Childlessness in Brazil: socioeconomic and regional diversity

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Abstract

Until recently talking about childlessness in Brazil would not find sound research grounds. Since 2005 the country has reached fertility replacement level and the newest estimates indicate that fertility continues its decline path, from 1.9 in 2010 falling to 1.7 in 2011. Fertility schedule is diverse when compared to other countries because childbearing starts early and also stops early in women's life. In such low fertility regimes it would be expected that a high percentage of women retreat from childbearing as in several European countries. However, the average in 2010 is that 13% of women aged 40-49, that is, women born between 1961 and 1970, at the beginning of fertility transition, did not have any children, a figure much lower than in most European countries. On the other hand, given the high inequality present in almost all socioeconomic indicators, childlessness is very different for well-educated and low-educated women, for wealth and poor people. The objective of this paper is to analyze the tendencies of childlessness in Brazil taking into account the socioeconomic and regional differences in order to advance some hypothesis to the future level of fertility in Brazil. The question we try to answer is whether Brazil will become a childless society or if only some segments of the population will be under such regime.

Introduction

Until recently talking about childlessness in Brazil would not find sound research grounds. However, since 2005 the country has reached fertility replacement level and the newest estimates indicate that fertility continues its decline path. In 2010 the TFR was 1.9 and falling to 1.7 in 2011 according to preliminary results. Fertility schedule is diverse when compared to countries with such low fertility regimes because childbearing starts early and also stops early in women's life (Cavenaghi and Alves, 2011). In such low fertility regimes it would be expected that a high percentage of women retreat from childbearing as in several European countries (Sobotka, 2005). However, the average in 2010 is that 13% of women aged 40-49, that is, women born between 1961 and 1970, at the beginning of fertility transition, did not have any children, a figure much lower than most European countries. Nonetheless, given the high inequality present in almost all socioeconomic indicators, childlessness is very different for

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well-educated and low-educated women, for wealth and poor people, and yet, for women living in the most and less developed regions in the country. Rosero-Bixby and colleagues (2008) stated that in several Latin American countries, Brazil included, young well-educated generations would be retreating from childbearing. The objective of this paper is to analyze the tendencies on childlessness in Brazil looking at the socioeconomic and regional differences in order to advance some hypothesis to the future level of fertility in Brazil. The question we try to answer is whether Brazil will become a childless society or only some segments of the population will be under such regime. We will also take into account the different parity orders to shed some light on the future of fertility level in the country and the patterns that will remain or will emerge in the near future.

Theoretical focus

The wealth flows theory of fertility transition (Caldwell, 1976) is a major contribution to demography theory and explains both high and low fertility regimes. According to the wealth flows theory, cultural transmission of new family values is the principal driving force in fertility transition. Nonetheless, macroeconomic conditions and the level of development also contribute to the reversal of the flows. When the wealth of flows goes from young generations to old generations (from children to parents) fertility tends to maximum values (natural fertility). But when there is a reversal of flows and the wealth goes from old to young generations (from parents to children) fertility tends to zero, if the new cultural values and economic rationality are taken into account. However, individuals continue to have children for cultural, social, family and psychological reasons. Alves (1994) proposed a theoretical approach that utilizes the generational dimension together with the gender dimension to explain the process of fertility transition in Brazil, showing that the reversal of wealth of flows and the changes in gender relations contributed to the low levels of fertility. In addition to this, in a country with marked social inequalities, this process will occur also differently according to the social and regional status and it will be a result of different reasons that lead women to be childless at the end of the reproductive age.

In Europe, the emergence of the public debate on childlessness occurred in parallel with the postponement of the first birth and the theory of the second demographic transition (Van de Kaa 1987). Indeed, in Brazil, the emergence of childlessness and new couple arrangements, for example, the double income no children (DINC), already occur in a context of rejuvenated

demography fertility regime with low age at first birth (Alves e Cavenaghi, 2008). It can be pictured as if Brazil has had three different demographic transitions happening at the same time: the first with limiting parity at low levels (parity-dependent birth control), a second with the postponement of first birth for a selected population segment, and a third transition that also occurs for selected segment by adoption of voluntary childlessness. The combination of these behaviors resulted in a very fast fertility decline and the future of fertility levels will be explained again by a combination of different behaviors adopted by the majority of population.

Data and research methods

Although Brazil has annual household surveys that collect fertility data, information on childlessness is not accurate for these surveys[3]. The most reliable data that are used in this study, although they present some problems, come from the demographic census. The questionnaire includes questions on still birth, children ever born, children born in the year preceding the census, surviving children for women aged 10 and plus[4], applied to a large sample of the population (the sample varied from 5% to 50% according to municipality size in 2010 and an average of 12% in the two previous censuses), and has the advantage of presenting several socioeconomic, demographic and regional information about these women.

Demography method of parity progression ratios for women who passed reproductive ages and estimates for those who still did not reach the end of reproductive ages is applied for several socioeconomic and regional groups. This method allows us to estimate an indicator that measures the probability of some groups of women not passing from having zero to one child. In order to project parity progression ratios is was utilized the On-line Manual X, Method of (Projected) Parity Projection ratios described in details by Moutrie and Zaba[5]. The method uses data on the distribution of parity (from zero to 18+ children) by five-years age groups of women (from 15-19 to 60-64 years) and the distribution of current fertility by age groups of mothers. This latter used to estimate PPR for women who did not finish reproductive history. It is important to mention that the estimate for zero parity may suffer from error of under-reporting, thus data from the youngest must be analyzed with care.

[3] Some of the reasons for that is the way the questions are phrased (they ask separately for children living and not living in the household) and also, so far, there are no consistent data when checking for this information.
[4] Correction of non-response for fertility data is not needed since in 2010 data were checked upon data entry in the PDA system. For previous censuses years El-Badry correction for the percentage of "true" non-response is applied although the percentage of non-response is very small.
[5] Published on Tools for Demographic Estimation (http://demographicestimation.iussp.org)

In order to have a multivariate analysis of the factors that most differentiate women, born in the beginning of the fertility transition and who retreat from childbearing, we fit a logistic binary model on childless women on covariates such as education, income, race, place of residence, participation in the labor market, and conjugal status. Although this model does not imply causality it can indicate how the variables taken into account explain the variance of the childless distribution and how much of the variance is left unexplained. More importantly, it allows for good estimates of relative risk from one variable when compared to the referenced category, after controlling the average effects of other variables.

Finally, a spatial analysis at the microregion level is carried out for the percentage of childless women, first showing only the thematic maps and then fitting a Moran Local Model (Lisa) to find whether there are spatial clusters with higher percentage of childlessness locations with low (or high) percentages close to places in the opposite situation, that is, places that are outliers compared to neighbors (Anselin, 1995).

Trends in fertility and childlessness in Brazil

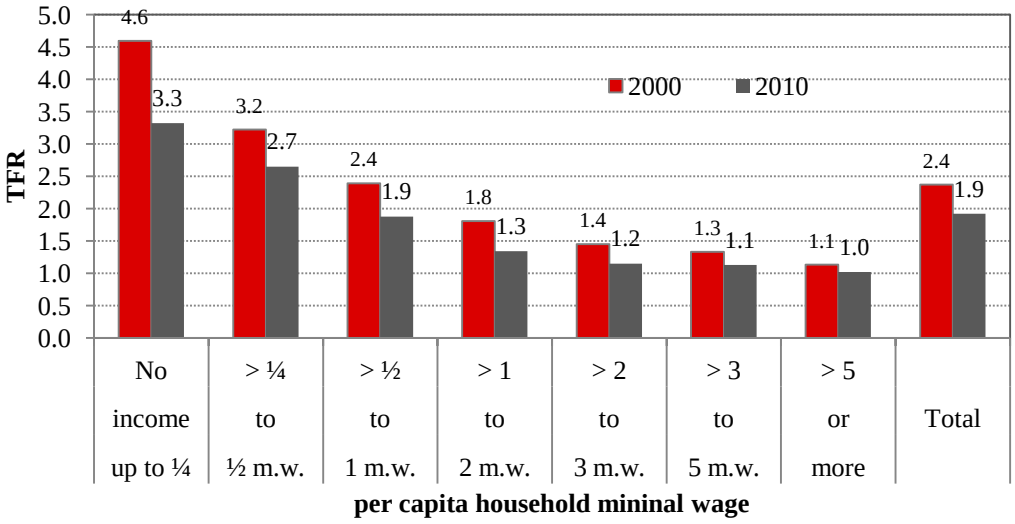
In the last decade fertility continued to fall in Brazil, with a 19% decline, reaching below replacement TFR at 1.9 children per women in average for the entire country. This rate continues to hide the regional and socioeconomic differences that always existed, but only the least developed region was above replacement level by 2010, the North region with TFR of 2.4. Even the Northeast, yet a less developed region, is below replacement (TFR of 2.0), and the lowest rates are at the more developed regions (1.7 in the Southeast and 1.8 in the South). The highest rates in Brazil are still the double of the average, since some rural areas in the states at the North region present TRF ranging from 3.2 to 4.7 children per women. Although these regions have small populations, the majority is formed by poor people and some indigenous populations, that contrasts with the richest states at the Southeast, very populous, where urban fertility rates range from 2.4 to 1.7.

Besides the regional heterogeneity in reproduction, the economic differences are also huge in Brazil and these differences remained the same in the last decade. Graphic 1 shows the TFR by groups of women according to the minimal wage received, measured as the per capita household income[6], and as it can be observed, all groups, the lower up to the higher income class, presented a decline in fertility from 2000 to 2010. Although differences are still high, the

[6] Income is from all source, jobs, pensions, government transfers, rents, etc.

poorest presented the highest declines, from 4.6 to 3.3 children per women in household with no income or at most one fourth of the minimal wage per capita. At the other extreme are the women in household with 5 or more minimal wages with TRF of one child in average.

Graphic 1: Total fertility rates (TFR) according to categories of average household income per capita, Brazil, 2000 and 2010.



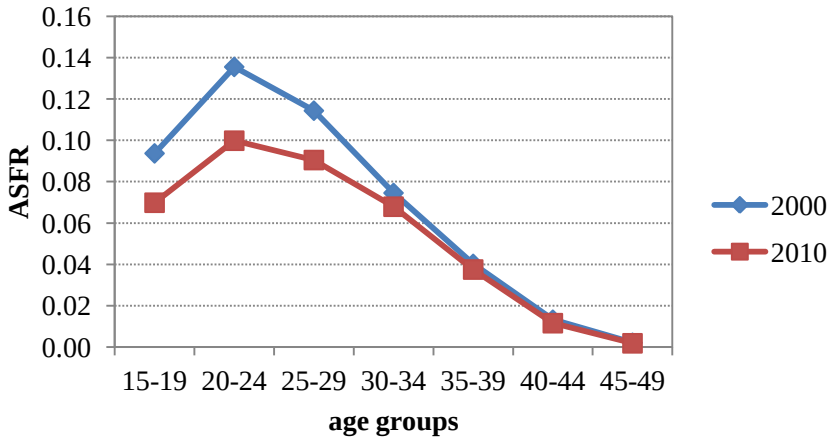
Source: IBGE, microdata from Brazilian Demographic Censuses, 2000 and 2010.

A second very important characteristic to keep in mind about fertility patterns and trends in Brazil is the schedule of fertility, discussed elsewhere (Cavenaghi and Alves, 2011; Alves and Cavenaghi, 2009). The timing of fertility in Brazil begins at very young age, concentrated at 15-29 years old, and it remains that way according to the last censuses, showing a small tendency to postponement (Cavenaghi, 2013), as it can be observed in Graphic 2, although all age groups, even the oldest in the reproductive ages present a decline in the already low levels of fertility. According to the 2000 data, 72.5% of fertility occurred by age of 29 years old and by the year of 2010 it was 68.6%. The youngest groups presented the highest declines in the ASFR, respectively, a drop of 26.3% and 25.5% for women aged 20-24 and 15-19.

In the context of all these changes in the TRF and in the timing of fertility it comes as no surprise that the number of women that remains childless by the end of their reproductive ages has increased in Brazil. Indeed, when compared to other countries and taking into consideration the TFR levels, Brazilian women showed a resistance to increase childlessness. From 2000 to 2010 there was an increase in percentage of women aged 45 and plus who were childless from 9% to 12%. Women aged 35-39 in the same situation increase from 12% to 16%. Although

these women still have time to catch up some postponement that might have happened, there is evidence that just few of them will still have children (Lesthaeghe R.,Willems, 1999).

Graphic 2: Age specific fertility rates (ASFR), Brazil, 2000 and 2010.



Source: IBGE, Microdata from Brazilian Demographic Censuses, 2000 and 2010.

Another very important characteristic related to childlessness in Brazil is the marital status, since even women who became pregnant or had children out of the wedlock at first, start a union right after the pregnancy or birth[7]. Table A1 in the Annex, presents the distribution of marital status by women's age groups[8]. It is very important to have in mind that in Brazil legal marriage and regular cohabitation are understood as legal unions, since couples not legally married have the same rights before the law as the legally married, with all the benefits such as health insurance, tax deduction, and for registering children. There were only 8.3% of women aged 45-49 years that remained single (never lived with partner), but 23.1% were already separated or widowed at this age. These figures are a little different if we consider socioeconomic characteristics. For the most educated the percentage of single at age 45-49, for example, reached 12.7% and for those least educated, the percentage was 6.5%. These figures are associated with the probabilities of having/wanting a partner to get married and probably cause important effects in the decision to childrearing.

The socioeconomic differences in the percentage of childless in 2010 are large (Table A2 in the Annex). For women over 45 years old who did not complete basic schooling the percentage of childless was 9.4% in 2010 and 21.3% for the most educated The same holds true if household income groups are compared: 9.8% for women in household where income is up to ¼ of minimal wage per capita and 23.7% for those with 5 or more minimal wage per capita. Larger

[7] There is no information on marital status at the first birth in the census data.
[8] The information indeed is from the question if the person had a spouse or partner, currently have or never had.

differences are found by conjugal status since in Brazil becoming pregnant means most of times to engage in marital union or consensual union. For those women aged 45 or plus in 2010 who declared to never be married nor to be in union, the percentage of childless is above 69%. On the contrary, for those who declared to be at union at the time of the census, only 6.9% were childless. As for the regional differences, the urban areas have more childless than the rural, 12.8% and 9.1%, respectively and for the North and Southeast regions respectively 9.0% and 14.2%. Other observed values of childless women for other age groups can be seen in the annex, but since several women still did not complete their reproductive lives, in the next section it is analyzed the parity progression ratios, which provides also projected estimates based on current fertility.

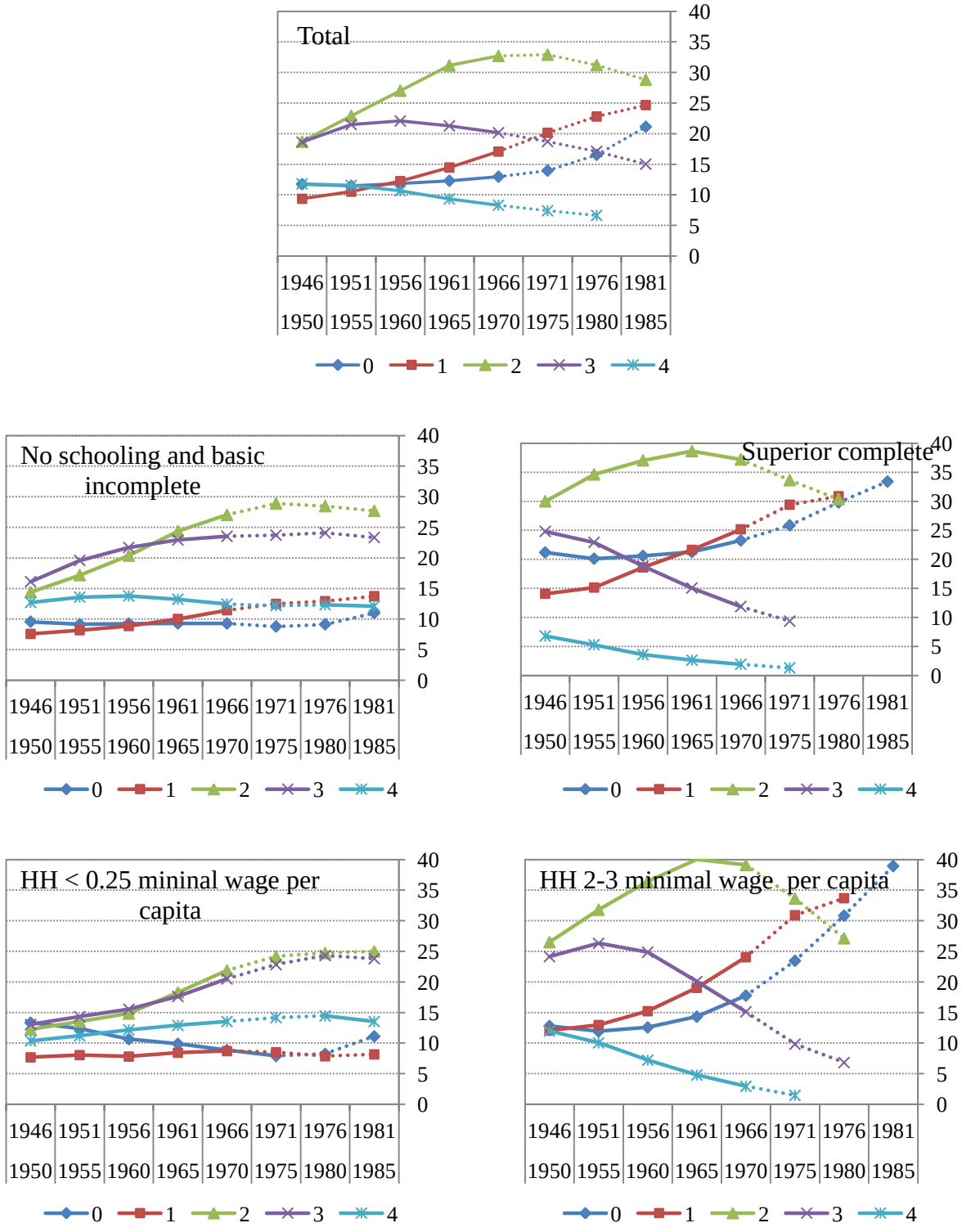
Parity progression ratios

During fertility transition, besides increasing the percentage of childless women it generally first occurs a decline of parity of higher others. Hence, it is essential to note the trends in the percentage of women in each single parity according to women's birth cohorts for all women as well as for different socio-economic characteristics. Estimates of this indicator, observed and projected, as described above, are presented in Graphic 3 for selected variables.

The PPR for the country shows that for observed data the percentage of women having 3 or more children has been declining for the cohort born in 1956-1960 and systematically for all newer cohorts. For example, 22.1% of women aged 50-54 in 2010 had 3 children and 20% of those born 20 years latter had had 3 children and if the newer cohorts follow the path shown by the current pattern of fertility, only 17% will have 3 children. In the same way women having 4 children dropped from around 10% to 6.5%. The percentage of women who has 2 children is still growing for the observed data (33% for women born from 1960-1970); however, the projected values show that women born in the middle of the 1970's will also have a lower percentage (29%) of those having two children, which used to be the magic number of desired children (when asked, women would say that they would want to have two children, preferably a boy and a girl).

On the other hand, the number of women having one and two children has been increasing along these last years. The percentage of one child women grew from below 10% to more than 17% and it is projected to increase to around 25% if the current patterns of fertility are confirmed in the near

Graphic 3: Parity progression ratios (observed and projected) by selected socio-economic characteristics (levels of education and average household income per capita), Brazil, birth cohorts from 1956 to 1985.



Source: IBGE, Microdata from Demographic Census of 2010.

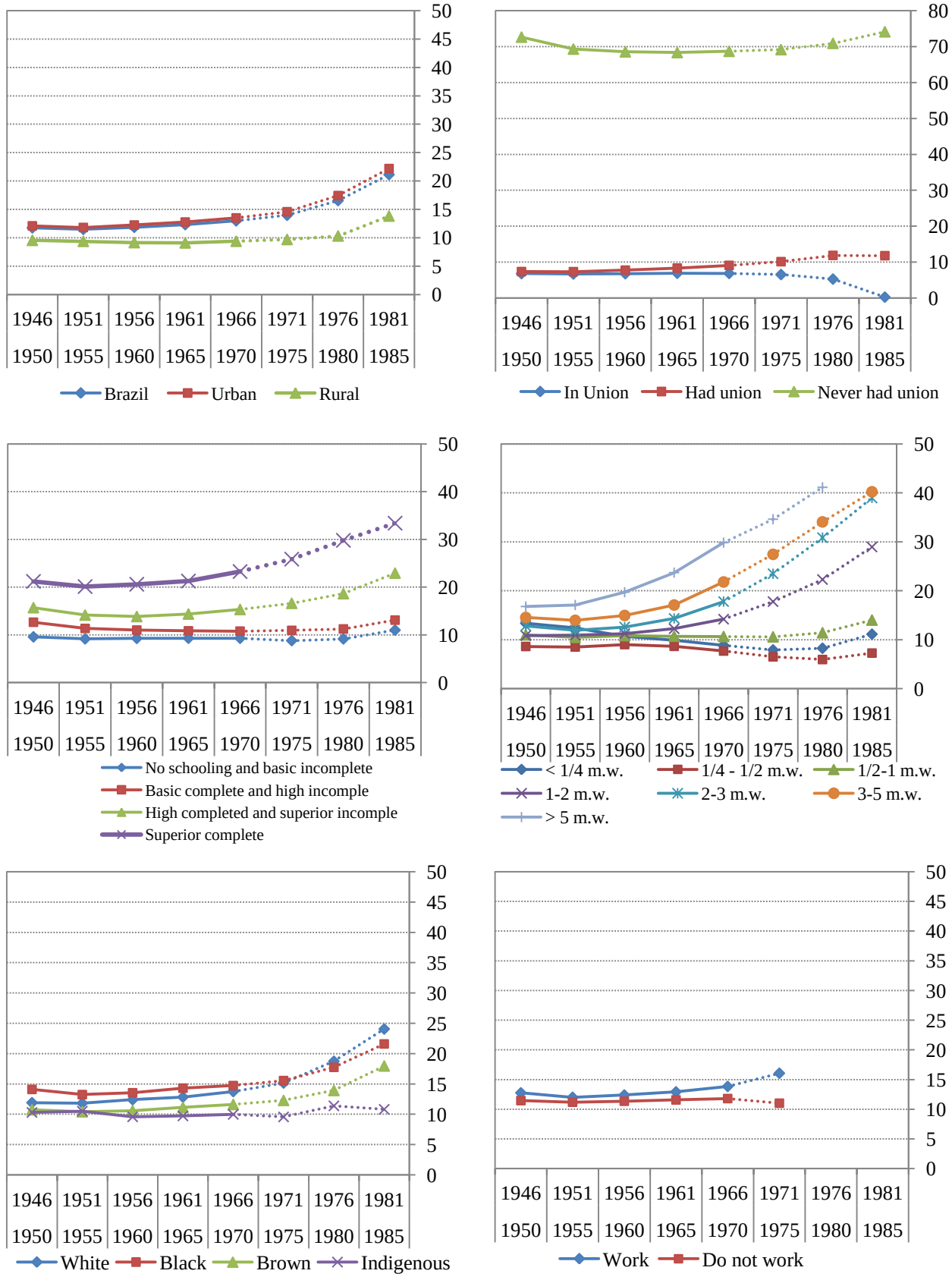
future. That is, one quarter of women will finish their reproductive lives not going for the second child that would be necessary to replace themselves. Women who did not become mothers in their lifetime are projected to reach values over than 18% (although there is an under-reporting from zero parity). If these projected values turn out to be observed in the future, to maintain the current level of fertility which is already low, the country should have more women having parities of 3 and more, and as the data show it is very unlikely.

The socioeconomic characteristics of women put this picture in prospect and corroborate the beliefs that fertility will drop to its lowest levels in Brazil. It is shown in Graphic 3, in the middle and inferior panels, the two extreme groups of education (no education up to incomplete basic school and complete superior education) and household average income (up to one quarter of minimal wage and from 2-3 minimal wage per capita). These figures show that for the more educated women and those living in household with 2-3 minimal wages per capita the percentage of women that will have only one or no children are much higher than those in the other extreme. And indeed, these women are the responsible for the changes that will come in the near future, taking into account that education is improving fast in the country, hence it is very likely that Brazilian society will witness very low rates of fertility.

Focusing now on the percentage of women with no children in their lifetime can bring insights about Brazil becoming or not a childless society. Graphic 4 presents the observed and projected percent of women with zero children by some socioeconomic characteristics and place of residence. It can be observed that if women live in rural areas, the percentage of childless is almost immutable at 10% along the different births cohorts; on the other hand, the changes come and will continue to come from women that live in urban areas. Regarding to the marital status it is interesting to note that most women who are childless have declared that they never had a union and the percentage had been almost constant around 70%; the future does not show a large difference, maybe even an increase. On the other side, being currently in a union is almost always linked to having at least one child and less than 10% are childless.

Although there are nuances, in general, education and income divide childless women in three groups: those with very high percentages, already with observed percentages above 20% and growing to 30% or more; those with low percentages of childless with an almost constant 10% in the past, present and future; and those in the middle way, which had more than 15% of childless in the past and present and show a tendency to increase to percentage above 20 or even 25% in the near future if current fertility trends will become reality.

Graphic 4: Percentage of childless women (observed and projected) by selected socio-economic characteristics, Brazil, birth cohort from 1956 to 1985.



Source: Brazilian Demographic Census of 2010, Microdata.

Other variables such as skin color and work status are not important among childless women. White and black women show slightly higher percentage of women who did not have children in their lifetime than brown women. Indeed, black women in this situation are much closer to white one that browns; however, the reasons for childlessness for these two groups are probably of different order. Moreover, black women used to have higher percentages of childless in the past and the situation will probably invert with white women becoming more childless, as the projected values indicate. The situation of women in or outside the work force shows results that would seem not expected at first, because the percentages are almost the same for both groups.

The effects of socioeconomic variables on childlessness

The discussions on why women are childless in our society are becoming an endless conversation, but no long before it was a lost battle for the childless, since in the common sense it would make no sense to choose not being a mother. Most would say "being a mother is an experience that every woman would want to have in her lifetime" and "poor men", who could not live the experience of childbirth. With progress and women's empowerment they are not condemned anymore to marry and have a child; like any human being they can have a professional carrier, not a job to complement family income, and to have or not a child is a choice that can balance out from the bonus and onus of being a mother.

In a world in which most benefits go from parents to child, not the opposite, the expected path would be to have no children (Caldwell, 1976), but there are other reasons that make people decide to have children. As we have seen, the socioeconomic and regional variables considered in the univariate analysis of childless show that people's and context characteristics, although do not explain why, at least show that choices are different for several population segments depending on these characteristics. In this section, although the census data do not allow explaining why women are childless, they can account for several characteristics in order to observe what are the variables that most differentiate non mothers and what are the variables most related to childlessness.

The variables we selected to include in the model were regional residence (great regions and urban and rural places); for socioeconomic variables we selected school attainment, average income per capita, participation in the labor market, and skin color; it also included a control for have been in a union. And since age is an important variable to identify childless women, we fit a model for women who have completed reproductive ages, from 45-49 years old, and also three

more models for those who are about to complete it soon, in order to see if the relationship among the variables change as younger women approach the end of reproduction ages. Table 1 presents the results for all fitted models, showing the coefficients (Odds Ratios) and estimates of model's quality of fit[9].

Regarding the goodness of fit, it is important to say that although all variables included in the models present statistically significant estimates, the model is right on about 45% of the times in predicting childless women. For women with child it is right more than 95% of times (see bottom of Table 1). Also, the variables explain only about 30% to 45% of the variance of the distribution of being childless from the oldest to the newest cohorts, which means that there are variables left out of the model that would explain the remaining variability in the distribution. Some of these variables are probably very difficult to measure and observe, mainly because it would need to be timing varying variables in a longitudinal model. Nonetheless, for a behavioral model using cross sectional data as the one utilized here, the comparison among the category of the covariates is what is at stake.

Thus, comparing covariates, we can observe that a woman who was born in the first half of the 1960 decade (first model), right before fertility transitions started for the country, who was never in union, may that be legal or consensual, put women with 30 times more chance of being childless than a women that was in a union[10]. Also, a woman who was separated/divorced or widowed by the time of the interview had 30% more chance of being childless than a "married" one. Also, if a woman was in the labor market she had 25% less chance of being childless than a woman currently in the labor market.

The socioeconomic variables for this cohort show also very different relative risks from the uneducated to the most educated and from the poorest to the wealthier. Indeed, income per capita differentiates more than education, since a woman living in a household with 5 or more minimal wage per capita had almost 3 times more chance (2.73) of being childless than a woman with less than one quarter of minimal wage. Also, the threshold of income seems to be

[9] It is important to mention that since the information used comes from a very large complex sample, designed for the long census questionnaire, for the fit it was used information on weights, but not expanded to the entire population. Instead it was recalculated as the inverse probability of each case to be in the sample, keeping the sample size and also considering the different probability of selection for each case (the new weight was the census' weights for individuals multiplied by a constant - the sample size of population of interest divided by the population of interest – n/N). We are aware that this is an approximation, but information on sample design is not distributed with the census microdata. An alternative would be using the minimal weighting areas as the clusters information and household as strata, however, this would also mean an approximation of the most accurate estimates.

[10] We must just to remind that those are the surviving women since the question is retrospective, and this holds true for all analysis with the census data.

around 1-2 minimal wages, and the relative risk increases from that level up. On the other hand, a women with at least complete superior education has 66% more chance of being childless than a woman with no schooling. For education, also having at least completed high school increases steadily the relative risk of not becoming a mother (39% more than no schooling) when the previous group shows only 9% more chance than the no schooling group. The skin color, which is very correlated with income and education (blacks and browns are less educated and poorer than whites), shows an interesting result, because brown and white women have about the same chance of being childless, but black women have 19% more chance of not becoming a mother by the end of reproductive ages. The reasons for that must go beyond choice since black women have less chance of being married.

The regional variables confirm the enormous diversity in childlessness around the country, even after controlling for other socioeconomic variables, but that is not linked directly with the level of development in each region and also not with the current levels of fertility. Women who live in rural areas have 16% more chance of not becoming mothers (and have higher fertility than the rural ones), and that is probably linked to marriage chances. On the other hand, a woman living in the most developed region (with lowest TFR), the Southeast, presents the highest relative risk of being childless, 46% more chance than a woman who lives in the North region. The other well developed region in the South (also with very low fertility), presents only 10% more chance of being childless than in the North region. On the other hand, a woman living in the Center-West has less chance of being childless that a woman living in the North. This shows that two different major reasons led women not to have children during their reproductive ages; one of them is linked to the chances of having a couple and the other to the choices between education and carrier and raising a child.

The results for the models regarding the other women's cohorts, shown in Table 1, are very consistent with the results found for women born from 1961 to 1965. The only trends that call attention in these models are that for younger cohorts, having higher income (and education at some point) put women at higher relative risks of being childless. In this sense, a woman born in the first half of the 1970's in a household that nowadays has 1-2 minimal wage per capita has almost 3 times more chance of being childless than a woman in the lower end of the income group. On the other hand, for the younger cohorts, although union still is what most differentiates the chances of being childless, this variable seems less and less important for these younger cohorts.

Table 1: Estimates (Odds Rations, significance and Wald test) of logistic regression on being childless on selected characteristics, by women's age groups and estimates of goodness of fit. Brazil, 2010.

Selected variables	45-49 (birth cohort 1961-65)			40-44 (1966-70)			35-39 (71-75)			30-34 (76-80)		
	Exp(B)	Sig.	Wald	Exp(B)	Sig.	Wald	Exp(B)	Sig.	Wald	Exp(B)	Sig.	Wald
Rural	1.16	***	8.88	1.21	***	157.49	1.28	***	304.86	1.19	***	206.03
North			96.87		***	1074.03		***	1184.75		***	1478.95
Northeast	1.31	***	13.94	1.34	***	216.56	1.32	***	260.03	1.43	***	606.13
Southeast	1.46	***	28.70	1.38	***	267.64	1.28	***	217.53	1.34	***	429.61
South	1.10		1.44	1.03		1.57	1.00		0.01	1.16	***	85.39
Center-West	.95		0.40	0.93	***	8.22	0.88	***	38.21	0.94	***	12.02
No schooling and basic incomplete		***	118.15		***	971.36		***	1459.28		***	4328.92
Basic complete and high incomplete	1.09	*	3.32	1.04	**	6.91	1.12	***	77.13	1.14	***	131.32
High completed and superior incomplete	1.29	***	42.12	1.28	***	475.75	1.42	***	1077.04	1.60	***	2415.08
Superior complete	1.66	***	108.71	1.49	***	759.43	1.54	***	1019.02	2.04	***	3516.05
Education unknown	1.62	*	3.43	1.59	***	41.69	1.53	***	48.58	1.70	***	122.34
< 1/4 m.w.			340.06		***	9121.84		***	18978.45		***	35363.64
1/4 - 1/2 m.w.	.82	***	10.46	0.83	***	106.51	0.83	***	115.60	0.82	***	201.69
1/2-1 m.w.	1.04		0.52	1.20	***	116.74	1.40	***	471.06	1.44	***	768.72
1-2 m.w.	1.30	***	20.42	1.88	***	1308.22	2.73	***	3806.02	3.17	***	6810.56
2-3 m.w.	1.54	***	38.15	2.50	***	1914.00	4.10	***	5248.05	5.47	***	10550.04
3-5 m.w.	1.85	***	69.16	3.14	***	2636.98	5.38	***	6702.95	7.14	***	12538.38
> 5 m.w.	2.73	***	185.03	5.03	***	5201.94	8.29	***	10453.39	11.84	***	18849.25
In Union		***	9168.44		***	104805.43		***	115821.79		***	137147.93
Had union	1.32	***	58.69	1.50	***	1326.48	1.59	***	1834.89	1.43	***	1299.33
Never had union	30.43	***	8682.01	30.92	***	101126.70	28.61	***	113297.95	22.61	***	134093.28
Do not work	1.25	***	49.42	1.32	***	863.66	1.27	***	713.41	1.13	***	249.86
White		***	9.71		***	104.21		***	152.92		***	146.68
Black	1.19	***	9.69	1.18	***	102.62	1.20	***	141.81	1.17	***	144.78
Brown	1.04		1.12	1.04	***	17.38	1.06	***	44.68	1.02	**	5.11
				0.96	***	178.09	0.94	***	484.97	0.88	***	2825.58
Constant	.03	***	1437.30	0.14	***	233.34	0.24	***	193.53	1.76	***	54.36
n	632,770			689,571			726,966			809,428		
-2 Log likelihood	35660.72			399037.59			460508.77			606126.97		
Cox & Snell R Square	0.17			0.19			0.22			0.30		
Nagelkerke R Square	0.31			0.34			0.38			0.45		
Percentage Correct with child	97.08			96.95			96.75			94.39		
Percentage Correct childless	45.61			46.58			46.62			53.88		
Overall Percentage	90.76			90.24			88.72			84.67		

Source: IBGE, Microdata of Brazilian Demographic Census of 2010.

Regional diversity on childlessness

The regional differences in childbearing are marked and still do not have a straight forward explanation. The map shown in the left panel in Figure 1 presents the diversity in the percentage of women born between 1961 and 1970 who in 2010 were childless according to microregions. These microregions were defined as socioeconomic homogenous regions and they are an aggregation of municipalities that are the smallest administrative and political subdivisions in the country. The percentage of childless women aged 40-49 varies from around 3% to almost 20%. The highest and lowest values are found all around the country, in developed and less developed regions. For example, in the up northwest there are microregions that have most indigenous populations which present very high percentage of childless women. On the other hand, places at the most developed regions of São Paulo State and Rio de Janeiro, which already have fertility below 1.6 children per women, present microregions with very few proportions of women who are childless at the end of the reproductive ages.

In order to have an easier comparison we have selected only the cohort with completed reproductive history, women aged 45-49, to analyze the spatial distribution of childlessness in Brazil. In Figure 1, in the right panel, it is presented the map for the distribution of childless women aged 45-49 in 2010 according to microregions. It is interesting that this map presents almost the same pattern seen in the map that includes the younger cohort (born in 1966-70, left panel in Figure 1). These maps shows areas that present very high percentage of childless women along the east coast, but more concentrated around the very high urbanized states of Rio de Janeiro, São Paulo and south of Minas Gerais; also a band in the Northeast, going from Pernambuco to the interior of the region; for microregions in the very South of the country; and finally, a cluster in the North west of the country.

Another important regional variable, as seen in the results of the multivariate analysis in the previous section, is the urban or rural place of residence. Women living in rural areas had higher chances of being childless than women living in urban areas. Figure 2 shows two maps, on the left panel for urban residents and on the right panel for rural residents, all at the scale of microregions. As it can be observed, rural areas. besides having a wider range for the percentage of childless woman (from low to high), also present a pattern that is less defined as the urban distribution. It is also interesting to note that urban areas of a microregion with high percentages of childless women

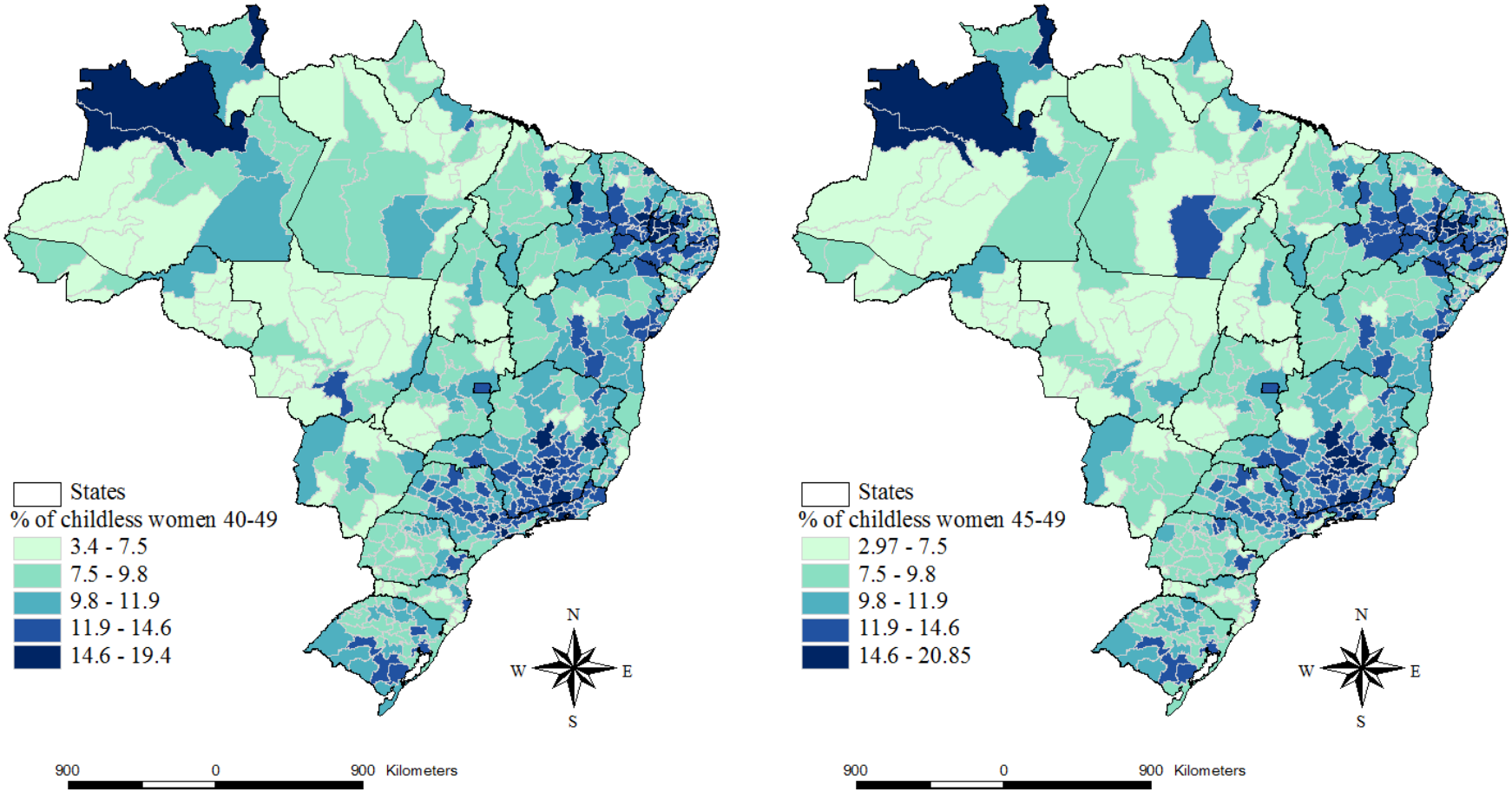
not always mean that the rural areas will have high percentage of women that did not have any child, as in the state of São Paulo, and the opposite can also be observed, as in the states of Mato Grosso and Mato Grosso do Sul, where urban microregions have low percentage of childless and the rural areas of these same microregions present high percentages of childless.

Choropleth maps, depending on the scale, can be deceiving; hence, in order to have a spatial pattern that has statistical significance, we estimated the local spatial autocorrelation, which is based on the Local Moran LISA statistics (Anselin, 1995). For estimating LISA we defined a matrix of neighborhood as microregions that shared boundaries[11]. The results of the clusters estimated by LISA are presented in Figures 3 and 4. The map on the left panel of Figure 3 presents data for all women and it shows a cluster clearly marked in the areas we have pointed before in the choropleth map. The microregions identified as high-high (red) and low-low (blue) in the legend are locations that suggest clustering of values that are very similar to each other, while the low-high and high-low places indicates spatial outliers (Anselin, 1995). Hence, besides the places identified before as clusters with high presence of childless women, this map shows that there are important clusters where neighbor microregions have low values with the presence of high outliers in the Center-West and North regions, and some microregions in the State of Santa Catarina (second from the bottom up). The two maps on the right side of Figure 3 present the same indicator for women living in urban and rural places, and confirm that the distribution is very different, where urban areas are much more clustered from one side, in two very significant locations, and present locations with significant outliers. On the other hand, the pattern in the rural areas is much less evident.

As we have seen in the previous sections, the percentage of childless women varies with socioeconomic characteristics besides the regional differences. Figure 4 presents four maps considering some of these characteristics. It is worth noting that the high-high cluster for the northeast region also presents a high-high cluster for single women who are childless. On the other hand, the metropolitan regions of São Paulo, Rio de Janeiro and Minas Gerais present high-high clusters for women in union. Again this confirms that childlessness in these places in the northeast are related to the lower chances of marriage and in the southeast to "choices" that have nothing to do with having a partner, probably more associated to different styles of life.

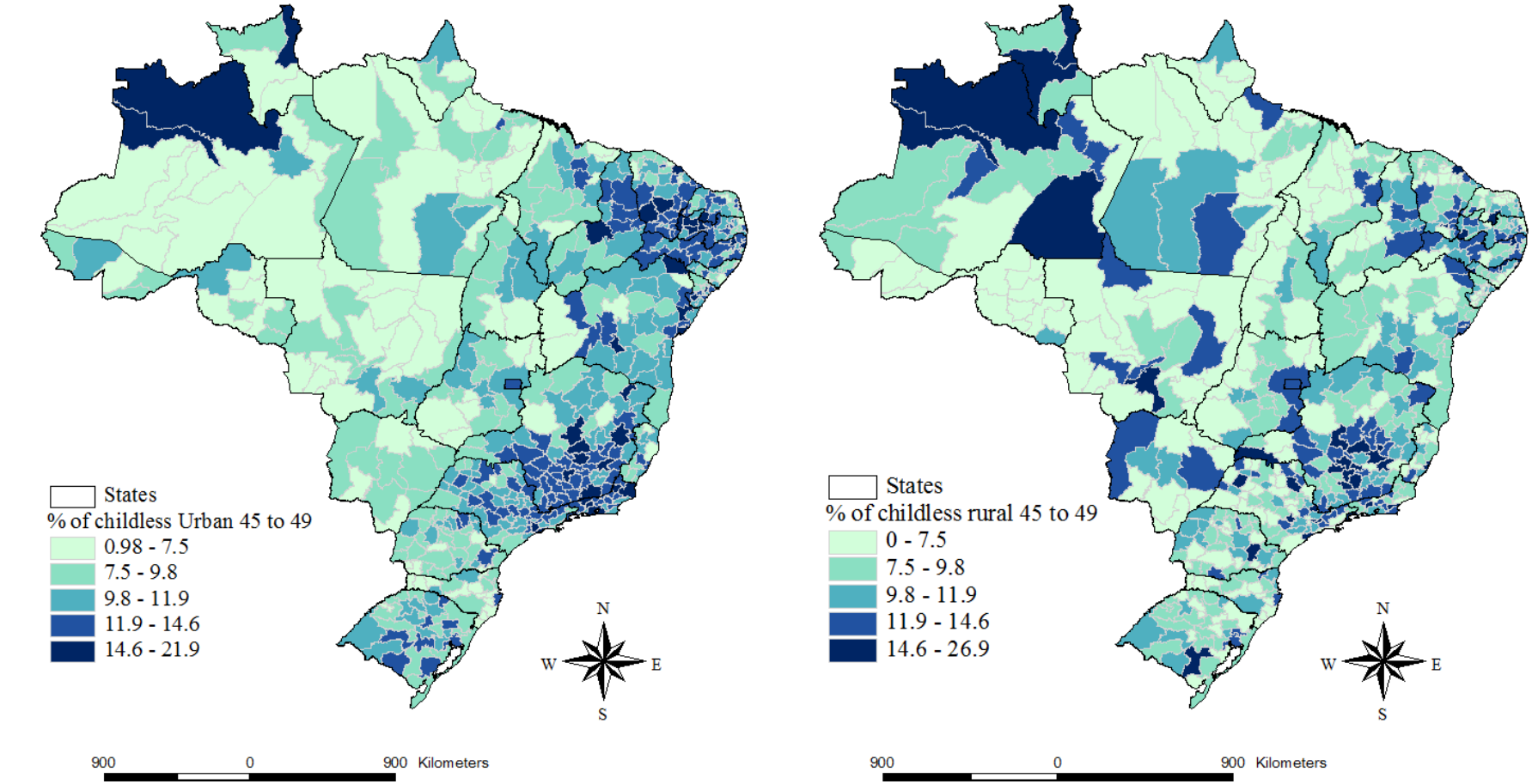
[11] In order to estimate LISA and the neighborhood matrix we utilized OpenGeoDA, 1998-2011, available at https://geodacenter.asu.edu/ogeoda.

Figure 1: Percentage of childless 40-49 and 45-49 years old women according to microregions, Brazil, 2010.



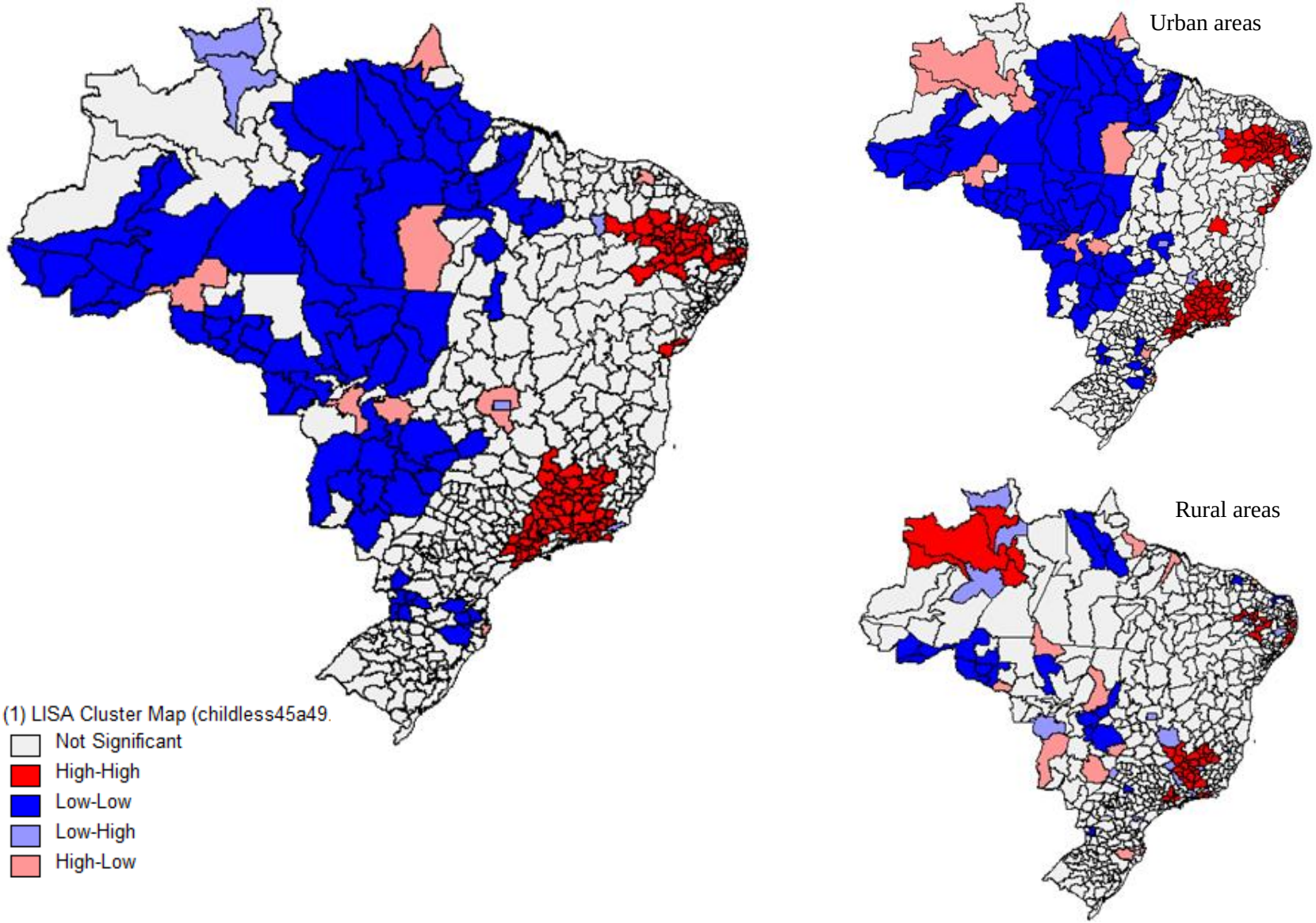
Source: IBGE, Brazilian Demographic Census of 2010, microdata.

Figure 2: Percentage of childless 45-49 years old women living in urban and rural areas according to microregions, Brazil, 2010.



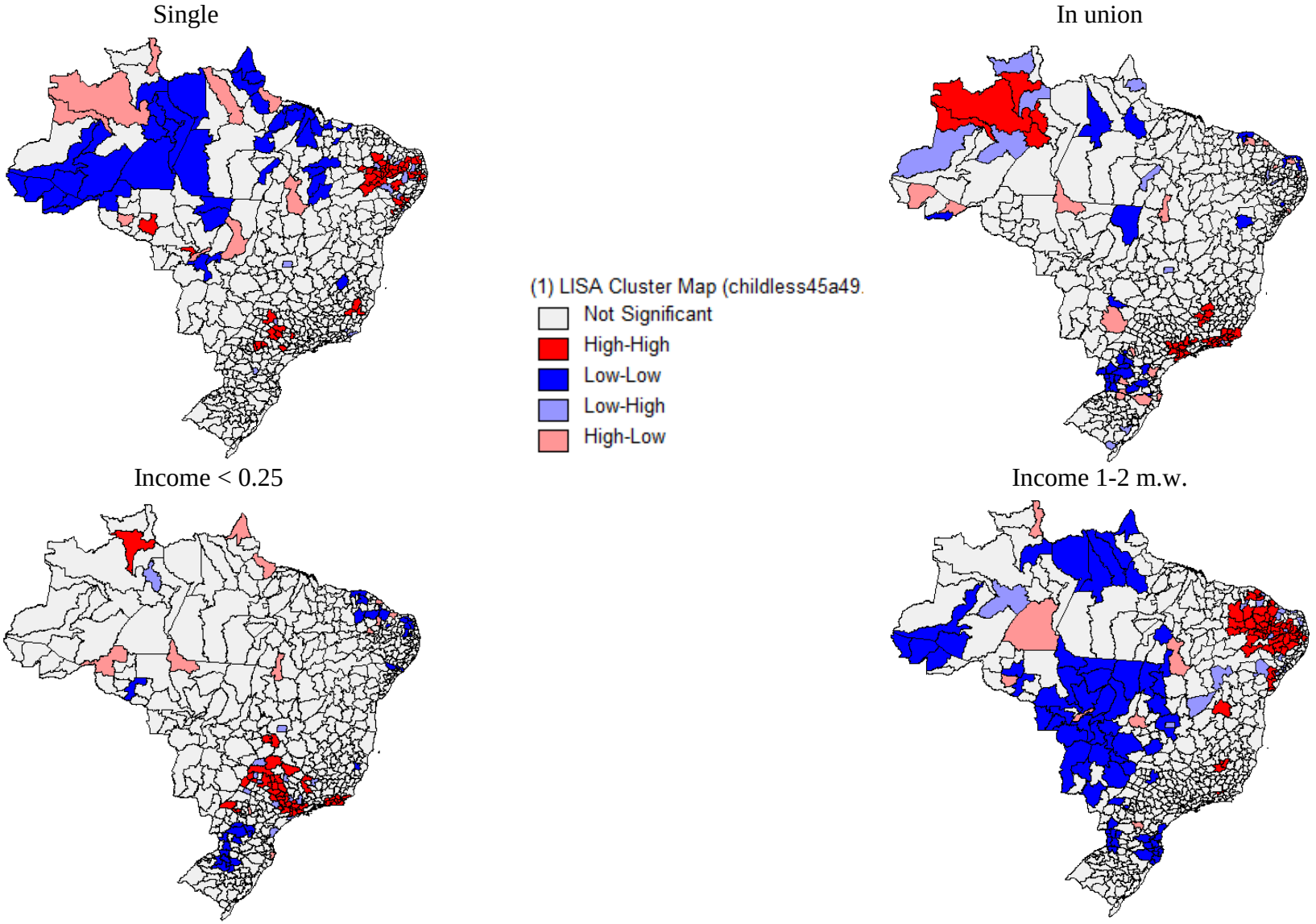
Source: IBGE, Brazilian Demographic Census of 2010, microdata.

Figure 3: Local spatial autocorrelation (LISA) for childless women aged 45-49 years living in urban and rural areas according to microregions, Brazil, 2010.



Source: IBGE, Brazilian Demographic Census of 2010, microdata.

Figure 4: Local Moran's I (Lisa) for childless women aged 45-49 years living in urban and rural areas according to microregions, Brazil, 2010.



Source: IBGE, Brazilian Demographic Census of 2010, microdata.

The LISA maps for income per capita, in the lower panels of Figure 4, show that for the southeast region there is a cluster of low income with high percentages of childless women and the same happens for the middle income in the Northeast region. These patterns are indeed difficult to explain without exploring them in a multivariate manner, but they must indicate the interaction about the level of fertility and the different reasons that lead women to remain childless in the current context.

Final considerations

Since fertility schedule is so young in Brazil, we expect a postponement in childbearing next years, and indeed, women at younger generations in 2010, who still did not complete reproductive ages already show a timid postponement. In 2010 there was even a decline in the 15-19 age specific fertility rates. This postponement is followed by an increase of women in parity zero and parity one. If these trends continue in the future and women miss the timing for childbearing, total fertility rates, those for period and also cohorts, will possibly decrease to the lowest levels in the next two decades.

Moreover, the diversity on reproductive behavior among social groups will still exist since college education is at very low levels in Brazil and regional differences are large in development level and access to high school. Besides, the results of high school education on reducing fertility will have to come with changes in the quality of education and a promise of a decent job, and this will still take some time to occur in Brazil for large groups of women.

Hence, the most probable answer to the question whether Brazil will become a childless society or only some segments of the population will be under such regime, is that the results of the analysis corroborate the second option. Women from the lower income status and the less educated will still have at least one child at young ages, although some postponements might occur; it still is far from pushing the age of first birth for ages above 25 years old as it occurs in some European countries. But women in the higher income groups and more educated, amongst others, will postpone the first birth and several of them will remain childless at the end of reproductive ages.

Nonetheless, there will be at least two different major reasons women will be summing up to the childless group. From one side, the lower desired levels of fertility and a choice for a carrier that is

still incompatible with raising children since most of the burden is over women, due to very uneven gender roles, and the lack of preparation from the state and the labor market for child care and childrearing will push more and more women to have no children. From another side, the lower chances of finding a partner to raise a child, for several reasons such as that women outnumber men or that women are more educated than men, also will push the percentages of childless women up.

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Annex

Table A1: Distribution of marital status by women's age groups (Total and groups of education), Brazil, 2010.

Age groups	In union	Had Union	Never in Union	Total
15-19	14.8	3.7	81.4	100.0
20-24	41.6	9.1	49.3	100.0
25-29	60.5	11.8	27.7	100.0
30-34	69.9	14.3	15.8	100.0
35-39	72.4	16.8	10.9	100.0
40-44	70.7	20.1	9.2	100.0
45-49	68.5	23.2	8.3	100.0
No schooling up to incomplete basic school				
15-19	21.7	6.0	72.3	100.0
20-24	57.4	14.1	28.6	100.0
25-29	70.3	14.6	15.1	100.0
30-34	74.2	15.7	10.1	100.0
35-39	75.0	17.2	7.8	100.0
40-44	72.9	20.0	7.1	100.0
45-49	70.6	22.8	6.6	100.0
Superior education completed				
15-19	7.3	2.4	90.4	100.0
20-24	21.1	3.2	75.8	100.0
25-29	43.3	5.9	50.8	100.0
30-34	62.7	10.1	27.3	100.0
35-39	68.3	14.0	17.7	100.0
40-44	67.2	18.5	14.3	100.0
45-49	65.0	22.4	12.7	100.0

Source: IBGE, Microdata from Brazilian Demographic Census of 2010.

Table A2: Percent of childless women by socioeconomic and regional characteristics according to women's age groups, Brazil 2010.

Selected variables	Categories	Women's age groups				
		25-29	30-34	35-39	40-44	45-49
Urban	Urban	42.1	25.4	16.8	14.0	12.8
	Rural	24.6	14.3	11.0	9.7	9.1
Region	North	27.9	16.8	12.1	10.1	9.0
	Northeast	35.3	21.6	15.5	13.2	12.0
	Southeast	45.4	27.9	18.4	15.3	14.2
	South	41.7	23.2	13.6	11.0	10.2
	Center-West	36.5	20.7	13.3	10.9	9.7
Marital situation	In union	23.5	14.1	8.9	7.3	6.9
	Had union	20.3	15.1	11.2	9.4	8.4
	Never in union	83.9	76.0	71.2	69.3	68.5
Work	Work	48.5	28.4	17.8	14.2	13.0
	Do not Work	29.0	18.0	13.7	12.4	11.7
Income	1	19.7	11.7	9.2	9.3	9.8
	2	19.1	10.4	8.0	8.2	8.7
	3	30.9	17.6	12.4	11.0	10.7
	4	51.5	30.6	19.7	14.6	12.3
	5	67.4	42.8	26.5	18.2	14.3
	6	75.0	49.8	31.3	22.3	17.1
	7	82.7	61.5	39.8	30.4	23.7
Education	1	18.2	12.2	9.9	9.6	9.4
	2	25.5	16.1	12.3	11.1	10.9
	3	45.6	27.5	19.2	15.8	14.4
	4	75.9	49.7	31.0	24.0	21.3
Skin color	White	46.6	27.8	17.5	14.2	12.9
	Black	36.8	24.3	17.7	15.3	14.4
	Brown	33.1	19.8	14.1	12.0	11.2

Source: IBGE, Microdata from Brazilian Demographic Census of 2010.