FERTILITY DECLINE IN BRAZIL: A DIFFERENT TEMPO EFFECT WITH STRONG CONSEQUENCES.

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Brazil has experienced a steady fertility decline during the last thirty years. The Brazilian Census Bureau figures indicate a decline in TFR: 6.3 (1960), 5.8 (1970), 4.4 (1980), 2.9 (1991), and 2.3 (2000). The Brazilian Southeast region is the most developed in the country, presenting already a TFR at replacement level in year 2000. A paper by Goldani (2002) presented at a recent UN Population Division seminar contrasted official projections of TFR at replacement level only in year 2025, while several expert predictions indicated below replacement fertility already in 2005. In spite of the good quality of the Brazilian census data, the debate on future fertility trends an its political/ economic consequences has been limited by the lack of good quality birth histories and vital registration. The only empirical evidence used by the experts is the measurement of period TFRs (incidence rates). Demographers know that the median age at marriage has been remarkably stable at around 22.5. They also know that the relative distribution of period ASFRs have been increasingly concentrated among women less than 25 years of age. The share of the 15-24 ASFR in TFR increased from 30% in 1973 to 45% in 1988 (Rios-Neto, 2000). The Census Bureau calculated the following increase in the share of 15-19 ASFR in TFR: 9.1% (1980), 15.3% (1991), and 19.4% (2000). These figures are consistent with the observed high prevalence of female sterilization in Brazil, which leads to a pattern of reduced birth spacing combined with termination by parity.

The use of incidence rates may mislead inferences, as pointed by Ortega and Kohler (2002). Also, not a great deal is known about birth intervals, parity progression rates, tempo effects, mean age by parity, etc. This paper will take an innovative methodology for the reconstruction of birth histories, applied to the Brazilian case, constructing a birth history from 1986 to 2000, based on the 2000 demographic census microdata. This paper will use this birth history reconstruction in combination with the Kohler & Ortega method to disentangle the period tempo, parity composition, and quantum effects of fertility during the strong fertility decline observed in Brazil.

A major concern about the future Brazilian trends in fertility is associated with the existence of positive or negative corrections of tempo effects from TFR to adjusted TFR. This paper will suggest that the tempo effect in Brazil has been operating in the opposite direction of the pattern found in developed countries. The main corollary is that if TFR is already converging toward replacement level, then adjusted fertility is already well below replacement level. The story would become more complicated for policy standpoint, if one predicts that some kind of second demographic transition will take place in the future. In this case, there would be a reversal in the tempo effect leading to a further decline in unadjusted TFR. An informed scenario with respect to the direction of the tempo effect can be built if we calculate fertility intensities controlling by women's education. Different tempo effects may arise from the application of the birth histories and the KO method for three levels of women's education measured in years of study: low (0-3), mid (4-8), and high (9+). We will also apply the exercise for women divided by race -- mainly white and black categories. A good example of the sort of trade-off faced by a policy maker in the future is the paradox between promoting family planning to reduce teenage pregnancy, a classical

human right policy, with the possible negative outcome of creating a negative tempo effect in a situation that adjusted period fertility is already way below replacement.

Methods:

The basic idea of the methodology consists in the reconstruction of birth histories, based on the censuses' family structure. The data requirement from the censuses, conditioned on the allocation of children to their presumable mothers, is the following:

1. Relationship of children to the family head.
2. Sex of children.
3. Age (of mother and children).
4. Parity or number of children ever born.
5. Number of dead children.

A major data limitation prevalent in most demographic censuses in developing countries is the absence of information on birth order and age of dead children. Thus, some restrictions must be applied in order to reconstruct birth histories:

1. Use only women with no dead children (remove women with dead children).
2. Use information about family composition to allocate present children under the age of 15 to the women in the family of ages 15 to 59, keeping only women whose allocation is presumably correct (remove women whose children allocation is not possible).

Removing these women from the analysis could potentially lead to biased estimates. In order to correct for the selection process we use a two-stage Inverse Probability Weight (IPW) procedure. The two subsequent weigth corrections ensure "parity and age", and "temporal" representativity respectively:

To ensure representation by parity and age, we correct the original weight by the ratio between two matrixes: the matrix of sum of weight factors of women by parity and age in the original data, divided by the equivalent matrix for the derived data (the data containing only women with no dead children). The matrixes cells values are the sum of the weight factors, by age and parity, for the original sample and the selected sample, respectively.

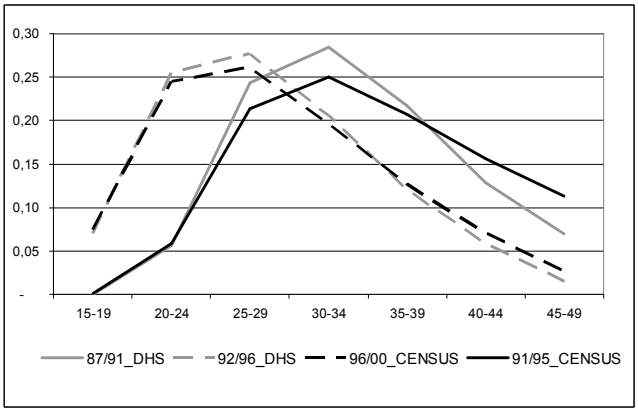
To ensure temporal representation, we control, within each parity and age category, for the probability of no dead children, based on the characteristics of the women (region of residence) and the children (sex, age and region of residence of each of the allocated children). These probabilities are based on external estimates, derived from life tables (in our case generated by Cedeplar). This correction is important since otherwise women with relatively young children, who would have lower probabilities of having any dead child, would be overrepresented. This would lead to inaccurate time trends.

The next step consists in the application of the Kohler & Ortega method. Based on the weighted birth histories, we obtain the parity and age distribution of women. For every year, we have the number of births by parity and age, and compute the birth intensities. Finally, the computed birth intensities are used to analyze fertility trends. The application of Kohler & Ortega decomposition leads to estimates of tempo, parity, and quantum effects of fertility.

Some results:

To check the methodology, we calculated the total fertility rate and the age specific fertility rates, based on the 1996 DHS and 2000 Census birth histories. Graphic 1 shows the relative age specific rates for 1987/1991 and 1992/1996, using DHS, and for 1991/1995 and 1996/2000, using Census data.

Figure 1: Brazil: relative age specific fertility rates, based on 1996 DHS and 2000 Demographic Census – 1987/1991, 1992/1996, 1991/1995 and 1996/2000



Fonts: BENFAM: Brazilian DHS, 1996
IBGE: Brazilian Demographic Census, 2000

The TFRs for the same periods are also consistent, and consist with the TFR traditionally calculated. Table 1 shows the results.

Table 1: Brazil: Birth Histories and Traditional Total Fertility Rates based on 1996 DHS, 1991 and 2000 Demographic Censuses

TFR					
Birth Histories				Traditional	
DHS	CENSUS	DHS	CENSUS	CENSUS	CENSUS
1987/1991	1991/1995	1992/1996	1996/2000	1991	2000
3,10	2,76	2,50	2,36	2,76	2,36

Fonts: BENFAM: Brazilian DHS, 1996
IBGE: Brazilian Demographic Census, 1991 and 2000

The TFR is approaching replacement level, but the adjusted TFR is well below replacement level, confirming that the tempo effect in Brazil operates the opposite way as the one observed in below replacement European countries.

Table 2: Brazil: Total Fertility Rate and Adjusted Total Fertility Rate based on 2000 Demographic Censuses

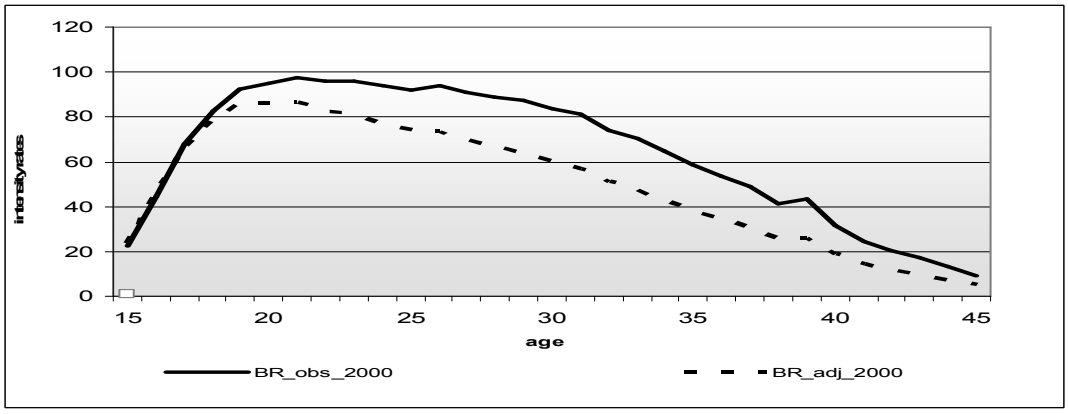
Measure	Parities						
	0	1	2	3	4	5+	Total
TFR	0,828	0,623	0,348	0,161	0,087	0,171	2,217
Adjusted TFR	0,705	0,233	0,108	0,073	0,053	0,121	1,294
Mean Tempo Effect (%)	14,76	62,58	68,82	54,46	38,56	29,47	41,63

Figure 2, presented in the next page, clearly confirm the negative adjustment due to the tempo effect, as portrayed in Table 2 above.

Concluding Remarks:

The Brazilian case may be considered a different paradigm with the combination of a fertility decline without the traditional tempo effect -- associated with postponement. To the extent that this European pattern is linked to some sort of second demographic transition and/or high women's education, one may foresee a pattern of low fertility in Brazil that could imply strong negative externalities.

Figure 2: Brazil, 2000: Observed and Adjusted Intensities for Parity 0



Fonts: BENFAM: Brazilian DHS, 1996

IBGE: Brazilian Demographic Census, 2000

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