The Geography of Opportunity: Social Segregation and its Effects on Public Education in the Metropolitan Region of Campinas

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INTRODUCTION

The rapid process of urbanization in Latin America over the past 50 years has resulted in large mega-cities characterized by high income inequality, poor housing conditions and reduced access to public services, particularly among the urban poor. Indeed, rising levels of urban poverty has proved to be a general characteristic of Brazilian urbanization. However, in recent years decreasing urban primacy in Latin American countries has led to high growth rates within smaller urban agglomerations. While some research has documented the extent of social segregation in the mega-cities of Latin America, less attention has been given to that of its secondary cities. Practically no research has been done on the relationship between segregation and access to public services in secondary cities.

In recent years the Metropolitan Region of Campinas, Brazil (see Figure 1), located about 100 km west of the city of São Paulo, has had one of the highest annual growth rates of the state of São Paulo. In 2000, 6.32 percent of the state's population lived within the region. In point of fact, during the 1970's the São Paulo state government began moving economic production away from the state capital of São Paulo towards the interior of the state, thus fueling rapid economic and population growth in Campinas. As a result, Campinas can be classified as an "emergent metropolis", in that the majority of its growth occurred within the last 30 years. As such, the processes and consequences of urban expansion within the region have been largely unexplored (NEPO/NESUR 2004).

The region's pattern of urban expansion resulted in a complex territory which reflects the contradictory nature of economic growth. This growth led to a process of urbanization that favored the increase of gated communities for middle and high income households. It simultaneously led to the concentration of the poor in periphery neighborhoods characterized by

precarious urban infrastructure, as well as the creation of *favelas* throughout the region (NEPO/NESUR 2004). Accordingly, as characteristic of many Latin American cities, the spatial distribution of Campinas is one where the affluent concentrate in the socially heterogeneous center of the region, while the poor tend to be homogenously concentrated in a large area occupying the southwest of the region (Cunha, Jakob, Jiménez and Luhr 2004). In Campinas, rapid urbanization and population growth has often outpaced the capacity of the local government to provide basic infrastructure and public services to its residents.

With this in mind, our objectives are two-fold. We first document the evolution of segregation in the Metropolitan Region from 1991 to 2000, the most recent period for which census data is available. We use two measures of segregation, the index of dissimilarity and Moran's I, to evaluate changes in the patterns of residential segregation over the decade. Second, we examine the relationship between the structural quality and average test scores of public schools in the municipality of Campinas[1] with the socioeconomic characteristics of the areas in which they are located, in order to explore variations in the relationship between neighborhood characteristics and the quality of public education within the municipality.

OVERVEIW OF THE METROPOLITAN REGION OF CAMPINAS

Demographic and economic characteristics

The Metropolitan Region of Campinas (MRC), consisting of 19 municipalities and containing almost 2.2 million habitants, is without a doubt one of the most important regions in Brazil, not only because of its economic production but also because of its prominence in Brazilian technological production (*polo tecnológico)*. As such, at the same time that the MRC expanded and assumed national importance it also accumulated—and continues to accumulate—

[1] At this time school quality information is only available for those schools located in the municipality of Campinas. However, it is important to note that approximately 50% of public schools in the metropolitan region are located in the municipality of Campinas.

undesirable consequences, the majority of which have manifested themselves in other Brazilian metropolises. These include a high concentration of poverty, unemployment, violence, increasing inequality and unequal economic development, and overall, a strong tendency towards social segregation.

As shown previously (Cunha et al. 2004), from a demographic standpoint the creation and expansion of the MRC reveals similarities with what has been established in other metropolises in the country. That is, expansion occurred as a function of high population growth, particularly in the peripheral areas of the region, although there are clear indicators that diverse processes, such as the growth of suburbs[2] and other municipal seats besides Campinas, also impacted growth. In the 1950's, Campinas became one of the most noticeable cities in the interior of the state of São Paulo both because of its dynamic economy and its population density. In a predictable manner, urbanization in the region accompanied economic growth; from 1946 to 1954 Campinas tripled its total area (Zimmermann 1988).

Principally in the 1970's Campinas received large government investments from the state of São Paulo, turning it into one of the major axes of industrial expansion into the interior of the state. As a result, the major push to move industrial production from the Metropolitan Region of São Paulo to the interior of the state rapidly increased population growth in the municipality of Campinas, as well as the Metropolitan Region as a whole (see Table 1).

Map 1, which shows the areas of the MRC by population growth in the last decade, illustrates the main axes of expansion in the region, the majority of which follow the main highways in the region. While occupation in three directions (west, southwest and north) was driven by the offer of low-income housing, there is also a high concentration of housing

[2] This and other terms have been used to represent different phenomena. Although important from a conceptual point of view, at this point of time we do not discuss the issue of suburbanization further. Without a doubt this theme will be a point of reflection in future work on this issue.

attractive to those of higher incomes in the north and southeast. These types of housing include gated communities, nature preserves, and even a complex for high technology production. Although many directions of expansion and population concentration exist, residential segregation within the region is most clearly defined by the Anhangüera Highway, which runs from the northwest to the southeast of the MRC (Cunha el at. 2004).

(Map 1 about here)

From an economic standpoint, the MRC has progressively increased its share of industrial production in São Paulo state. In 20004, production in the Metropolitan Region was responsible for 7.4% of the state's GDP. In fact, table 2 illustrates that 7.8% of value-added production São Paulo state is due to activities in the region. Although there are differences between municipalities, particularly those farthest from the metropolitan center, the economy of the MRC remains an urban, principally industrial, one.

Social-spatial heterogeneity

As in other metropolitan regions in Brazil, Campinas has a significant level of segregation, although in some zones of the region it is possible to observe the coexistence of residents of various socio-economic strata, such as areas where *favelas* or irregular occupations are juxtaposed with middle- and high-income housing. Our previous work demonstrated spatial differences in the region according to housing infrastructure using such indicators as the connection to a wastewater system and the number of bathrooms[3] in a household. Between 1991 and 2000 there was a significant improvement in housing quality throughout the region, while at the same time the concentration of precarious housing conditions increased in the most

[3] In point of fact, greater accessibility to basic sanitation services in São Paulo state, in addition to the poor quality of information about basic sanitation because of citizens' difficulties in distinguishing what type of service they have, leads to our conclusion that the number of bathrooms in a household is more powerful predictor of differences in the structural quality of households.

peripheral areas of the municipality of Campinas, particularly the southwest. Similarly, when mapping head of household income, there is a clear differentiation between the zones delimitated by the Anhangüera Highway. There is a "corridor of affluence" to the east of the region, whereas in the southwest and west the population of lower income tends to concentrate in what we label the "corridor of poverty[4]" (Cunha et al. 2004). While this spatial distribution is very distinct from that of the concentric circles model present in other regions such as the Metropolitan Region of São Paulo, it does express a center-periphery dichotomy in a different form, with the Anhangüera Highway as the dividing line.

SPATIAL SEGREGATION: CONCEPTS AND MEASURES

Although studies of residential segregation in the United States most often focus on spatial differences based on race, populations can be also geographically concentrated according to socioeconomic status, life cycle position, and/or ethnicity (Frisbee and Kasarda 1988). In the case of Brazil, socioeconomic status is a far stronger predictor of residence than race (Telles 1992, 1995). Indeed, measures of residential segregation by race in Brazilian cities are moderate when compared to the same measures calculated for U.S. cities (Telles 1992). In all cases, residential segregation is meant to refer to the phenomenon where the two or more social groups reside in physically distant areas of the urban fabric (Massey and Denton 1988). However, it is important to note that residential segregation (i.e., physical distance) does not necessarily equate social exclusion (i.e., social distance), although it is a possible indicator of it (as Park 1967 argued). Regardless, researchers have embraced the idea that residential segregation is a complicated phenomenon that can exist in varying dimensions.

[4] Further analysis reveals that these regions are also ones with higher proportions of children and school-age population. For more information, see NEPO/NESUR 2004.

In their work on residential segregation in the United States, Massey and Denton identify five dimensions of segregation—evenness, exposure, concentration, centralization, and clustering (Massey and Denton 1988, 1989). However, as other researchers have noted (e.g., Sabatini 2004), not all of these dimensions of segregation are applicable to the study of Latin American urban areas. As such, we calculate measures for two aspects of segregation—evenness and clustering. Evenness is a facet of spatial distribution where a social group can be *over*-represented in some census tracts and *under*-represented in others with respect to the proportion of group in the total area. Clustering refers to the distribution of the population in space—whether the areas occupied by a population are spatially contiguous versus being dispersed throughout the urban area.

The index of dissimilarity (D), created by Duncan and Duncan (1955), is the measure most commonly used to quantify the concept of evenness. The index analyses the level of equity in the distribution of two social groups in each territorial unit (in this case, the Brazilian equivalent of a census tract, the *setor censitário*). The index represents the proportion of one social group that would have to change residence to make its distribution in all territories the same as that in the universe (Massey and Denton 1988, 1989). The index ranges from 0 to 1, where 0 indicates perfect integration and 1 indicates perfect segregation.

Although frequently used in studies of segregation, since the index of dissimilarity is an aspatial measure of segregation since it does not take into account the population's distribution across the territory. As such, it masks differences in levels of segregation within the urban fabric. However, the local Moran's I allows for the identification of contiguous areas of poverty and affluence within the city, so called hot spots and cold spots (Anselin 1995). The global Moran's I is the summed values of the local Moran's I, and it indicates the degree to which the

characteristics of a defined area are a significant predictor of the characteristics of its neighboring areas.

With both of these indicators, the definition of the area and scale at which segregation is measured greatly affects the results. The modifiable area unit problem (MAUP) frequently arises in spatial analysis because of the arbitrary nature in which spatial units (e.g., census tracts) are designed. Usually spatial units are designed for methodological ease and do not reflect the neighborhoods in which people reside. Related to MAUP is the issue of scale, in that the level of aggregation of data which is used will greatly affect the results of studies of segregation. Indeed, our previous work in this region illustrates that area and scale are very important when evaluating patterns of spatial segregation in Campinas. The index of dissimilarity for the Metropolitan Region of Campinas as a whole is very different from the indices of dissimilarity calculated using only census tracts southwest of the highway or northeast of the highway—the area of concentrated affluence (northeast) is more socially heterogeneous than that of the area of concentrated poverty (southwest) (Cunha et al. 2004). If we had used a division other than the Anhangüera highway to divide the territory of the MRC—municipal boundaries, for example—our results would have been completely different. Although we recognize the importance of these methodological issues to the study of segregation, we are limited by the data available to us.

DATA AND MEASURES

To accomplish our objectives we use data from the Brazilian census in 1991 and 2000 at the census tract (*setor censitário*) level, the smallest level at which Brazilian census data is aggregated. For the Metropolitan Region of Campinas in 1991, there were 1815 census tracts, 39 of which are omitted from our analysis due to missing information (these census tracts have less

people than the minimum necessary for IBGE to release data). In 2000, there were 3106 census tracts; once those tracts with missing data are excluded, we have 3064 census tracts.

Here it is necessary to identify indicators that permit us to adequately characterize social-spatial segregation. As mentioned above, this phenomenon can be evaluated according to many dimensions (income, race, religion, migratory status), yet in Brazil, there is no question that segregation principally manifests itself according to socio-economic status. However, one indicator alone is not capable of revealing the great differences between people residing in a region like Campinas. Furthermore, the socio-economic indicators most frequently used, such as the poverty line, are problematic for several reasons. First of all, Brazil has no federally mandated poverty line as does the United States. As such there is no consensus on how to calculate the Brazilian poverty line (although generally some sort of calculation of the cost of a food basket is used), nor its analytical meaning. Regardless of the debate surrounding the meaning and measurement of poverty, we agree with other authors (e.g., Torres, Marques, Ferreira et al. 2002) that poverty is multi-faceted and income levels alone are inadequate measures of poverty. With this in consideration, in this paper we use a conjunction of indicators that reflect not only human capital characteristics of household heads, but also factors related to housing quality and household composition.

We use two sets of indicators of socioeconomic status. We follow the work of Torres, Marques, Ferreira et al. (2002) and conduct a factor analysis to obtain summary indices of poverty (see Appendix A for the list of variables). We arrive at 4 indicators of different yet overlapping indicators of poverty for 1991—socio-economic status, neighborhood characteristics, household structure and family life cycle. The results of the factor analysis for 2000 are very similar, although there is no significant indicator for household structure. As our

main objective in this paper is to evaluate changes in the patterns of residential segregation from 1991 to 2000, we omit this indicator and concentrate on the results for the three factors significant at both points of time.

Although several variables indicating the level of schooling of the household head is included in the various poverty indicators, education has been consistently shown to be a strong indicator of socio-economic status in itself, and as such we use it to calculate measures of segregation as well. Years of education of the head of household is dichotomized according to the mean for each year that D is calculated (1991 mean=5.92, 2000 mean=6.63). We also calculate whether or not the head of household has a primary education (4 years or less versus more than 4 years of schooling).

RESULTS

The Changing Pattern of Social-Spatial Segregation

The combination of different measurements of segregation, as well as different indicators with respect to poverty, permits us to better clarify the magnitude and nature of segregation in the region. During the 1990's, levels of education and income increased within the Metropolitan Region of Campinas, as did access to basic public services such as running water, garbage collection and the waste water system. Additionally, levels of illiteracy decreased, both among children 7 to 14 and among heads of household (see Table 1 in Appendix A). This indicates an overall improvement in the socioeconomic conditions within the metropolitan region.

When calculating the index of dissimilarity we use the two dichotomized head of household education variables. While recognizing the difficulties of using the dissimilarity index to evaluate the phenomenon at hand, particularly considering its variability depending on the spatial unit studied (Vignoli 2001, Préteceille 2004), the index is still useful as a summary

indicator to evaluate the changes in the region during the 1990's, a decade which represents a crucial time of consolidation of the metropolization process. Table 3 illustrates that the indices of dissimilarity both for mean years of education and whether or not the householder had a primary education decreased slightly from 1991 to 2000. From 1991, the index of dissimilarity according to mean education decreased from 33.70% to 31.13%. This means that in 2000, a little more than 31% of those households whose head has less than 7 years of schooling would have to change their census tract of residence so that their distribution across census tracts would be equal to their presence in the metropolitan region as a whole. Similarly, in 2000 the index of dissimilarity decreased from nearly 30 to 25.57, indicating that about a quarter of those households where a head has less than a primary education would have to move residences so that their distribution across census tracts would be equal to that in the entire metropolitan region. Overall, these changes in the dissimilarity index most likely can be attributed to increases in education in the Brazilian population. Although recent educational gains in Brazil have been slight, according to IBGE the average years of schooling of the Brazilian population older than 10 years of age increased from almost 5 years in 1991 to 6.4 years in 2003.

(Table 3 about here)

The changes in the index of dissimilarity must be interpreted with some caution due to the sensitivity to changes in the composition of the population. Overall however, the dissimilarity index indicates relatively low levels of segregation according to education in both 1991 and 2000. Yet, as noted above, this summary index of segregation masks differences in the urban fabric.

Table 4 presents the global Moran's I values for 1991 and 2000 by education and poverty indicators. Since our final objective is to evaluate the relationship between household

characteristics and quality of public schooling, we use a critical distance threshold of 2 kilometers in order to calculate the weight matrixes. We base our rationale on a state law that mandates that children should live a maximum of 2 kilometers from a public school. These results demonstrate that there is significant positive clustering by head of household education level and all poverty indicators; however the former is stronger than the latter. These results differ somewhat from those obtained using the index of dissimilarity, although generally they indicate that segregation is lower in 2000 than it is in 1991.

One interesting exception is that of mean years of education. Here, it was not necessary to dichotomize the mean years of schooling of the household head in order to arrive at the global Moran's I. This is the only indicator of segregation by education where segregation increases, albeit slightly (from 0.53 in 1991 to 0.58 in 2000). This perhaps points to the effects of the loss of information in dichotomizing a continuous variable. Additionally, the Moran's I for the family life cycle indicator of poverty increases slightly between 1991 to 2000, from 0.29 to 0.33, indicating an increase in the clustering of neighborhoods with younger heads of households and higher dependency ratios, although here again, only slightly.

(Table 4 about here)

When mapping local Moran's I values, we are able to visualize where clustering of affluence and poverty occurs within the Metropolitan Region of Campinas. In our analysis, hot spots (red) are significant clusters of census tracts with high values on a variable, and cold spots (dark blue) are significant clusters of census tracts with low values on a variable. As our previous work demonstrated (Cunha et al. 2004), there is a significant clustering of high educated households in center of Campinas—mainly to the northeast of the Anhangüera Highway—while there is a large cluster of low educated households in the area spanning the

southwest of the MRC, what we call the "corridor of affluence" and the "corridor of poverty", respectively (See Maps 2 and 3).

(Maps 2 and 3 about here)

The areas surrounding the municipal seats of Americana and Paulínia prove to be exceptions to this spatial pattern (see Figure 1 for the location of the 19 municipalities of the Metropolitan Region of Campinas). However, both cities are known for their industries that attract highly educated workers. Additionally, the significant cluster of highly educated heads of households in the far south of the region represents the municipal seat of Indaiatuba, which recently became popular for the development of middle- and high-income gated communities. However, when assessing changes in the pattern of hot spots and cold spots by householder education, we observe the corridor of poverty stretch further to the northwest of the region, while the corridor of affluence spreads both northwards and southwards along the Anhangüera Highway. Similarly, the maps for clustering by our measure of socio-economic status (poverty factor 1) demonstrate the move from a highly concentrated areas of affluence in the center of the metropolitan region in 1991 to a more disperse area of high socio-economic states to the northeast of the highway.

(Maps 4 and 5 about here)

The neighborhood characteristics (Maps 6 and 7) indicator of poverty departs from this corridor pattern in distinct ways. In 1991 the neighborhood characteristics indicator is the only one that portrays a clear traditional center-periphery dichotomy; in 2000 continues to do so. This indicates that more recently settled areas with high concentrations of affluent households lack the same basic neighborhood infrastructure as those areas where the poor concentrate. Still, in this

analysis it is the indicator with the weakest level of clustering in 1991 and remains so in 2000 (0.37 in 1991 and 0.28 in 2000).

(Maps 6-9 about here)

These maps also confirm the heterogeneity of the corridors of affluence and poverty in the metropolitan region. There is a lot of light blue (areas of low poverty, surrounded by areas of high poverty) and pink (areas of high poverty, surrounded by areas of low poverty) to be seen on these maps. The neighborhood characteristics poverty indicator showed the most heterogeneity in terms of the mix between middle zones, which is confirmed by the relatively lower global Moran's I scores. In this case, hot spots and cold spots are not the wide swaths of areas that they are for other indicators of socio-economic status and poverty. While there have been significant improvements in the overall level of access to better housing, these improvements are not uniform across the metropolitan region. As we shall see below, unequal access to public services is not only characteristic of the Metropolitan Region of Campinas but also a feature of the municipality of Campinas itself.

The geography of opportunities: Social Segregation and Public Education

The intent to know, measure and characterize existing residential segregation becomes even more important when taking into consideration that in cities, the area where families live represents an important factor in the improvement or deterioration of their material conditions, what Sabatini (2004) and others refer to as the "geography of opportunities".

In order to demonstrate this hypothesis this study uses the example of public education in two dimensions: the quality of schools with respect to their infrastructure and student achievement measured by tests administered to all students in the state of São Paulo academic system (SARESP). We intend to examine whether the areas that are most segregated, most

precarious and furthest from the region's center are also where the majority of schools with fewer resources and worse student performance are located.

In 1996 the Brazilian government amended the constitution to ensure universal enrollment of all children from first to eighth grades. This amendment also dictated that 15% of municipal and state tax revenue be spent on public schools, as well as guaranteed a minimum amount of federal spending for each student in these grades (Torres, Ferreira and Gomes forthcoming). However, universal enrollment of Brazilian children has not ensured universal levels of educational quality. Since public schools are all funded by the state or municipal government, theoretically all schools should be of equal quality. Instead, at least in Campinas, school infrastructure and student academic achievement vary significantly from school to school.

We obtain information about public schools from two sources. First, the 2003 Brazilian school census provides information on the structural quality of schools using the following four dichotomous indicators: whether the school has a library, whether the school has a sports field, whether the school has a computer lab, and whether the school has a science lab (for all variables, yes=1). When these four services are summed we obtain a single measure of school infrastructure which ranges from 0 to 4.

Second, the System of Evaluation of Academic Achievement in the State of São Paulo (SARESP) is a standardized test administered to students attending state schools. The main objective of this test is to monitor the quality of the state educational system. In 2000, the test was administered to students enrolled in state schools in the fifth and seventh grade. Test scores range from 0 to 100 percent; in 2000, the average score in the Metropolitan Region of Campinas was 45 percent. In this case, information is only available for state-administered schools.

To begin, segregation (as measure by clustering) in the municipality of Campinas exists at similar levels as it does for the MRC as a whole (see Table 5). Next, maps 10 and 11 illustrate the location of public schools that offer up to one service and all four services, respectively, compared to hot spots, cold spots, and mixed areas as defined by the socio-economic status poverty indicator. Poorer quality schools (those that offer no or one service) primarily are distributed towards the periphery areas of the municipality, although there are some situated in the central areas of the city. When comparing the location of poorer quality schools in relation to the hot spots and cold spots of poverty identified in our previous analyses, it is clear that the majority of these schools fall within these hot spots of poverty (see Map 10). At the other extreme the situation is somewhat different; those schools that offer all 4 services are mostly concentrated in the center of Campinas and its surroundings, areas that are also much less poor than those in the southwest region of the municipality, but these high quality schools are located in hot spots of poverty as well (see Map 11).

The distribution of schools according to their mean scores (less than or equal to the mean score of 45 percent versus above the mean) on the SARESP exam in 2000 is presented in Map 12. Visually more striking than in Map 11 is the distribution of schools according to mean scores; lower performing schools are spread out in the direction of the periphery and almost none are found in the more central areas of the municipality. What is most notable, however, is the low average test score of students in the region (45.1 percent, ± 5 percent).

We should emphasize that in Brazil, as a rule low income children only attend public schools, a fact which exacerbates the concentration of poverty and its effects on schooling. It is also clear that when dealing with public schools in Brazil, many centrally located schools also serve students residing in the peripheries of the municipality. Luhr and Cunha (2004) illustrate

this when analyzing the case of one of the oldest schools in Campinas, located in the center of the municipality in one of the highest priced areas of the city. Overall, this does not diminish the importance of the results here emphasized since by law children should study in the areas closest to their residences. In fact, few students attend schools outside of their immediate area, as verified using information from the Origin/Destination[5] survey conducted in the region in 2003.

CONCLUSIONS

Our LISA analysis demonstrates that there are significant and large clusters of low and high poverty areas in both 1991 and 2000, while our summary measures of segregation indicate moderate levels of residential segregation by education and poverty for both these years. We do not consider these results to be contradictory; rather, they point to the many facets of residential segregation, and highlight the importance of using more than one measure of segregation when studying this phenomenon.

If Campinas is to be taken as a case of one of the many smaller, faster growing metropolises of Latin America, this may bode well for the future of metropolises in the region. Indeed, in the United States it is the fastest growing cities in the South and the West of the country with the lowest levels of residential segregation according to race and ethnicity (Glaeser and Vigdor 2001). Perhaps this means that the new metropolises of Brazil are not condemned to repeat the sins of their fathers, the mega-cities of São Paulo and Rio de Janeiro.

As our data on public school quality show, equal access to services does not ensure equal quality of services. However, our analysis demonstrates that the lack of utilities and waste disposal is not as concentrated as other indicators of poverty used; indeed, clusters of areas lacking these public services are located throughout the Metropolitan Region—both in clusters of

[5] The Origin and Destination survey was conducted for the first time in the Metropolitan Region of Campinas in 2003 by the Empresa Paulista de Planejamento Metropolitano SA (EMPLASA), part of the Secretaria de Estado de Economic e Planejamento, with the objective of measuring people's daily trips from their households.

high and low socio-economic status households. Furthermore, low quality public schools tend to be found in poorer areas, but schools lacking infrastructure are found in wealthy areas of the municipality as well. The difference, though, is that affluent households tend to have the financial recourses to purchase goods to substitute the lack of public provision of services (e.g., private schooling), whereas poor households have little choice but to utilize whatever services are offered. Even though residential segregation is not as drastic as in other cities, the opportunities for upward mobility for poorer residents in the Metropolitan Region of Campinas are constricted by the lack of quality public schooling available to them.

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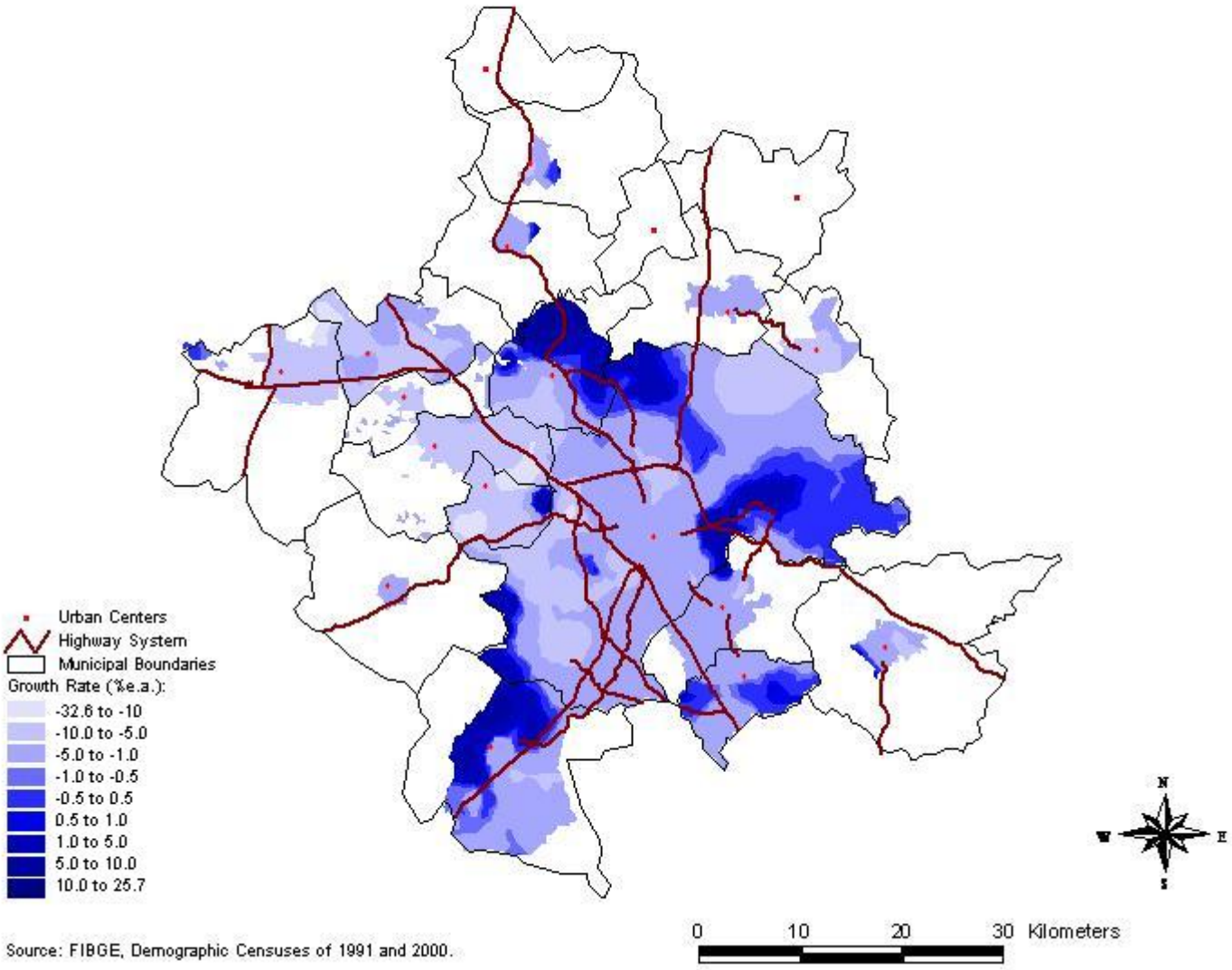
Figure 1. Metropolitan Region of Campinas by Municipality, 2000.

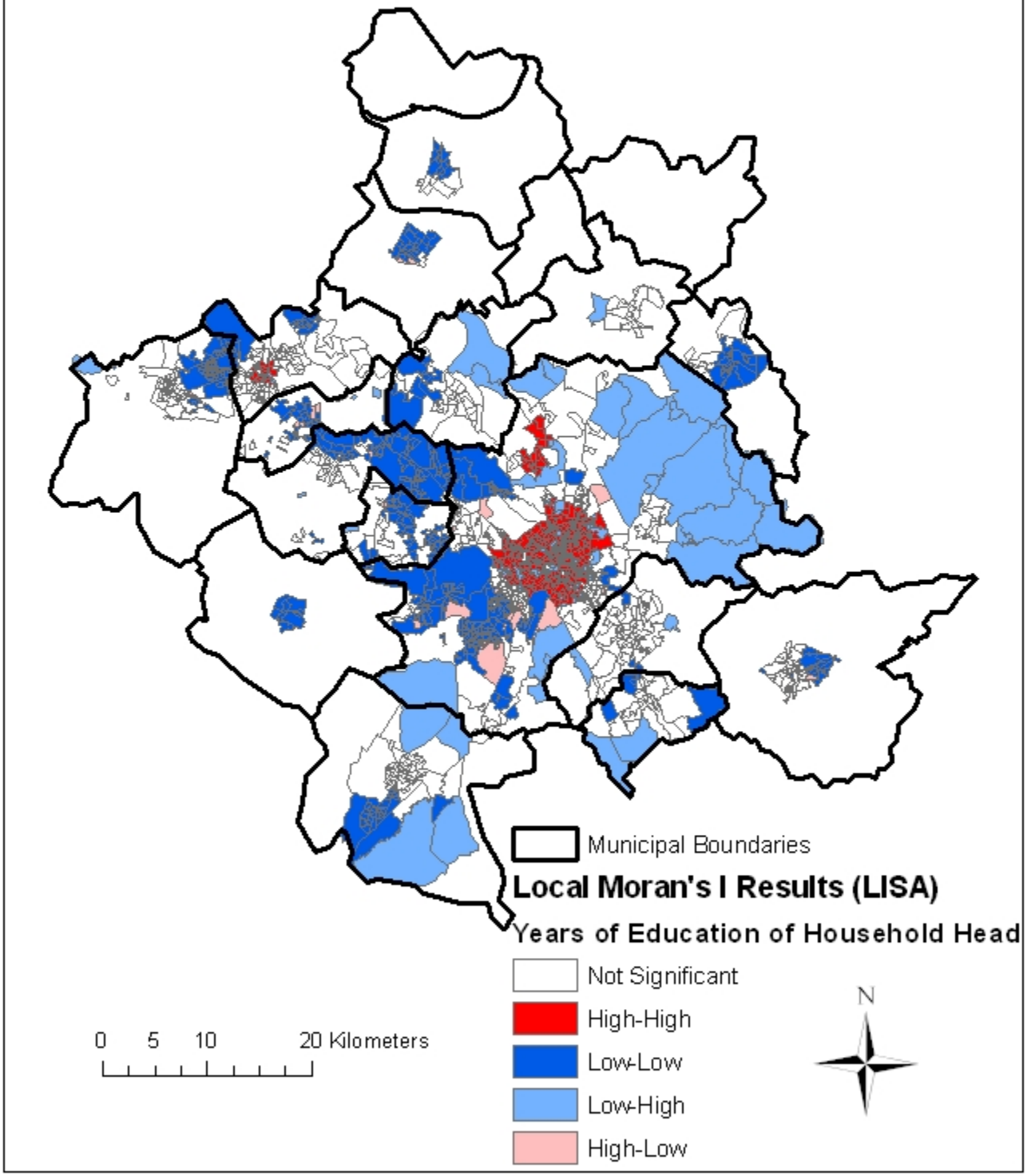
Map 1. Mean Geometric Growth Rates by Census Tract
Metropolitan Region of Campinas, 1991-2000.



Source: FIBGE, Demographic Censuses of 1991 and 2000.

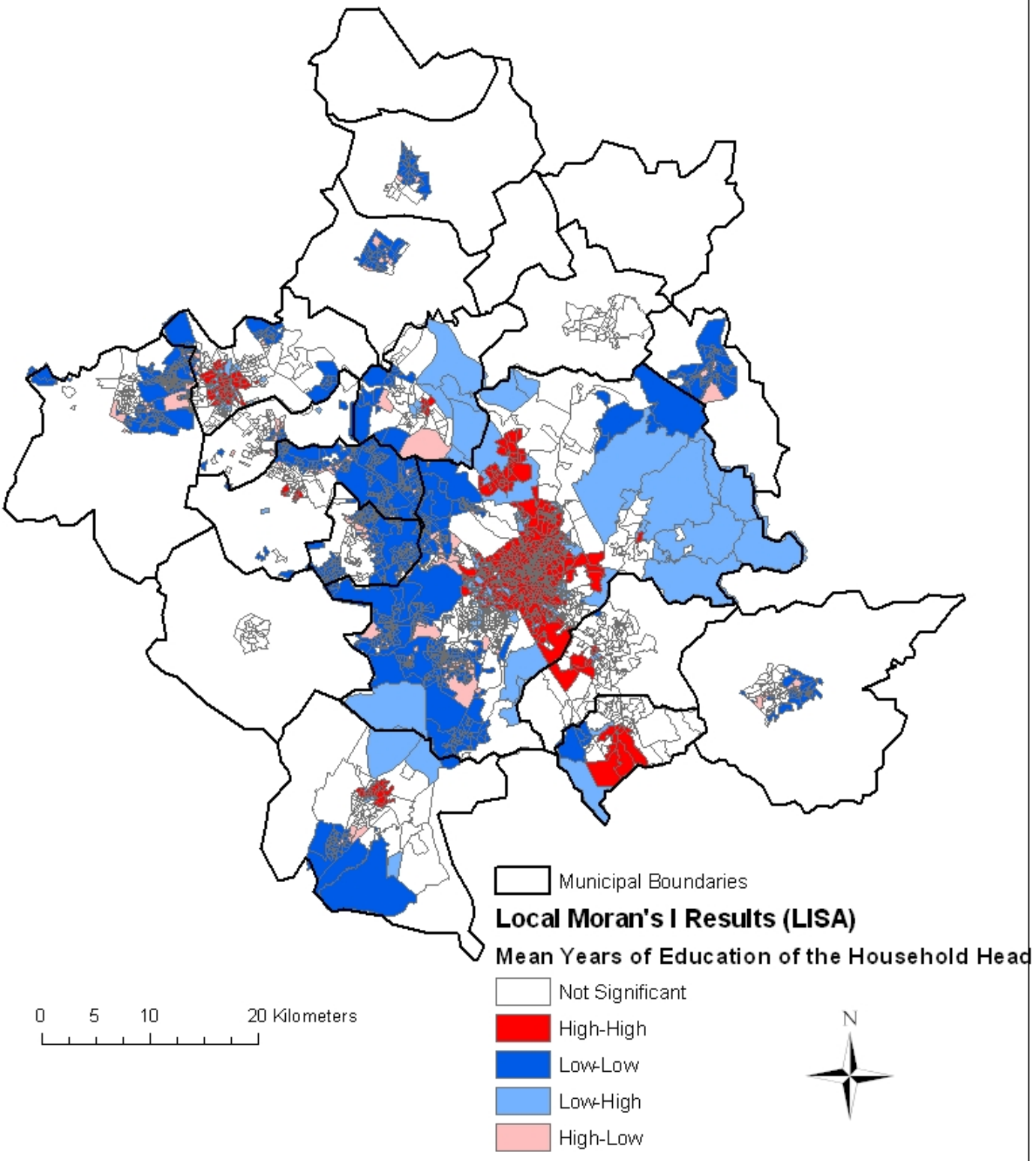
MAP 2: Results for Local Moran's I for Mean Years of Schooling of Household Head, Metropolitan Region of Campinas, 1991.

SOURCE: IBGE, Demographic Census 1991.



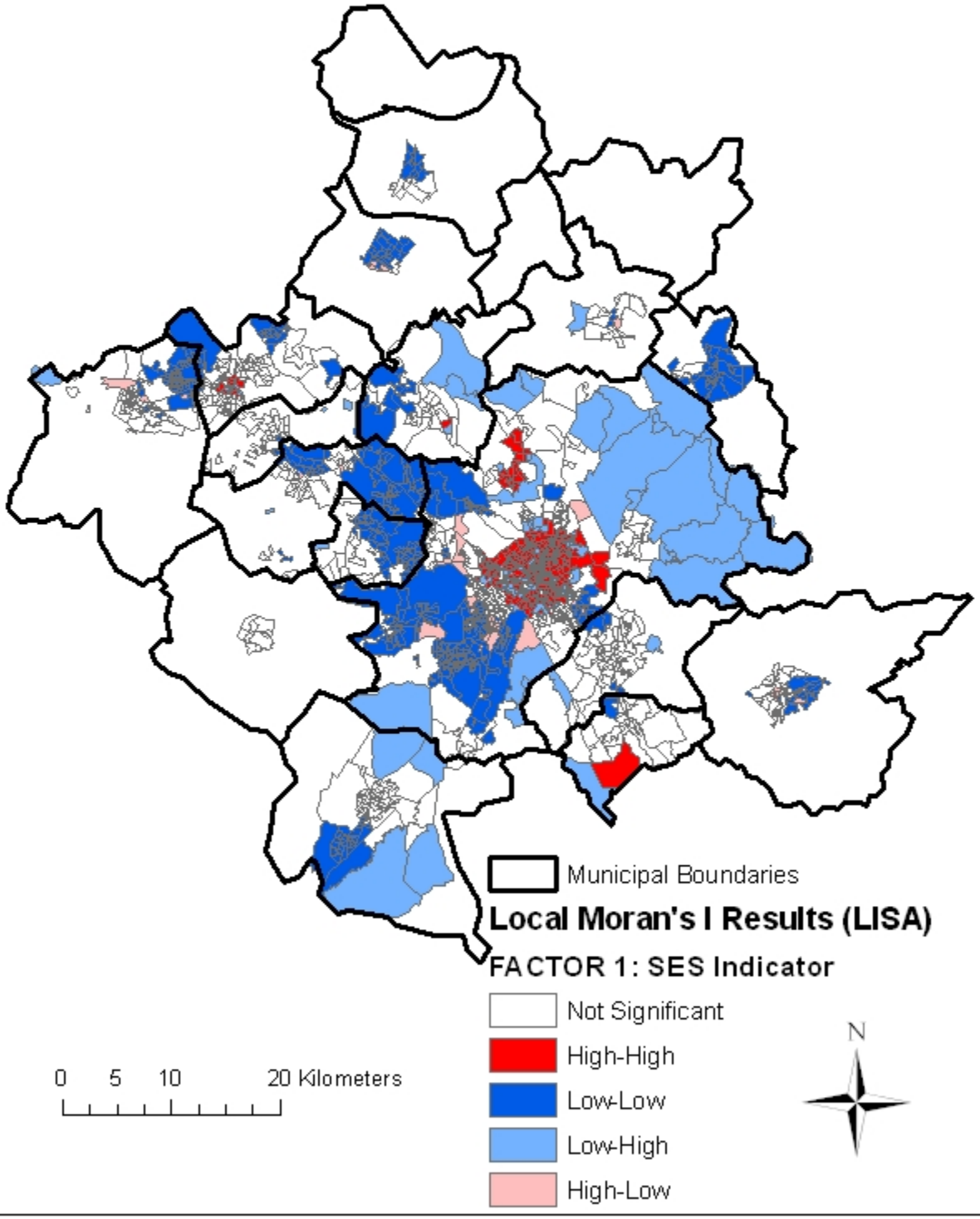
MAP 3: Results for Local Moran's I for Mean Years of Schooling of Household Head, Metropolitan Region of Campinas, 2000.

SOURCE: IBGE, Demographic Census 2000.



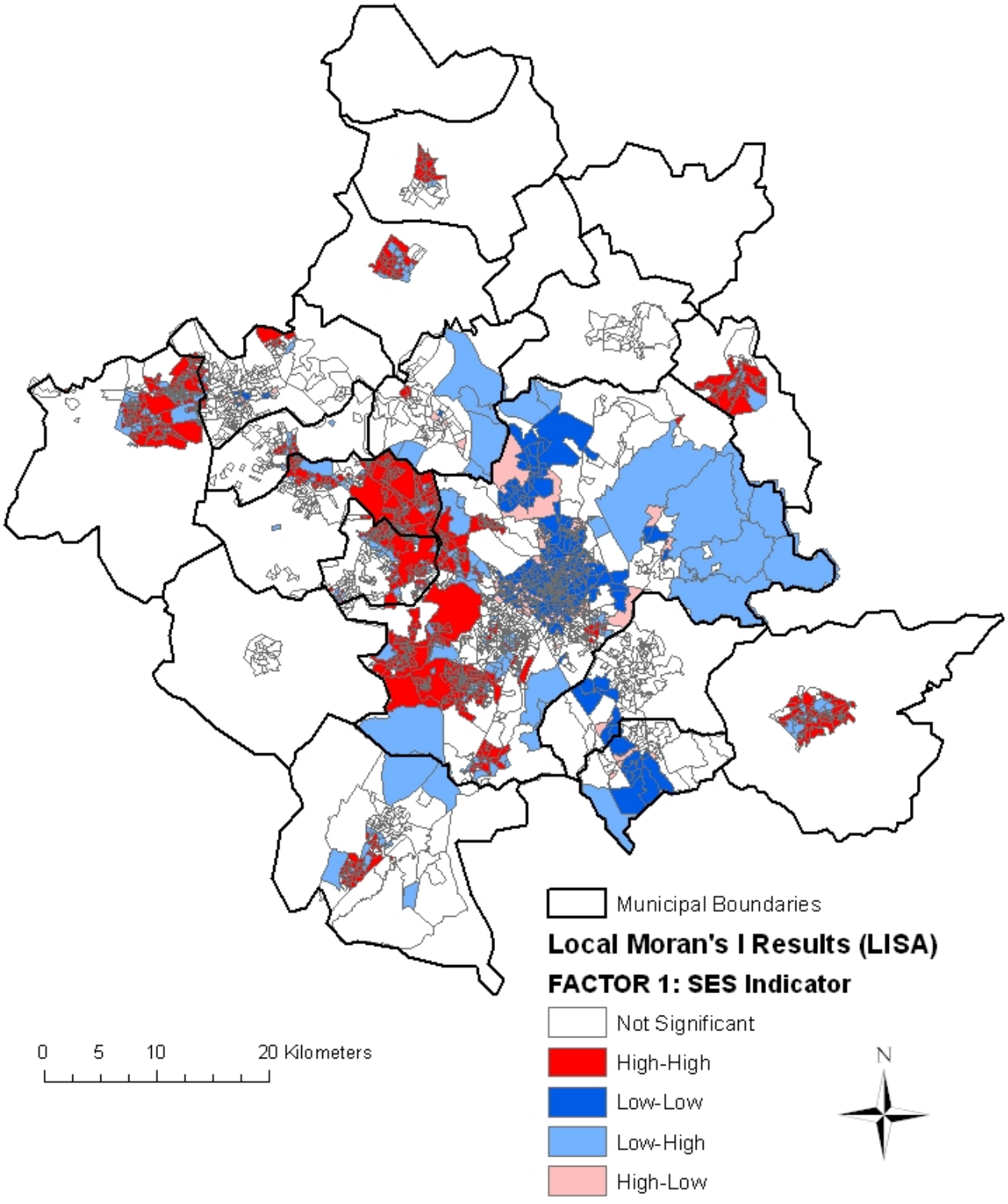
MAP 4: Results for Local Moran's I for Socio-Economic Status Indicator (Poverty Factor 1), Metropolitan Region of Campinas, 1991.

SOURCE: IBGE, Demographic Census 1991.



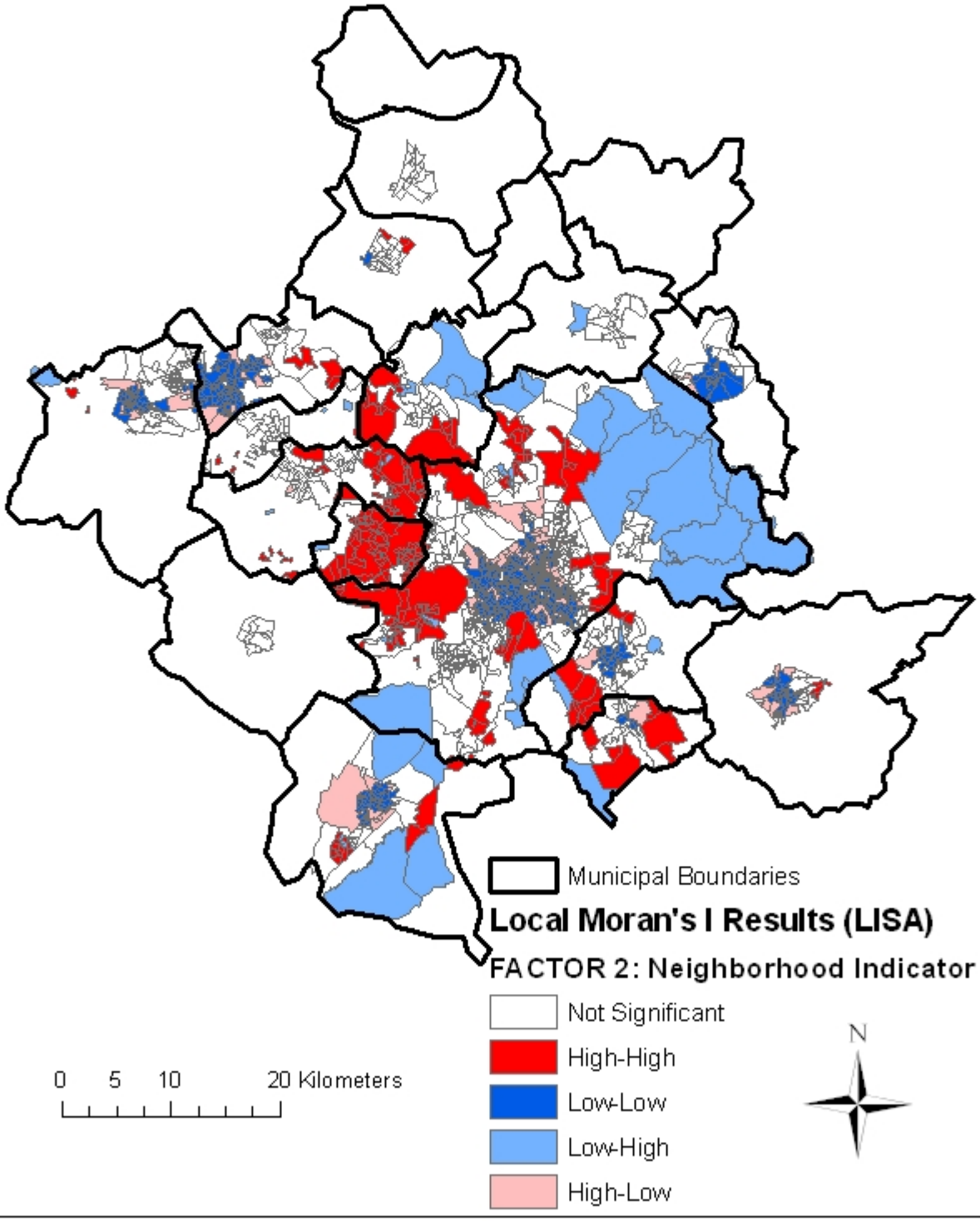
MAP 5: Results for Local Moran's I for Socio-Economic Status Indicator (Poverty Factor 1), Metropolitan Region of Campinas, 2000.

SOURCE: IBGE, Demographic Census 2000.



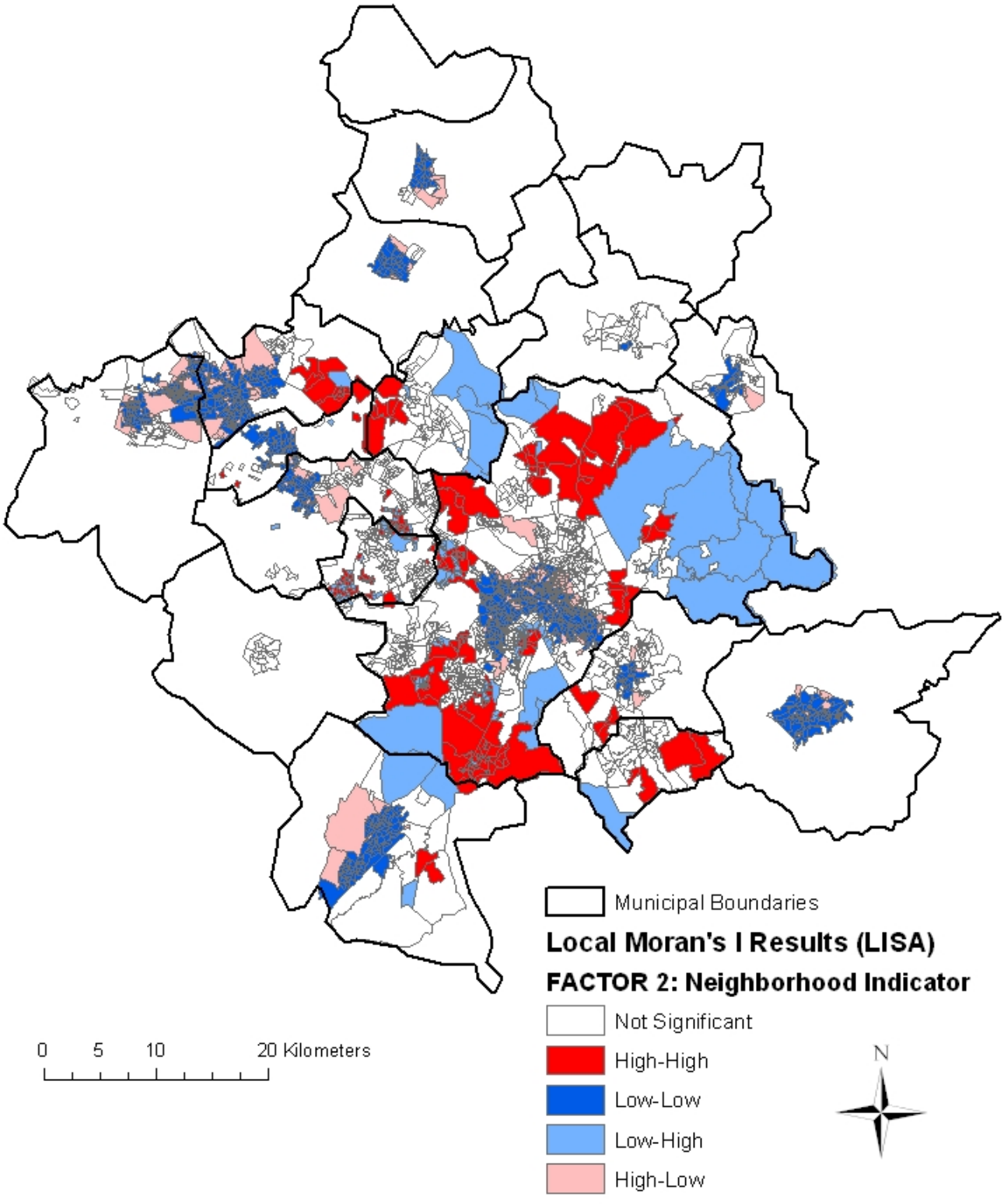
MAP 6: Results for Local Moran's I for Neighborhood Characteristics Indicator (Poverty Factor 2), Metropolitan Region of Campinas, 1991.

SOURCE: IBGE, Demographic Census 1991.



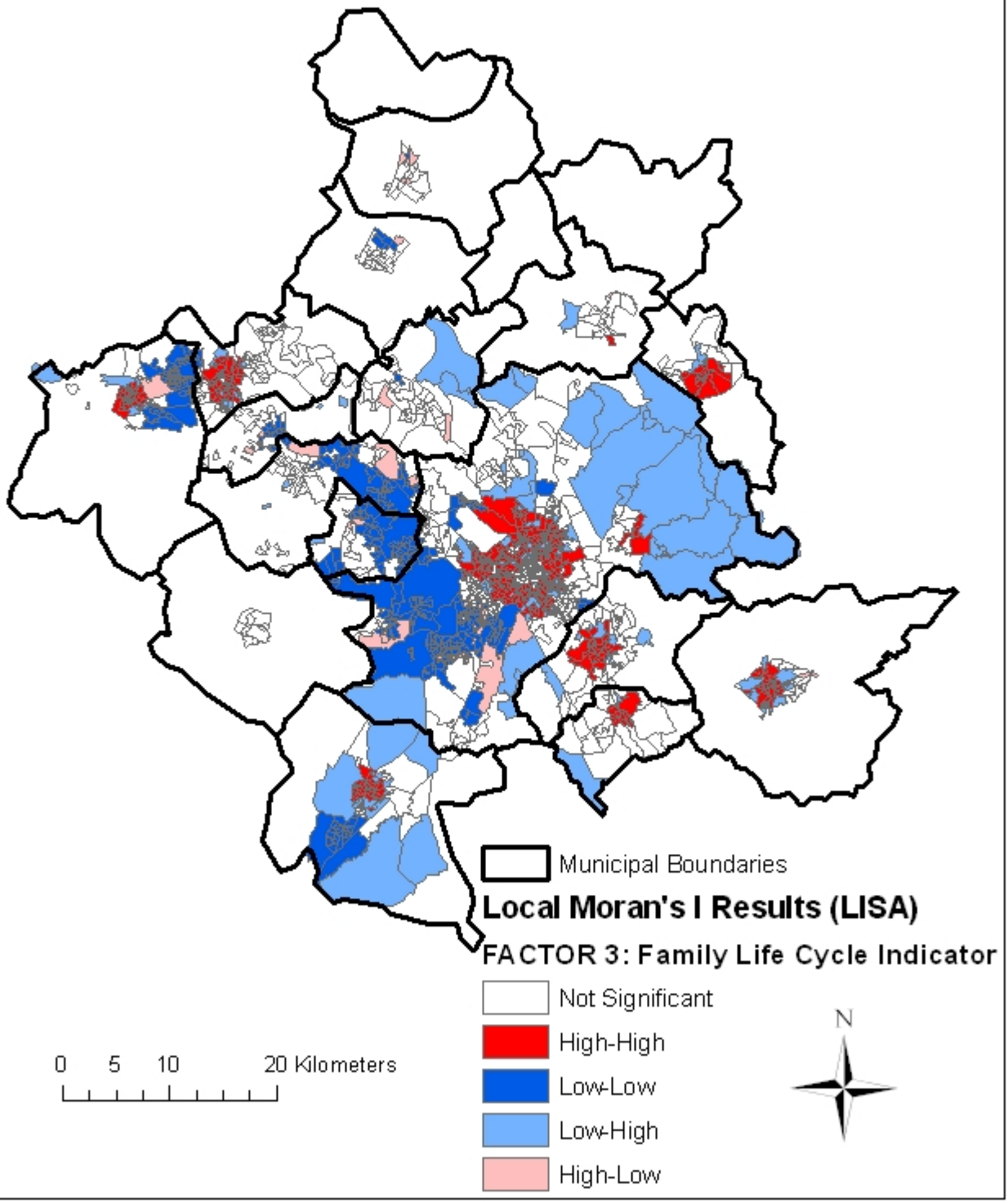
MAP 7: Results for Local Moran's I for Neighborhood Characteristics Indicator (Poverty Factor 2), Metropolitan Region of Campinas, 2000.

SOURCE: IBGE, Demographic Census 1991.



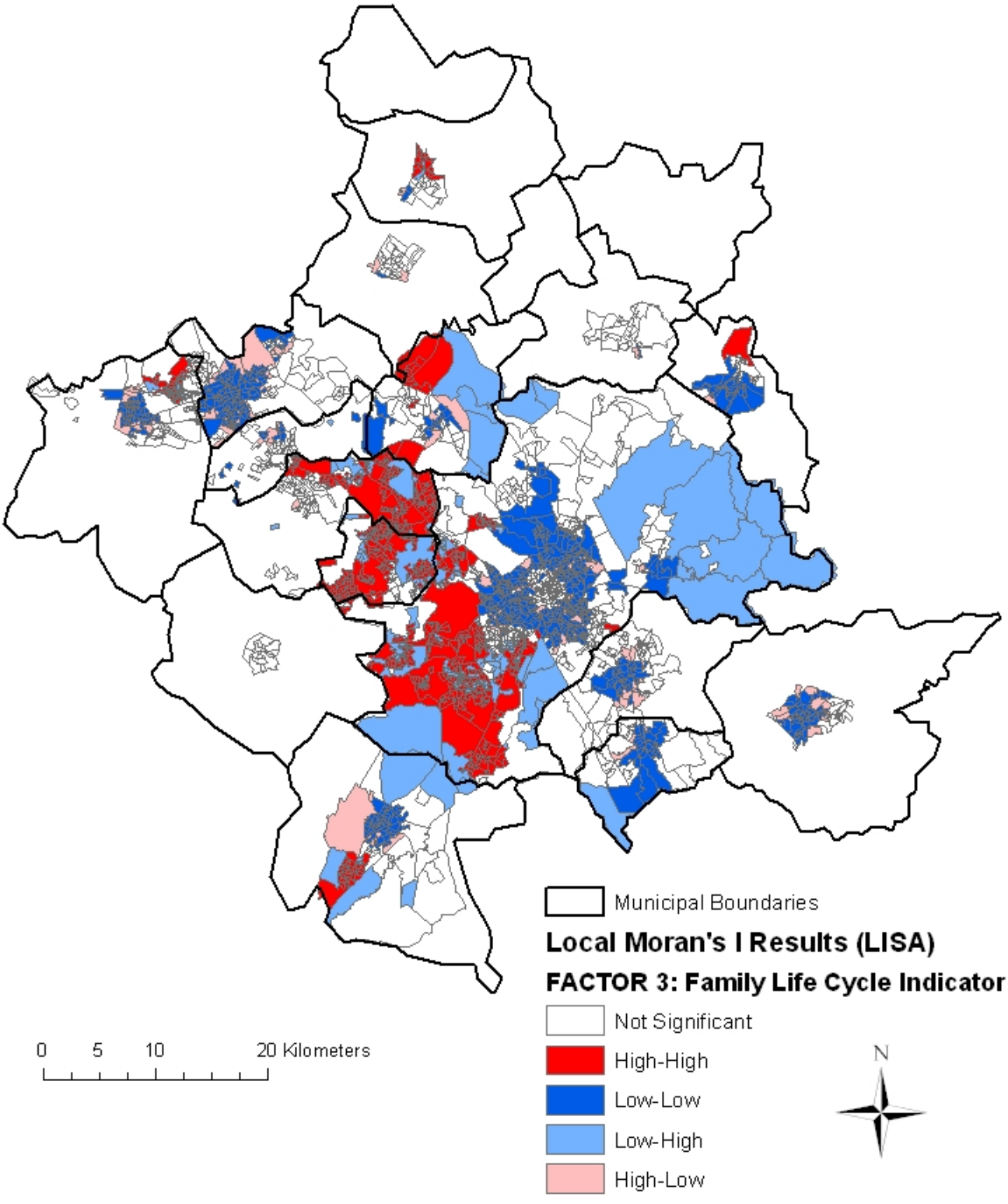
MAP 8: Results for Local Moran's I for Family Life Cycle Indicator (Poverty Factor 3), Metropolitan Region of Campinas, 1991.

SOURCE: IBGE, Demographic Census 1991.



MAP 9: Results for Local Moran's I for Family Life Cycle Indicator (Poverty Factor 3), Metropolitan Region of Campinas, 2000.

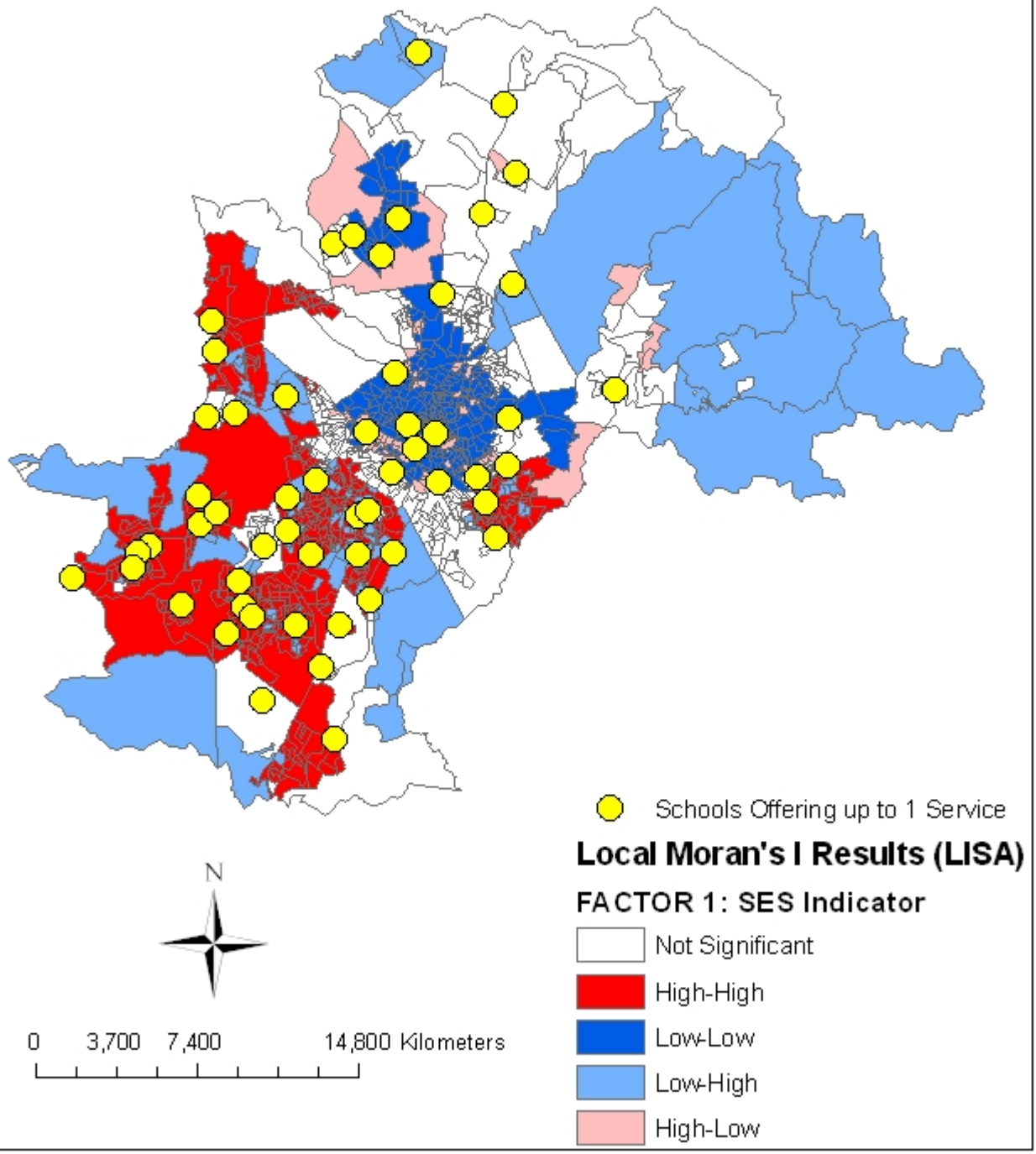
SOURCE: IBGE, Demographic Census 2000.



MAP 10: Results for Local Moran's I for Socio-Economic Status Indicator (Poverty Factor 1) (2000) and Public Schools Offering up to 1 Service* (2003), Municipality of Campinas.

*Services can be of the following: library, sports field, computer lab, and/or science lab.

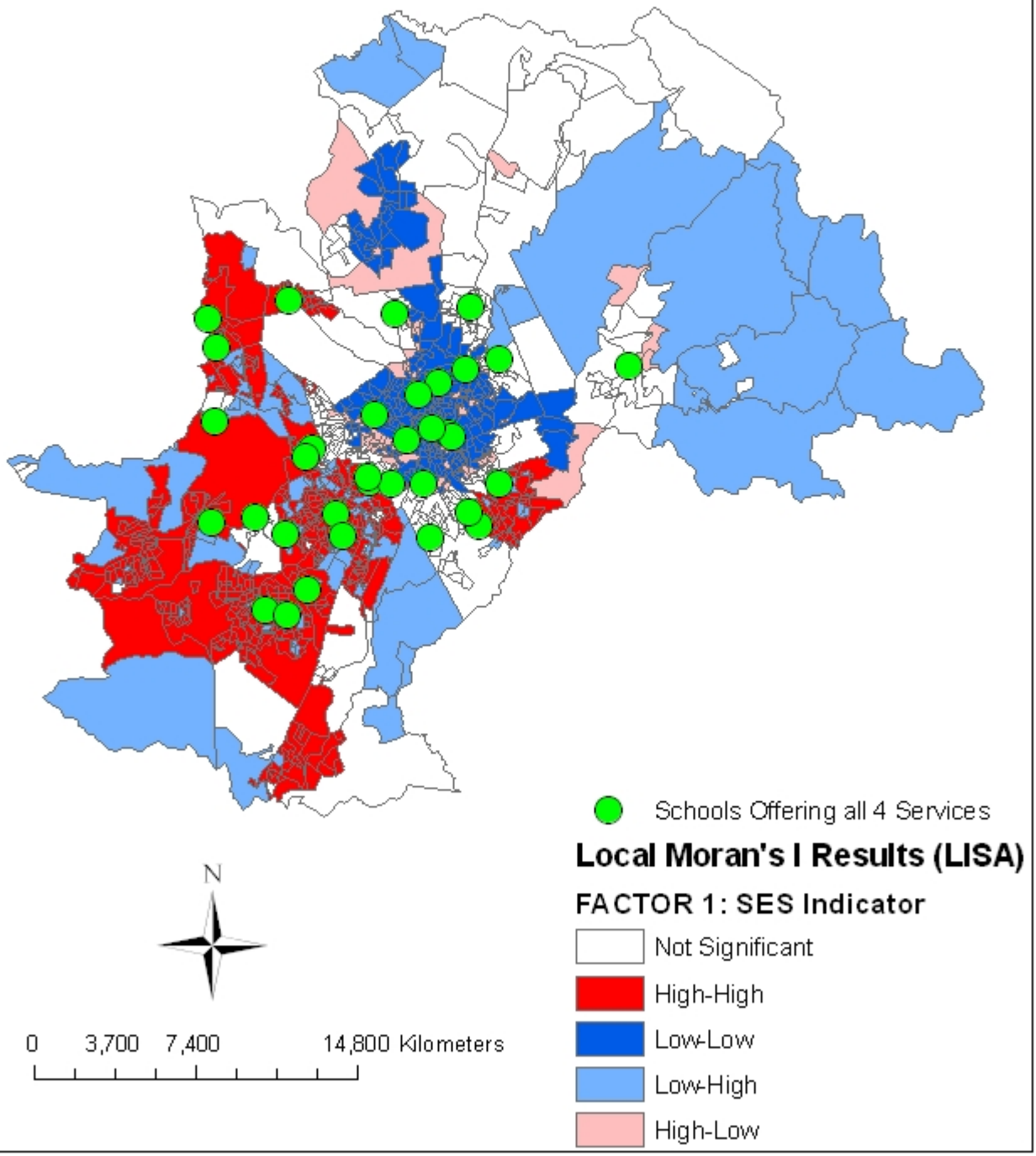
SOURCES: IBGE, Demographic Census 2000, and INEP, DATAESCOLA Brasil 2004.



MAP 11: Results for Local Moran's I for Socio-Economic Status Indicator (Poverty Factor 1) (2000) and Public Schools Offering All 4 Services* (2003), Municipality of Campinas.

*Services can be of the following: library, sports field, computer lab, and/or science lab.

SOURCES: IBGE, Demographic Census 2000, and INEP, DATAESCOLA Brasil 2004.



MAP 12: Results for Local Moran's I for Socio-Economic Status Indicator (Poverty Factor 1) (2000) and Mean SARESP scores of State-run Public Schools (2003), Municipality of Campinas.

SOURCES: IGBE, Demographic Census 2000, and SARESP, 2003.

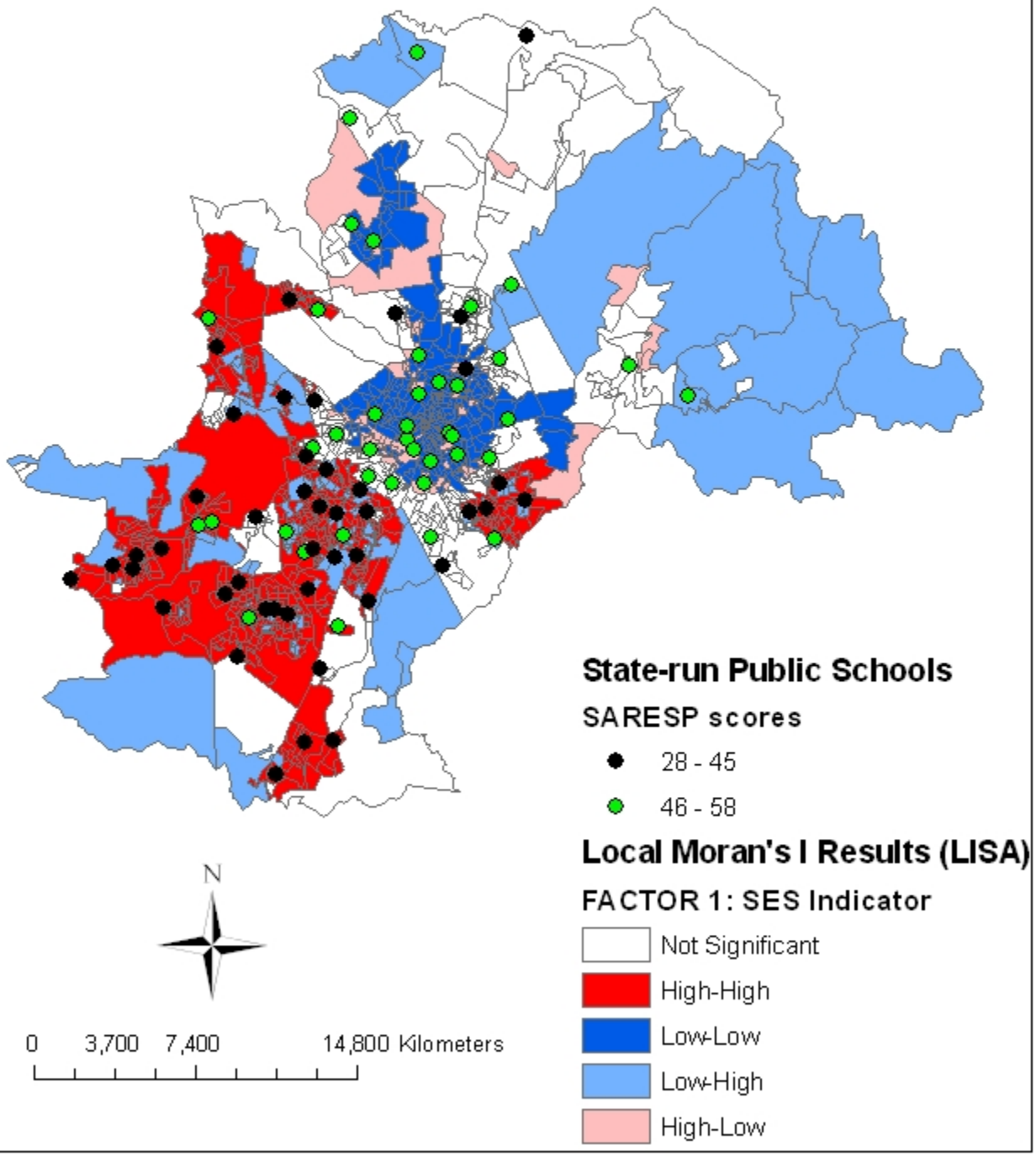


Table 1. Mean annual growth rates, Metropolitan Region of Campinas, 1970-2000.

	1970-1980	1980-1991	1991-2000
Brazil	2.48	1.93	1.63
São Paulo State	3.49	2.13	1.78
Metropolitan Region of Campinas	6.49	3.51	2.54
Municipality of Campinas	5.86	2.24	1.50
Other Municipalities in the Metropolitan Region	7.22	4.74	3.34

SOURCE: FIBGE, Demographic Censuses, 1970, 1980, 1991 and 2000.

Table 2. Value-added Production and Gross Domestic Product, Metropolitan Region of Campinas and São Paulo State, 2004.

	Value-added Production				GDP (millions)
	Agriculture	Industry	Services	Total	
Metropolitan Region of Campinas ($R)	820.22	13,169.10	14,003.19	27,992.51	32,237.09
São Paulo state ($R)	32,519.50	169,062.16	213,733.26	415,314.92	438,148.30
Metropolitan Region of Campinas/ São Paulo state (%)	2.52	7.79	6.55	6.74	7.36

SOURCE: Fundação SEADE.

Table 3. Index of Dissimilarity by Education*, Metropolitan Region of Campinas, 1991 and 2000.

Measure	1991	2000
Education		
Mean years of education**	33.70	31.13
Primary education or less (≤4 years vs. >4 years)	29.98	25.57

SOURCE: Brazilian census, 1991 and 2000.

*Years of education of the household head.

** As noted in the text, in 1991 mean years of education is dichotomized into less than 6 years and 6 years or more of education. In 2000, mean years of education is dichotomized into less than 7 years and 7 years or more of education.

Table 4. Global Moran's I by Education* and Poverty Indicators for the Metropolitan Region of Campinas, 1991 and 2000.

Measure	1991	2000
Education		
Mean years of education	0.5293	0.5813
Poverty indicators		
Socio-economic status	0.5370	0.3776
Neighborhood characteristics	0.3706	0.2755
Household structure***	0.1600	--
Family Life Cycle	0.2913	0.3259

SOURCE: Brazilian census, 1991 and 2000.

Note: All results significant at the $p < .05$ level.

*Years of education of the household head.

** As noted in the text, in 1991 mean years of education is dichotomized into less than 6 years and 6 years or more of education. In 2000, mean years of education is dichotomized into less than 7 years and 7 years or more of education.

*** Only an indicator in 1991.

Table 5. Global Moran's I by Education* and Poverty Indicators for Municipality of Campinas, 2000.

Measure	1991	2000
Mean years of education	0.4614	0.5047
Poverty indicators		
Socio-economic status	0.5163	0.4062
Neighborhood characteristics	0.3005	0.2640
Household structure**	0.1757	--
Family Life Cycle	0.2196	0.2596

SOURCE: Brazilian census, 1991 and 2000.

Note: All results significant at the $p < .05$ level.

*Years of education of the household head.

** Only an indicator in 1991.

Table 6. Characteristics of Public School Infrastructure by Type of Cluster where the School is Located, 2000/03/04.

Type of Cluster*	Number of Public Schools (Municipal and State-run)	Mean number of services offered	Percent of Schools Offering up to 1 Service	Percent of Schools Offering all 4 Services
Areas of clustered poverty	83	2.3	27.71 (23)	13.25 (11)
Areas of clustered affluence	22	2.6	22.73 (5)	31.82 (7)
Areas of poverty surrounded by affluence	18	1.9	38.89 (7)	11.11 (2)
Areas of affluence surrounded by poverty	11	2.5	18.18 (2)	18.18 (2)
Areas of no significant clustering	43	2.2	34.88 (15)	31.25 (13)
TOTAL	177	2.3	29.37 (52)	18.08 (35)

SOURCES: Brazilian census 2000, DATAESCOLA Brasil 2004, SARESP 2003.

* Defined using the SES indicator of poverty (poverty indicator 1).

Appendix A. Variables to calculate summary index of poverty

Table 1. Descriptive Statistics

Variable	1991	2000	Range
Socioeconomic Status			
Proportion of children 7-14 years old who are illiterate (%)	8.50	4.98	0-100
Proportion of illiterate heads of households (%)	9.96	6.26	0-100
Proportion of heads of households with a primary education or less (%)	50.47	44.53	0-100
Average years of schooling among heads of households	5.92	6.98	0-17
Average head of household income*	R$1133.57	R$1371.22	0- 332330.410
Housing Characteristics			
Proportion of households without garbage collection (%)	7.16	0.02	0-100
Proportion of households without piped water (%)	3.06	0.01	0-100
Proportion of households without a bathroom (%)	3.65	0.01	0-100
Proportion of households not connected to the sewage system (%)	24.89	0.08	0-100
Proportion of rented households	19.52	18.29	0-100
Age, Family and Gender Characteristics			
Proportion of head of households 10-29 years old (%)	18.12	14.74	0-100
Average age of head of household	43.08	45.31	10-125
Proportion of population who are young or old-age dependents (%)	40.60	37.03	0-100
Proportion of heads of households who are female with a primary education or less (%)	8.80	10.51	0-100

* In January 2002 reais.

Table 2. Results for Factor Analysis, 1991.

Variable	Factor 1 SES	Factor 2 Neighborhood characteristics	Factor 3 Household characteristics	Factor 4 Family Life Cycle
Socioeconomic Status				
Proportion of children 7-14 years old who are illiterate (%)			0.4780	
Proportion of illiterate heads of households (%)	-0.5927	0.4139	0.4319	
Proportion of heads of households with a primary education or less (%)	-0.9077			
Average years of schooling among heads of households	0.9202			
Average head of household income*				
Housing Characteristics				
Proportion of households without garbage collection (%)		0.7233		
Proportion of households without piped water (%)			0.8167	
Proportion of households without a bathroom (%)			0.8092	
Proportion of households not connected to the sewage system (%)		0.7123		
Proportion of rented households	0.4075	-0.6265		
Age, Family and Gender Characteristics				
Proportion of head of households 10-29 years old (%)				-0.8865
Average age of head of household				0.9062
Proportion of population who are young or old-age dependents	-0.5486	0.4853		
Proportion of heads of households who are female with a primary education or less (%)	-0.4722	-0.6600		
Total Amount of Variance Explained (%)	**42.86**	**12.99**	**10.60**	**8.62**

Using the varimax procedure, we arrive at 4 factors of poverty in 1991, which combined explain 75.07 percent of the variability in the variables listed in Table 1 of this appendix (see Table 2). When using the same procedure for 2000 we have 3 poverty indicators, which explain 61.71 percent of variability in the same variables (see Table 3).

Table 3. Results for Factor Analysis, 2000.

Variable	Factor 1 SES	Factor 2 Family Life Cycle	Factor 3 Neighborhood Characteristics
Socioeconomic Status			
Proportion of children 7-14 years old who are illiterate (%)		0.4964	
Proportion of illiterate heads of households (%)	0.6938		
Proportion of heads of households with a primary education or less (%)	0.8913		
Average years of schooling among heads of households	-0.9003		
Average head of household income*	-0.7873		
Housing Characteristics			
Proportion of households without garbage collection (%)			0.7451
Proportion of households without piped water (%)			
Proportion of households without a bathroom (%)			
Proportion of households not connected to the sewage system (%)			0.7457
Proportion of rented households			- 0.496
Age, Family and Gender Characteristics			
Proportion of head of households 10-29 years old (%)		0.8890	
Average age of head of household		-0.9232	
Proportion of population who are young or old-age dependents	0.5518		
Proportion of heads of households who are female with a primary education or less (%)	0.7598		
Total Amount of Variance Explained (%)	**38.32**	**13.01**	**10.37**