Fertility in Brazil between 1946 and 1960: An Application of the Own-Children Method

Ana Paula de Andrade Verona, *The University of Texas at Austin*
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This paper analyzes the timing of the onset of the fertility decline in Rio Grande do Sul, Brazil, using microregions as unity of analysis. The data came from the Brazilian demographic census of 1960. Based on the own-children method of fertility estimates and the Brass relational model of life tables, preliminary results show that the Total Fertility Rate in Porto Alegre (capital of Rio Grade do Sul) was already low in 1946, and that this rate did not change substantially between 1946 and 1960. These results challenge previous studies that assume that the first stage of the Brazilian fertility decline extends from the mid-1960s until 1980. The second step of this paper is to examine whether (and how) any pioneer microregions influenced other neighboring places during the timing of onset of the fertility decline in Brazil.

Introduction

The fertility decline in Brazil has been widely investigated, among other reasons, due its rapid pace, the various attempts offered to explain this phenomenon, and the absence of an official family planning policy. However, some gaps in the understanding of this phenomenon still persist. One of them concerns the lack of a more precise knowledge about the beginning of the fertility decline in Brazil using smaller spatial units, such as microregions. Almost all the studies regarding the timing of fertility decline use as a primary unit of analysis the Brazilian physiographic regions. In this way, it is virtually impossible to capture the heterogeneity within these units, both when analyzing variations in the reproductive system behavior and in the socioeconomic context.
Many studies have dated the beginning of fertility decline in Brazil in the mid-1960s (Carvalho, 1974; Fernandez & Carvalho, 1986; Frias & Oliveira, 1991; Frias & Carvalho, 1994; Potter, 1999), when the annual rate of population growth began to decrease.

However, these and other studies show that fertility had showed variations before 1960. Fernandez & Carvalho (1986), using the own-children method (OCM), calculated the total fertility rates (TFR) between 1930/1940 and 1970/1980 and explained that this rate slowly decreased between 1950 and 1960 (around 8%) and quickly between 1960 and 1970 (approximately 26%). In another study, Frias & Oliveira (1991) explained that fertility in Brazil already had signs of reduction between 1930 and 1945, although the decline of this component has become more evident after 1960.

Empirical evidences also show quite clearly that the decline of fertility in Brazil varied substantially across physiographic regions, place of residence and, socioeconomic groups. In general, groups with the most favorable conditions, with higher income and

high education, for example, were the first to experience such decline. While this differential is considerably decreasing, it still exists. When analyzing the fertility differentials by place of residence, those living in urban areas began the decline, and then were followed by residents in rural areas at the end of the 1960s. Finally, when considering the pioneer places, Sao Paulo, Rio de Janeiro, and the south region are characterized by declining fertility even in1950/1960 and 1960/1970 (Fernandes and Carvalho, 1986; Frias and Oliveira, 1991; Frias and Carvalho , 1992).

The objective of this work is to examine the timing of fertility decline in Brazil using TFR estimates for the years between 1945 and 1960, across 25 microregions of the state of Rio Grande do Sul. This state was chosen because it was one of the pioneers in the fertility decline in Brazil. Thus, by using data from the Rio Grande do Sul from smaller units of analysis, such as microregions; it is very likely find low TFR before 1960.

This paper has some advantages and contributions to the current literature and the knowledge of the timing of fertility decline in Brazil. One of them is the use of the own children methodology (OCM), which allows estimating fertility for years preceding the census. Furthermore, this study uses the demographic Brazilian census from 1960, which can bring significant contributions to a better understanding of the beginning of the process of fertility decline. Finally, another contribution of this work is to employ microregions as the unit of analysis, which allows considering demographic and socioeconomic differentials within the state. In other words, instead of examining the Rio Grande do Sul states through homogeneous and aggregated values, the microregion analysis will allow capturing heterogeneity within this state.

Some Contributions for Explaining the Fertility Decline in Brazil

According to IBGE (*Instituto Brasileiro de Geografia e Estatística*), the Brazilian total fertility rate fell from approximately 6.3 children per woman in 1960 to below 2.5 in 2000. Most studies about the early state of the fertility decline in Brazil assume that this demographic component remained fairly constant at a high level until the 1960's. Until this period, reduced fertility was restricted to wealthier income groups and regions, especially in urban areas (Martine, 1997). After the 1960's, fertility started to fall in other social groups and regions. In the rural areas, for example, the decline probably started between 1968 and 1970 (Fernandez and Carvalho, 1986). Taking into consideration such context, the first stage of the Brazilian fertility decline may be identified as extending from the mid-1960s until 1980 (Potter, 1999). In order to illustrate this first stage (and some decades which anteceded such period) Fernandez and Carvalho (1986) presented the total fertility rates[1] (TFR) in Brazil, from 1930/1940 until 1970/1980. They showed that fertility slowly declined from 1950s to 1960s (around 8%) and quickly decreased from 1960s to 1970s (26%).

Although all regions have been affected by the fertility decline, the early stages when this phenomenon happened were different across regions and states in Brazil. Fernandez and Carvalho (1986) presented numbers about this decline for three regions and four states in Brazil[2]. Among their results, they showed that in the Northeast and Minas Gerais the fertility rates held almost constant from 1950 to 1970. On the other hand, these rates varied significantly in Sao Paulo and Rio de Janeiro over the same period (-11 and -12%, respectively). This result would be expected since Sao Paulo and

[1] These estimates were corrected by the Brass indirect technique.
[2] Amazonia, Northeast, Minas Gerais, Sao Paulo, Rio de Janeiro, South, and Mid-west.

Rio de Janeiro are states where the fertility rates had already fallen to about 4.5 and 4.7, respectively, by 1950-60.

Several authors have analyzed a large variety of aspects underlying the beginning, and persistence, of the fertility decline in Brazil. Martine (1996) provides an overview of many factors underlying this decrease. He started analyzing the role of four proximate determinants of fertility change in Brazil: marital patterns, contraception, induced abortion, and postpartum nonsusceptibility. He argued that birth control played the major role in causing the decline. Moreover, according to Martine (1996), induced abortion appears to be the most important method of fertility control in the early years of the decline[3] [4] (p. 51).

Potter (1999) also examined the early state of the process of adopting modern contraceptive methods in Brazil. Taking the 1964-80 period, he emphasized that until this time contraception services were most provided by private physicians, hospitals, and pharmacies, rather than government institutions. Indeed, according to this author, Brazilian government tended to restrict the use of contraception during this period, what would have provoked the rejection of some technologies, such as IUD. Furthermore, Potter (1999) showed how the period that followed the first stage of the fertility decline in Brazil was marked by the significant increasing use of the female sterilization as a contraception method.

The fertility decline has been frequently associated to the development process to which Brazil has undergone over the last decades. Before the end of 60's, Gendell (1967) was already interested in this association. Even tough the limitations of the available data,

[3] As Martine (1996) says, this hypothesis is based on a process of elimination.
[4] However, Martine (1996) emphasizes that whether it is examined the middle stage of fertility decline, female sterilization became to show the greater impact on it.

he tried to investigate whether the fertility decline would be caused by the social and economic changes implicit in the Brazilian development. This issue is still part of the population studies agenda. In a recent study, Potter at al (2002) used Brazilian census of 1960, 1970, 1980, and 1991 for examining the potential relationship between changes in fertility and development shifts through time. They found a strong and consistent association between the estimates of fertility and development indicators. Among these indicators, the increase in the women's education and participation in labor market are also associated to decline of fertility in Brazil. For instance, Lam and Duryea (1999) showed that improvements in schooling can account for an important part of Brazil's fertility decline during the 1960s and 1970s.

In his revision, Martine (1996) also discussed the influence of other factors, which have been recognized as affecting the fertility transition in Brazil, such as the key social institutions, the modernization and economic pressure, and the unintended outcomes of institutional changes and public policies. Based on earlier findings of Vilmar Faria's studies, Martine affirmed that many actors, including the State, the Catholic Church, women's movements, the spread of mass communications, among other, contributed to fertility decline in Brazil; however their effects were essentially unanticipated and unintended. This author also explained that urbanization is part of modernization theory's explanation of fertility decline; nevertheless it has been largely ignored in studies about Brazilian decline. According to him, since urbanization is associated with many social, economic, and political changes that happened during the decline of fertility in Brazil, it must not be neglected in studies that explain such phenomenon.

Certainly there are many aspects underlying the fertility decline in Brazil. As was shown above, the specialized literature has tried to explain such phenomenon in different ways.

The Own-children method

The own-children method of fertility estimation is a reverse-survival technique for estimating age-specific birth rates for years preceding a census or household survey. This method was developed by Grabill and Cho in 1965. Since then, the own-children method has been refined and re-adjusted in many aspects (Cho, Retherford, and Choe, 1986). Among some changes, improvements were made to handle problems such as age misreporting and changes in mortality levels during the past.

Since we are interested in studying the earlier stage of the fertility decline in Brazil, the value of applying the own-children methodology resides largely in the fact that it allows to observe the year-by-year change in fertility. It is not possible to be done when using the Brazilian censuses, since they provide information in each ten years. Certainly, the use of yearly fertility information will permit a more accurate investigation about the fertility change, especially during the beginning of such change.

The own-children method is estimated using information about children and mother's ages. After they are classified by this variable, the matched children are reverse-survived to estimate numbers of births by age of mother in previous years. Using the same procedure, reverse-survival is applied to estimate numbers of women by age in previous years (Cho, Retherford, and Choe, 1986, p.2). In order to match children and probable mothers is fundamental that they be identified in the census as living in the

same household. Hence, the own-children method suggests employing only information about children who are not older than fourteen years, corresponding to births from 1 to15 years before the census. This restriction is made to avoid an increasing number of children who cannot be matched, since it could be large the proportion of them whom do not reside in the same household as their mothers. One strength relates to this children's age requirement is that the own-children estimates of age-specific birth rates do not suffer from age truncation. This advantage is based on the idea that the initial matching of children to mothers is done for women up to age 65 at the time of the survey, who were 50 years old at the time of the previous enumeration (Cho, Retherford, and Choe, 1986).

The first step when estimating the own-children method is the allocation of children (0-14) to their mothers (15-64) inside the household. The foundation of the allocation procedure is based on information of children and women's relationship to the household head. This information permits to make inferences about how non-heads may be related to one another. The matching between children and mothers can be done through three ways: (1) woman who is the head of household and those children who are classified as their son or/and daughter; (2) woman who is spouse of the household head and those children who declared as son or/and daughter and (3) woman who is daughter of head and those children who are classified as grandchild of the head of household (Miranda-Ribeiro and Rios-Neto, 2005).

After allocating children to their probable mothers, some adjustments have to be made. One of the adjustment factors proposed by Cho, Retherford, and Choe (1986) is related to the non-own (unmatched) children. During the allocation, some children cannot be matched, probably because they are not living in the same household as their mothers,

or because their mothers died. In this case, the adjustment is made computing non-own (unmatched) children as the reciprocal of the proportion of children aged x to x+1 at the time of the census who are matched to mothers.

An additional correction suggested by Cho, Retherford, and Choe (1986) is the adjustment factor for underenumeration and age misreporting of children and women. This is factor is obtained from an independent source, such as a postenumeration survey. In places where no postenumeration is available, as is the Brazilian case, Cho, Retherford, and Choe (1986) recommend to set the factor adjustment to one.

Another important adjustment is to correct for mortality levels during the past. Such correction is done applying the probability of surviving from birth to age x and the probability of surviving from birth to age x for females. This reverse-survival procedure assumes the complete life tables by sex and single years of age are accessible. However, if complete life tables are not available (this is the case for Brazil), they must be interpolated by single years of time and age (Cho, Retherford, and Choe, 1986).

After all theses adjustments are made, the number of reverse-survived births is divided by the total of reverse-survived women in order to calculate the age-specific birth rates.

Results

Table 1 shows the total number of children allocated in the first part of the implementation of the OCM by child's age (between 0 to 14 years), when using the information about the “relationship with the head of the family". Among children between 0 to 14 years old, almost 92% were allocated using this information. To ensure more reliable results when performing the allocation, it was considered only women who

gave birth at least once during her reproductive are span. By the age of 6 years, 94% of children were allocated to their supposed mother at home. After this age, the percentage of children allocated decreases until reaching 84% of children at age 14. This decline could have been anticipated, since children are more likely tend to leave their parents' house when they get older.

Table 1 - Percentage of own children allocated by age according to the relationship with the head of the family

Child's age	Own Children	All Children	% of allocated children
0	37,900	40,470	94%
1	35,280	37,552	94%
2	42,058	44,696	94%
3	41,938	44,521	94%
4	41,100	43,755	94%
5	39,197	41,674	94%
6	37,930	40,578	93%
7	36,808	39,658	93%
8	35,724	38,802	92%
9	33,746	36,862	92%
10	34,478	38,220	90%
11	30,201	33,869	89%
12	31,777	36,511	87%
13	28,753	33,444	86%
14	26,881	32,048	84%
Total	533,771	582,660	92%

Source: IBGE, the 1960 Brazilian Census

Table 2 shows the estimates of the TFR when applying the OCM. After the allocation, the next two steps completed were the construction and the use of the reverse-survival factor and the adjustment factor for non-own (unmatched) children. The results shown on Table 2 are averages for three periods of five years each, between 1946 and 1960. These averages allow correcting the errors for preference for digits in the age reporting.

Table 2 – Own-children estimates of trends in the TFR by microregion at Rio Grande do Sul, between 1946 and 1960

Microregion	1946-1950	1951-1955	1956-1960
Porto Alegre	3,57	3,43	3,17
Santa Cruz do Sul	4,13	4,08	3,73
Jaguarão	5,35	4,77	3,82
Campanha Meridional	5,03	4,54	3,82
Serras de Sudeste	5,37	5,17	4,27
Cachoeira do Sul	5,55	5,41	4,33
Campanha Central	5,28	5,03	4,35
Lajeado-Estrela	5,09	4,92	4,39
Santa Maria	5,32	5,14	4,45
Sao Jerônimo	5,70	4,69	4,46
Pelotas	5,49	4,79	4,55
Campanha Ocidental	5,71	5,34	4,56
Restinga Seca	5,84	5,80	4,57
Litoral Lagunar	5,40	5,42	4,65
Três Passos	6,08	6,11	5,20
Caxias do Sul	6,45	6,36	5,30
Santiago	6,68	6,35	5,35
Santo Ângelo	6,65	6,59	5,56
Vacaria	6,49	6,76	5,77
Cerro Largo	7,19	7,22	5,87
Guaporé	7,51	7,26	6,28
Erechim	7,07	7,42	6,39
Santa Rosa	7,24	7,11	6,51
Ijui	7,52	7,89	6,52
Frederico Westphalen	9,63	9,98	8,47
Rio Grande do Sul	5,48	5,36	4,61

Source: IBGE, the 1960 Brazilian Census

The first aspect to be highlighted on Table 2 is the existence of fertility decline between 1946 and 1960. It is greater than 15% in 16 microregions of Rio Grande do Sul. Moreover, it occurred prior to the period of 1956-1960, and in some cases, before 1951-1955. Another aspect to be highlighted on Table 2 is that Porto Alegre and Santa Cruz do

Sul microregions have TFR relatively low in all three periods analyzed. These rates may indicate a fertility decline in these microregions even before 1946.

Discussion: Reasons for the earlier fertility decline in Porto Alegre

This section looks for some potential explanations for the earlier fertility decline observed in Porto Alegre microregion, based on demographic and socioeconomic variables of the 1960 census. The goal in this comparison was inferred on the potential weight of the Porto Alegre city in explaining its low fertility observed in its microregion.

Table 3 shows the total of women between 25 and 39 years of age. This age group was chosen because at 25 years of age it is likely that a considerable proportion of women have already experienced both marriage and maternity in 1960. Among those with 39 years or older who have not experienced such events, the chance of occurrence is residual.

The first three variables observed on Table 3 help to explain the family structure and reproductive behavior of these women. Regarding the family structure, there is a high percentage of women in this age group who still remained single and with no children in 1960. In the city of Porto Alegre, this figure was almost 20%, while in the microregion and in the state, represented 17% and 15% of all women between 25 and 39 years.

The singulate mean age at marriage in Porto Alegre shows that women postponed marriage more than the total who resided in the state of Rio Grande do Sul Table 3 also presents the parity of women between 25 and 39 years and indicates a substantial differential in the number of children ever had between them. Among those who resided in Porto Alegre, almost 29% had no children in 1960. Regarding the high parity, the state of Rio Grande do Sul presents a percentage much higher than that observed in its capital;

approximately 52% of women between 25 and 39 years had 3 children and more in 1960, while in Porto Alegre this proportion was 33%.

Table 3 – Women between 25 and 39 years old. Rio Grade do Sul (RS), Porto Alegre microregion (MR-POA) and Porto Alegre (POA), 1960

Variáveis demográficas e socio-econômicas (%)	RS	MR-POA	POA
Family Structure			
Single, no children	14,63	17,14	19,89
Single, with children	0,85	1,25	1,55
Married, no children	5,41	7,47	8,11
Married, with children	74,57	67,74	63,18
Divorced or Widow	4,28	6,11	6,94
Parity			
No child	20,58	25,39	28,86
1-2	27,21	37,05	37,92
3 and over	52,21	37,56	33,22
Race: White	90,92	88,03	86,28
Education			
No Education	25,00	17,01	14,76
1 a 4	66,42	63,31	60,79
5 e mais	8,58	19,57	24,45
Labor Market Participation	18,59	27,40	30,75
Urban area	52,06	86,88	98,10
Total	139.887	28.954	21.492

Source: IBGE, the 1960 Brazilian Census

The existing literature has shown that the four last variables on Table 3 may contribute to some of the many explanations of the decline in fertility in Brazil. In general, white women, more educated and high participation in the labor market (Lam and Duryea, 1999), and residents in urban areas, began the process of declining fertility

in Brazil. Moreover, differences by years of schooling, work in salaried workers and residents in urban areas are marked in the three groups of women. Among those living in Porto Alegre, less than 15% were illiterate in 1960 while the state of Rio Grande do Sul had 25% of women between 25 and 39 years old, with no education. Among those with five years and more than education, the Porto Alegre City had almost three times that of women of the state with a whole.

Porto Alegre and the Porto Alegre microregion had approximately 12% and 9% of women who worked in the labor market in 1960 more than the state. Finally, as it was expected, almost all women in Porto Alegre was living in urban areas, whereas this percentage is slightly more than half among those living in Rio Grande do Sul.

In general, Porto Alegre and its microregion had in 1960 a structure family and reproductive behavior that could already indicate a low fertility. Furthermore, a higher percentage of women between 25 and 39 years with higher education (5 years and over), and greater participation in the labor market, and residents in urban areas, must have contributed to the earlier fertility decline in Porto Alegre and its microregion.

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