she is not included in the records and does not pay income taxes. Illegal occupation areas, irregular land developments and shantytowns are marginally surveyed, and the data obtained about them is controversial and difficult to be verified.

These four arguments indicate the issue of access to public services and housing inequality is related to a complex set of factors, i.e., processes of political representation, action rationale of the bureaucratic segments responsible for service provision, demographic dynamics, and institutional aspects related to land ownership and registration. When jointly considered, such arguments also suggest that – even if the local power falls in the hands of more democratic administrations, which could cease the favoring of richer areas – the public sector would still face difficulties in providing public services such as education.

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[17] This is the case of the sanitation and education segments. This information has been privately provided by the Secretary for Education of São Paulo, and by the Planning Superintendent of Sabesp, the sanitation company of the State of São Paulo.

Such a scenario occurs because the public administration, even when it focuses on the poor, is unable to find regular land in the periphery in which to install new equipment. Also, its databases present important gaps and do not capture the existing demand or the ongoing demographic expansion. In other words, the absence of land regularization seems to significantly contribute to stress inequalities in the access to other social services.

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