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Introduction

Brazil's fertility decline began during a period in which there were only modest family planning programs and in which government policy was relatively pro-natalist. The fertility decline became rapid in the 1970's, during a period of rapid economic expansion, which suggests that it may have been driven by economic development. However, the decline also continued during a period of severe recession in the economically depressed 1980's, which was perhaps even more rapid than that which had occurred during the earlier growth years (Lam et al., 1993).

Fertility in Brazil was practically constant until the mid-sixties. Then, between the mid-sixties and the mid-seventies the total fertility rate (TFR) declined 25.9 percent (from 5.8 to 4.3 children per women). Despite regional differences in fertility, the decline was evident in all regions and in rural as well as urban areas. In the first half of the eighties the TFR showed a further decline of 16 percent, reaching a mean of 3.6 children in the period 1979/84. Estimated TFR using data from the 1986 survey performed by the Demographic and Health Surveys (DHS) program declined further to 3.4 children, showing some regional differences, such as 2.7 children in the Southeast and 5.0 in the Northeast (Rios-Neto et al., 1991; Carvalho and Fernandez, 1986; Silva et al., 1990).

According to demographic theory, two sets of variables — population composition, especially age structure, and marriage patterns — are important in analyzing fertility decline. Both mediate the relationship between individual reproductive behavior and birth rates observed in a population. In this analysis of Brazil's accelerated fertility decline the component "marriage patterns" has been selected for observation.

There are strong indications that contraception within marriage has played a major role in Brazil's accelerated fertility decline (Merrick and Berquó, 1983). Duration of marriage and use of contraception are the principal proximate determinants of fertility in Brazil. At the individual level, duration of marriage, which taps the length of exposure to risk of conception, is the main determinant of current cumulative fertility (Silva et al., 1990).

Recent changes in nuptiality patterns, expressed by an increasing number of consensual unions, and the dissemination of sexual freedom values, seem to operate in the direction of increasingly earlier exposure to intercourse. At the same time, favorable attitudes toward and greater knowledge of contraception, including sterilization at an earlier age, might balance the aggregate effect of earlier entry into unions, especially because consensual unions tend to last for less time than formal marriages (Silva et al., 1990).

Education also exerts a strong effect on potential family size in Brazil, given its relationship to postponement of marriage and the resulting reduction of women's total sexual exposure time (Silva et al., 1990; Lazo, 1991; Lam et al., 1993). Data presented by Merrick and Berquó (1983) showed important differentials in fertility among

different educational groups and areas of residence (urban and rural). In 1976 the TFR for women with 5 years or more of schooling who live in urban areas was 2.4 children per woman. This value is almost 60 percent lower than the TFR for urban women with no education. Analogous relationships were observed within rural areas, where the fertility levels always are higher.

Lam et al. (1993) emphasized the importance of using educational levels to explain the rapid fertility decline. They affirmed that "Brazil provides an intriguing case study because increasing educational levels are one of the only consistent trends coinciding with the fertility decline. Family planning programs appear to have been a relatively minor factor, while the economy overall has experienced very large fluctuations in rates of economic growth, with fertility decline occurring during periods of both rapid growth and massive recession." (ibid., p. 4) Reconstructing both the schooling and fertility histories of cohorts of Brazilian women back to 1930, the authors found that substantial increases in the level of schooling for women and their husbands played a critical role in the timing of the onset of Brazil's rapid fertility decline. Comparison of fertility profiles across cohorts indicated that fertility began to decline with the 1940 birth cohort and was dominated by the cohort effect. Further, cohorts that appeared to initiate the dramatic fertility decline were those that also exhibited the most dramatic increases in schooling.

In Brazil, there are also important regional fertility differentials. In the period 1975/80, the extremes were located in the North and Northeast regions, with a TFT between 5.9 and 6.8, and in the Southern region (including the states of Rio de Janeiro and São Paulo), with a TFR between 2.8 and 3.2 children per woman (Fernandez and Carvalho, 1986).

With the above characteristics in mind, the main objective of this project is to explore the differentials and tendencies of marital fertility in Brazil, by type of union, during three periods of the fertility transition, 1976, 1984 and 1991, in three main regions: Northeast, São Paulo and South. Levels of education and place of residence are also considered as important covariates in the analysis.

Data

The data used in this project originated in the National Household Surveys (Pesquisa Nacional por Amostra de Domicílios - PNAD) conducted in 1976 and 1984 in Brazil and the DHS program conducted in 1986 and 1991. The PNAD surveys used a probabilistic sample, which guarantees that the data are statistically representative, even by regions. At the national level we have information for more than 50,000 actually married women at the time of the 1976 survey and for more than 67,000 in 1984. The survey recorded information on fertility and nuptiality for women 15 years and older, including marital status, duration of marriage for currently married women, total number of births, date of last birth, and various socio-economic variables such as education and place of residence.

The 1986 DHS survey included analogous information, and also used a probabilistic sample that is representative at the national level, but of much smaller size, i.e., less than 6,000 actually married women at the time of the interview. Because this sample size was not appropriate to fit the model that we were interested in using, by regions, we have not included the 1986 results in this report.

The 1991 DHS data for the Northeast region also used a probabilistic sample with information analogous to that indicated for the PNAD data. This data set has information available for more than 5,000 women actually married at the time of the survey. This sample size permitted satisfactory use of the data in our research.

Methodology

The analysis will follow the Rodríguez and Cleland (1988) model, based on earlier work of Page (1977).

Page (1977) considered a general model of marital fertility by both age and duration of first marriage, where the marital fertility rate f(a,d,t) at age a and duration of first marriage d for a given time period t was given by

$$f(a,d,t) = T(t)\, A(a,t)\, D(d,t)$$

where T(t) is a period effect in the overall level of fertility, A(a,t) is a time-varying age pattern of fertility and D(d,t) is a time-varying duration pattern of fertility.

After observing a long series of Swedish data, Page noticed that a) the age pattern A(a,t) was rather constant over time and resembled the average of Henry's schedule of natural fertility and b) the duration pattern D(d,t) for each period was a monotonic function of duration that could be approximated reasonably well by an exponential. So for a fixed period, Page considered the following model

$$f(a,d) = \Theta\, n(a) \exp[\beta d]$$

where f(a,d) is the marital fertility rate at age a and duration of first marriage d, Θ is a parameter representing the level of natural fertility, n(a) is the age pattern of natural fertility and β is a parameter representing the extent to which marital fertility at a given time-period departs from natural fertility as a function of increasing duration of first marriage.

Later, Rodríguez and Cleland (1988), considering the logarithm of the rate of the marital fertility at a given age and duration f(a,d) to the natural fertility at that age n(a), obtained a simple linear function of time elapsed since first marriage

$$\log [\ f(a,d)/n(a)\ ] = \alpha + ß\ d$$

where α corresponds to the logarithm of the parameter Θ that represents the level of natural fertility in Page's model.

This simplified version of Page's model could be fit to empirical data consisting of counts of births and exposure time for a fixed period. Rodríguez and Cleland used a log-linear Poisson regression model, treating the number of births in the reference period for each woman as a realization of a Poisson random variable that has an expected value equal to the product of the exposure time and a theoretical fertility rate that depends on her age, the length of time since her first marriage, and her socioeconomic characteristics.

Rodríguez and Cleland used these results to estimate the total fertility rates, the α-Index (or percentage reduction from maximum natural fertility and also called the spacing index) and the ß-Index (or measure of marital fertility control after ten years of marriage and also called the limiting index). These were defined as

$$I_{\alpha} = \left(1 - \frac{11.85}{15.30} e^{\alpha}\right)$$

$$I_{\beta} = 100\ \left(1 - e^{10\beta}\right)$$

where α and ß are the parameters of the model with $\alpha = \log \Theta$ (Rodriguez and Cleland, 1988).

We used the Rodríguez and Cleland model to study marital fertility in Brazil in 1976, 1984 and 1991 for each type of union, i.e., civil and religious, civil only, religious only, and consensual, which are the four types of unions considered in the 1976 and 1984 PNAD surveys (and also correspond to the type of union considered in the national census), and formal marriages (aggregate) and consensual unions, which were considered in the 1991 DHS survey.

In order to fit the Rodríguez and Cleland model and because the PNAD-76 only included information on the date of birth (month and year) of the last birth, we considered as the response variable the number of births that occurred during the year previous to the interview. Doing so incorporates a certain bias, since if more than one birth occurs during the year, this other birth will not be considered. In addition to sampling limitations there are other statistical restrictions for working with a small period of time as a reference period, but since we worked with a national survey having a considerable sample size, these problems are less important.

The explanatory variables in the analysis include two demographic controls: age and duration of union. For 1976 we had complete information on date of birth (month, day and year), but only the year of marriage of the actually married women (including consensual unions). This omission carries some extra bias in our estimations of duration of marriage.

As has been mentioned, Brazil has important fertility differentials by geographic regions. We have considered three main regions as explanatory variables in the model: Northeast, São Paulo state and South. The Northeast region includes the states of Maranhão, Piaui, Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Sergipe and Bahía. Traditionally, this region has had one of the highest fertility rates in the country. The Southern region includes the states of Parana, Santa Catarina and Rio Grande do Sul. It has the lowest fertility rates in Brazil.

In our analysis of marital fertility for each type of union and region, some important socioeconomic explanatory variables already mentioned, such as women's education and area of residence, are also considered.

Women's education was measured using years of schooling. The categories were grouped to satisfy sampling restrictions. As shown by Merrick and Berquó (1983), some fertility differential studies for 1976 used three groupings: none, 1 to 4, and 5 or more years of schooling. In our case, it was convenient to use three groups also, but they were redefined as less than 4 (did not complete elementary school), 4 to 7 (completed elementary school or did not complete middle school), and 8 or more (completed middle school or more) years of schooling.

Place of residence was first considered through the classic dicotomic division: urban and rural areas. Later we introduced the more accurate classification that was used in the PNAD's, i.e., dividing the place of residence into three: belonging to the metropolitan area, belonging to larger cities (also called self-represented areas, in the sense that they have to be present in the survey), and small towns (or not-self-represented areas in the sense that only a survey of these areas will be included in the National Household Survey). The survey households belonging to this last area also belong, in a high proportion, to the rural area. If we have some sample size restrictions for some types of union, as may be the case for women in religious or consensual unions only, we expect to have enough observations for the other two types of unions, i.e., civil and religious marriages, which are the majority (see Table 1).

The data have been processed using a PC/486 bought for this project. The systems used were the Statistical Analysis System (SAS) for preparing the data and the Generalized Linear Interactive Modeling System (GLIM) for fitting the model.

Nuptiality Patterns

The changes in nuptiality patterns in Brazil in recent years can be observed in Table 1. There is a general decrease in religious unions and a slight decrease in civil/religious unions, compensated by an increase in only civil unions and, to a lesser degree, in consensual unions.

Table 1. Nuptiality Patterns in Brazil, 1970-1984.

Region or Total	Year	Proportion of Women by Type of Union				Total
		Type of Union				
		Civ./Rel.	Civil	Religious	Consensual	
Brazil	1970	64.5	14.1	14.4	7.0	100.0
	1976	67.4	15.5	8.3	8.8	100.0
	1980	63.8	16.3	8.1	11.8	100.0
	1984	63.0	20.5	5.2	11.4	100.0
Northeast	1970	43.2	14.4	33.1	9.3	100.0
	1976	46.0	17.6	23.2	13.2	100.0
	1980	46.0	19.6	20.0	14.4	100.0
	1984	46.0	27.3	11.9	14.7	100.0
São Paulo	1970	81.2	11.6	3.1	4.1	100.0
	1976	80.0	12.4	1.6	6.0	100.0
	1980	74.5	14.7	1.8	9.0	100.0
	1984	74.6	16.6	1.2	7.5	100.0
Southern	1970	77.5	12.2	6.1	4.2	100.0
	1976	79.6	11.4	3.9	5.1	100.0
	1980	77.8	11.8	2.8	7.6	100.0
	1984	76.5	14.4	1.8	7.4	100.0

Note: Data for 1970 and 1980 are based on the census.
Data for 1976 and 1984 are based on unweighted sample data, so they are approximate estimations.

This general framework has important regional differentials. The biggest changes can be observed in the Northeast where religious marriages decreased more than 20 percentage points during the period 1970-1984. Almost all of this reduction was translated into an increase in civil unions. The proportion of civil/religious and consensual unions stayed almost constant during the last decade.

The other extreme is São Paulo state which has almost no variation in the proportion of only religious marriages (3 percent and 1 percent of the marriages) and a small decline in civil/religious marriages (around 7 percent during the period), which is compensated by an increase in only civil unions (around 5 percent) and a small increase in consensual unions (3 percent) during the 15-year period.

The pattern of the Southern region is similar to São Paulo state, but with a small decrease in religious marriages which translates into a 3 percent increase in consensual unions.

One could conclude that few changes in the nuptiality patterns in the Center and Southern regions are expected in the near future, whereas significant changes can be expected in the Northern regions and likewise in the nation, since the 1991 census indicates that the Northern regions represent almost 36 percent of the national population.

Thus, it is important to look at the fertility differential by type of union during the fertility transition process in Brazil in order to estimate the impact of these changes in the past and how these patterns could affect national fertility levels in the future.

General Effect of Type of Marriage

The fertility transition in Brazil has important differentials by geographic region, place of residence (urban, rural) and education, as has been mentioned. Several authors have already discussed these effects. However, the effect of type of union on the fertility transition in Brazil has been neither discussed nor quantified until now. With the support of Page's model and the Cleland and Rodríguez extension, we have focused on this objective and will now discuss our interesting results.

The first result from the quantification of the effect of type of union on marital fertility in Brazil is that consensual unions have higher fertility levels than formal unions (see Table 2). The limiting index (I_β) and the equivalent Total Marital Fertility Rate (TMFR) show that formal unions have higher marital fertility control. The limiting index (I_β) for civil/religious unions was around 50 percent in 1976 and 60 percent in 1984; for consensual unions it was only 25 percent and 43 percent, respectively. The equivalent TMFR also shows an average difference of one child between both types of unions.

The second interesting result we have observed is the higher increase in the limiting index of consensual unions (with respect to formal marriages) during the transition period studied (1976-1984, for Brazil). In the first group, the limiting index increased more than 75 percent (from 24.5 to 43.1) and formal marriages increased less than 20 percent (from 49.8 to 58.9 for civil/religious marriages, for example). These changes indicate that associated with the fertility decline is a convergence process during the fertility transition where marital fertility differentials become more homogeneous over time.[1]

The spacing index (I_α) seems to suggest that small changes have occurred during the transition period with respect to the reduction from maximum natural fertility. Differences between civil/religious and consensual unions levels are small but larger differences appeared between civil/religious and civil only marriages. Civil marriages have almost half the spacing index of civil/religious unions (15.2 and 28.7 in 1984, respectively).

[1] A similar process of homogenization was noticed by Rodríguez and Aravena (1991) for many countries in Latin America with respect to place of residence, after adjusting for wife's education and husband's occupation.

Table 2. The Effect of Type of Union and Place of Residence on Marital Fertility.

Estimates of Spacing Index (I_α), Limiting Index (I_β) and Equivalent Total Marital Fertility Rate (TMFR), Brazil 1976-1991

Region or Total	Type of Union	Survey	Index		Goodness of Fit		TMFR
			I_α	I_β	Deviance	d.f.	
Brazil	Civ./Rel.	PNAD-76	21.7	49.8	3454	2698	6.7
		PNAD-84	28.7	58.9	3203	2759	5.9
	Civil	PNAD-76	11.1	50.0			7.1
		PNAD-84	15.2	59.2			6.5
	Religious	PNAD-76 *	19.7	18.8			-
		PNAD-84 *	16.8	29.6			-
	Consensual	PNAD-76	35.2	24.5			7.1
		PNAD-84	24.3	43.1			7.2
Northeast	Civ./Rel.	PNAD-76	22.8	23.8	2405	2221	8.8
		PNAD-84	14.8	48.3	2356	2355	7.3
		DHS-91 **	17.7	64.1	1904	2211	5.6
	Civil	PNAD-76	13.9	22.6			10.4
		PNAD-84	10.3	31.0			8.0
	Religious	PNAD-76	20.4	8.6			10.4
		PNAD-84	29.5	39.5			9.6
	Consensual	PNAD-76	22.9	5.7			10.7
		PNAD-84	18.1	25.8			9.0
		DHS-91	41.0	42.0			5.6
São Paulo	Civ./Rel.	PNAD-76	37.6	53.0	1273	1454	5.4
		PNAD-84	37.7	65.1	1185	1478	5.0
	Civil	PNAD-76	22.0	51.6			5.7
		PNAD-84	31.0	61.1			5.8
	Religious	PNAD-76 *	50.7	18.2			
		PNAD-84 *	84.3	22.1			
	Consensual	PNAD-76	41.8	49.4			5.4
		PNAD-84	37.2	47.6			6.5
South	Civ./Rel.	PNAD-76	29.1	49.9	1160	1393	5.9
		PNAD-84	37.1	60.9	1347	1617	4.8
	Civil	PNAD-76	27.4	54.6			6.0
		PNAD-84	22.9	67.5			5.6
	Religious	PNAD-76	3.0	52.3			7.7
		PNAD-84	18.2	27.1			9.2
	Consensual	PNAD-76	45.5	20.2			6.9
		PNAD-84	46.9	45.8			5.4

* We did not get a compatible equivalent TMFR for this group.

** DHS-91 has only two categories: formal unions (including civil/religious, only civil and only religious unions) and consensual unions.

Effect of Geographical Regions of Residence

The national patterns have important differences when we look at the regional data. At the begining of the transition period studied here (1976), the Northeast region had the highest fertility levels, i.e., 3 more children (on average) than the national average. It also had the lowest limiting index (I_g), especially for women in consensual unions (less than 6 percent of marital fertility control below natural fertility after 10 years of union) and I_g=24 percent in the case of women in civil/religious unions (see Table 2).

In contrast the Northeast region had the highest increase in marital fertility control during the period. The limiting index increased around 100 percent for women in formal unions and more than 4 times for consensual unions. Curiously, these significant changes are not reflected in the equivalent TMFR, which was reduced by only one child in the case of civil/religious marriages and by only two children for consensual unions during the decade.

The data from the 1991 DHS survey for the Northeast region also show very good fit and the results (Table 2) indicate a continuing fertility decline. The limiting index and the equivalent TMFR achieved levels already observed in the more developed regions of the country (São Paulo state or the Southern region) in the mid-eighties. The results for the consensual unions are surprising in that the spacing and limiting indices and the equivalent TMFR are very close to those of the Southern region in 1984 (41.0, 42.0, 5.6 and 46.9, 45.8, 5.4, respectively).

During the period 1984-1991, consensual unions in the Northeast showed a higher fertility decline than the other types of union. The limiting index had an increase double that of formal unions[2], and the equivalent TMFR decreased almost 3.5 children (from 9.0 to 5.6), which is almost two times the decrease of formal unions (from 7.3 to 5.6 children).

These results corroborate our conclusions that in addition to a process of fertility decline, the transition process in Brazil has been associated with a process of homogenizing patterns along the marital fertility by type of union.

Finally, we should mention that as the transition process achieves lower fertility levels (as in the case of São Paulo state and the Southern region), declines appear to be smaller, which suggests that they are approaching some level of convergence.

Effect of Wife's Education

As has been noted already, wife's education is one of the main covariates in the fertility transition process in Brazil. Therefore, in the second stage of our analysis we also controlled our estimations using women's education.

[2] Because of sample size restrictions, we grouped the civil/religious and civil only unions in one group called formal unions. We maintained consensual unions as a separate group, but in some cases we did not get good fits or compatible parameter estimates. These cases are indicated in Table 4.

The results corroborate the general pattern already mentioned by previous authors: women with less schooling have higher fertility levels and women with more education have lower levels independent of type of union or, as in our case, of geographic region.

What can also be observed from Tables 3 and 4 is that fertility decline during the period 1976-1984 is a consequence of fertility control of the less educated women, since marital fertility stayed almost constant for the more educated group. Again, the groups with higher fertility were the ones that increased their marital fertility control more, which also contributed to the homogenization process. The equivalent TMFR for women with less than 4 years of schooling, in consensual unions and living in the Northeast was reduced by almost 2 children (from 11.7 to 9.6 between 1976 and 1984) (see Table 4).

An explanation for the fertility control in these cases is the regular increase of the limiting index for higher levels of education.[3] Women in formal union, with more than 8 years of schooling, have controlled between 70 percent and 80 percent of their fertility below natural fertility after 10 years of marriage, independent of the geographic region of their residence. We can see these results in São Paulo, and also in the South and the Northeast (see Table 3).

However, this pattern of formal unions does not seem to be followed by consensual unions. In this case, fertility control seems to be explained by the regular increase of the spacing index (or reduction from maximum natural fertility) for higher levels of education.[4] For example, among the PNAD-76 data for Brazil, the spacing index varies from 29.4 percent to 57.7 percent between the groups with less than 4 and more than 7 years of schooling, respectively, whereas the limiting index only varies from 31.9 percent and 33.4 percent, respectively between the same groups (see Table 4).

The fertility transition in the Northeast region between 1984 and 1991 turns out to be an exception to the patterns already discussed for the period 1976-1984. In this region, even the more educated women reduced their fertility by a significant number (2.2 children), almost the same reduction of the equivalent TMFR of women with less than 8 years of schooling. Further, the main proximate cause of this change is found in the increase of the index of spacing practices rather than limiting practices (see Table 3).

Effect of Area of Residence

With respect to formal unions, the effect of place of residence in the fertility transition shows what we expected[5]: higher fertility in rural areas, independent of geographic regions, and higher reduction of fertility in rural areas during the transition period (as part of the homogenization process) (see Table 5). The exception is the Northeast region (a region of high fertility in both areas), where fertility was reduced by almost the same level for rural and urban areas. The main proximate cause of these changes can be found in the increases of the limiting practices.

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[3] An analogous situation was observed by Rodríguez and Aravena (1991) for Latin American countries.

[4] An analogous situation was observed by Rodríguez and Aravena (1991) for Trinidad & Tobago, a Caribbean country with a high prevalence of consensual unions.

[5] We only considered formal unions in this case because the sample sizes for the other types of union in rural areas were inadequate.

Table 3. The Effect of Wife's Education on Marital Fertility in Formal Unions

Estimates of Spacing Index (I_α), Limiting Index (I_β) and Equivalent Total Marital Fertility Rate (TMFR), Brazil 1976-1991

Region or Total	Years of School	Survey	Index		Goodness of Fit		TMFR d.f.
			I_α	I_β	Deviance		
Brazil	≤ 3	PNAD-76	12.3	47.2	1857	1908	7.9
		PNAD-84	15.5	50.0	2019	2075	7.2
	4 to 7	PNAD-76	12.1	65.3			6.5
		PNAD-84	9.8	70.1			6.2
	≥ 8	PNAD-76	3.3	78.9			6.6
		PNAD-84	12.8	79.1			6.1
Northeast	≤ 3	PNAD-76	-15.1	38.2	1062	1259	11.1
		PNAD-84	2.8	39.1	1492	1738	9.5
		DHS-91	1.8	53.0	824	1069	7.6
	4 to 7	PNAD-76	2.3	52.6			8.5
		PNAD-84	-0.2	65.4			7.4
		DHS-91	23.1	59.0			5.8
	≥ 8	PNAD-76	5.8	71.2			6.7
		PNAD-84	10.5	77.6			6.9
		DHS-91	40.5	67.5			4.7
São Paulo	≤ 3	PNAD-76	29.3	50.5	1024	1373	5.8
		PNAD-84	18.1	63.2	1003	1508	6.0
	4 to 7	PNAD-76	15.6	71.5			5.8
		PNAD-84	27.6	76.1			5.0
	≥ 8	PNAD-76	9.5	79.7			5.5
		PNAD-84	32.2	74.6			5.3
South	≤ 3	PNAD-76	13.5	56.6	1039	1245	6.8
		PNAD-84	38.4	52.2	1180	1585	5.0
	4 to 7	PNAD-76	30.7	57.7			5.3
		PNAD-84	23.5	69.8			5.3
	≥ 8	PNAD-76	30.0	68.5			4.9
		PNAD-84	34.6	70.2			4.8

Table 4. The Effect of Wife's Education on Marital Fertility in Consensual Unions

Estimates of Spacing Index (I_α), Limiting Index (I_β) and Equivalent Total Marital Fertility Rate (TMFR), Brazil 1976-1984

Region or Total	Years of School	Survey	Index		Goodness of Fit		TMFR
			I_α	I_β	Deviance	d.f.	
Brazil	≤ 3	PNAD-76	29.4	31.9	901	1087	7.8
		PNAD-84	16.2	39.1	1366	1461	8.6
	4 to 7	PNAD-76	33.9	41.2			7.1
		PNAD-84	14.0	59.7			7.5
	≥ 8	PNAD-76	57.7	33.4			5.0
		PNAD-84	42.8	48.9			6.1
Northeast	≤ 3	PNAD-76	2.1	20.6	387	370	11.7
		PNAD-84	8.2	36.0	895	946	9.6
	4 to 7	PNAD-76	10.1	25.3			10.4
		PNAD-84	-6.6	60.8			8.9
	≥ 8	PNAD-76 *	-	-			-
		PNAD-84	21.4	58.2			7.2
São Paulo	≤ 3	PNAD-76	34.7	54.3	225	295	6.1
		PNAD-84	37.4	35.6	411	480	6.8
	4 to 7	PNAD-76	5.7	75.4			7.0
		PNAD-84	2.7	81.3			6.6
	≥ 8	PNAD-76 *	-	-			-
		PNAD-84	51.9	9.8			6.2
South	≤ 3	PNAD-76 *	-	-			-
		PNAD-84	29.1	51.0	448	569	6.4
	4 to 7	PNAD-76 *	-	-			-
		PNAD-84	48.5	42.7			5.4
	≥ 8	PNAD-76	-	-			-
		PNAD-84	60.8	54.1			3.6

* The sample size was inadequate.

Table 5. The Effect of Place of Residence on Marital Fertility in Formal Unions

Estimates of Spacing Index (I_α), Limiting Index (I_β) and Equivalent Total Marital Fertility Rate (TMFR), Brazil 1976-1991

Region or Total	Place of Residence	Survey	Index		Goodness of Fit		TMFR
			I_α	I_β	Deviance	d.f.	
Brazil	Urban	PNAD-76	22.2	55.9	1784	1377	6.6
		PNAD-84	24.3	64.7	1673	1438	5.9
	Rural	PNAD-76	8.0	36.8			9.3
		PNAD-84	16.6	44.9			7.7
Northeast	Urban	PNAD-76	9.7	45.7	1105	1146	8.6
		PNAD-84	16.6	59.1	1203	1246	7.0
		DHS-91	36.2	56.9	763	895	5.2
	Rural	PNAD-76	-6.6	27.4			12.1
		PNAD-84	4.5	34.6			10.1
		DHS-91	6.4	46.0			8.1
São Paulo	Urban	PNAD-76	26.0	63.0	891	987	5.8
		PNAD-84	31.0	67.6	697	981	5.2
	Rural	PNAD-76	13.8	44.2			7.2
		PNAD-84	34.0	61.6			5.0
South	Urban	PNAD-76	40.6	55.9	887	1038	4.7
		PNAD-84	35.1	65.7	954	1131	4.9
	Rural	PNAD-76	14.6	47.7			7.5
		PNAD-84	28.8	55.3			6.3

A situation analogous to the above can be observed for consensual unions at the national level and for the Northeast region (see Table 6).

For the three areas of residence considered in the PNAD's (metropolitan area, cities or towns) the result for formal unions is interesting. In Brazil, the highest fertility decline during the transitional period 1976-1984 was observed in the bigger cities, rather than in the metropolitan areas, where by 1976, the fertility was already much lower. Surprisingly, small towns do not show variations.

For consensual unions in Brazil, their higher fertility rates decline in small town areas by only one child, stay fairly stable in metropolitan areas and increase by one child in big cities. This surprising result may be a consequence of important migration movements from rural to urban areas during the period (see Table 7).

Table 6. The Effect of Place of Residence on Marital Fertility in Consensual Unions

Estimates of Spacing Index (I_α), Limiting Index (I_β) and Equivalent Total Marital Fertility Rate (TMFR), Brazil 1976-1984

Region or Total	Place of Residence	Survey	Index		Goodness of Fit		TMFR
			I_α	I_β	Deviance	d.f.	
Brazil	Urban	PNAD-76	37.0	33.3	988	1090	7.2
		PNAD-84	25.6	46.4	1118	1087	7.4
	Rural	PNAD-76	26.9	12.2			9.6
		PNAD-84	14.1	34.3			7.4
Northeast	Urban	PNAD-76	16.4	12.6	685	722	11.1
		PNAD-84	12.1	42.7	767	841	8.9
	Rural	PNAD-76	22.4	6.6			10.7
		PNAD-84	0.7	40.5			9.9
Brazil	Metrop.	PNAD-76	37.0	42.0	1184	1432	6.8
		PNAD-84	26.4	51.3	1497	1535	7.0
	City	PNAD-76	41.5	31.8			6.8
		PNAD-84	21.5	37.7			8.4
	Town	PNAD-76	25.0	16.2			9.6
		PNAD-84	20.3	34.8			8.6
Northeast	Metrop.	PNAD-76	23.8	8.6	750	752	10.1
		PNAD-84	9.4	50.9	930	1017	8.4
	City	PNAD-76	31.1	6.0			8.9
		PNAD-84	21.8	21.2			9.2
	Town	PNAD-76	15.3	11.3			11.2
		PNAD-84	3.4	36.9			10.1

Note: Because we did not have good fits for São Paulo state and the Southern regions, these were not included here.

In the Northeast region, stable marital fertility levels only occur in bigger cities, but fertility in metropolitan areas and small towns has been reduced by more than one child (see Table 7).

This pattern shows big differences when we look at formal unions along the geographic regions. The Southern region, which has the lowest fertility levels, shows a big fertility decrease only in the small town category. The fertility of São Paulo state, which is relatively higher than the Southern region, has declined by almost 2 children between 1976 and 1984 in both the big city and the small town categories. Finally, the Northeast region, with the highest fertility levels, had a fertility decline of approximately 1.5 children in all three areas.

Table 7. The Effect of Area of Residence on Marital Fertility in Formal Unions

Estimates of Spacing Index (I_α), Limiting Index (I_β) and Equivalent Total Marital Fertility Rate (TMFR), Brazil 1976-1984

Region or Total	Place of Residence	Survey	Index		Goodness of Fit		TMFR
			I_α	I_β	Deviance	d.f.	
Brazil	Metrop.	PNAD-76	21.3	60.4	2186	2016	6.4
		PNAD-84	20.6	67.7	2143	2103	6.1
	City	PNAD-76	14.8	55.9			7.0
		PNAD-84	27.7	63.7			5.6
	Town	PNAD-76	14.8	55.9			7.0
		PNAD-84	14.6	53.7			7.2
Northeast	Metrop.	PNAD-76	17.8	46.2	1359	1470	7.9
		PNAD-84	23.2	60.5	1530	1724	6.4
	City	PNAD-76	6.0	40.6			8.4
		PNAD-84	12.5	60.4			7.1
	Town	PNAD-76	-2.9	32.4			11.0
		PNAD-84	3.9	40.1			9.5
São Paulo	Metrop.	PNAD-76	23.8	63.4	1206	1481	6.1
		PNAD-84	23.6	67.9	1124	1542	5.8
	City	PNAD-76	5.8	70.1			6.5
		PNAD-84	43.2	63.3			4.6
	Town	PNAD-76	33.1	48.1			6.5
		PNAD-84	36.1	67.5			4.6
South	Metrop.	PNAD-76	43.9	55.2	1087	1324	4.3
		PNAD-84	36.7	67.0	1222	1574	4.7
	City	PNAD-76	30.2	64.3			4.9
		PNAD-84	39.6	54.2			5.1
	Town	PNAD-76	23.1	47.6			6.9
		PNAD-84	27.7	60.8			5.6

This brings us to believe that the fertility decline for formal unions is related much more to the fertility levels observed by region than to the geographic region itself. In this sense, it might be worthwhile to perform more accurate analysis in the future.

Conclusions

Our main objective in this project was to study marital fertility differentials in Brazil through its fertility decline process from 1976 to 1991. Our main results corroborate some previous observations of higher marital fertility for consensual unions and lower fertility for formal unions. Despite significant increases in consensual unions, fertility through the transition process declined by more than one child during the decade 1976-1986.

The higher fertility declines in regions of high fertility, e.g., the Northeast, for all types of union, and also for special high-fertility subgroups, e.g., the less educated, contributed to this result. The main proximate cause of these changes can be found in increases of the limiting practices.

Taking into consideration place of residence (metropolitan area, cities or towns), a higher fertility decline was observed for formal unions in the bigger cities rather than the metropolitan area, which already had a much lower fertility by 1976. Small towns only showed small variations.

In general, during the transition process groups with relatively low fertility had less fertility decline than groups with high fertility, associating the fertility decline process with a homogenizing patterns process.

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