Fertility Decline in Brazil: Tempo, Quantum and Parity Composition Effects

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I – Introduction

In the first decade of this century, Brazil entered into the group of countries that had below replacement fertility. This occurred about 40 years after the onset of fertility transition in the country. The transition process began in the late 1960s, when the total fertility rate (TFR) was 5.8 children per woman. This transition accelerated during the 1980s, reaching an average of 2.4 children per woman by the end of the century. Data from the National Household Sample Survey (PNAD) of 2006 showed that the TFR in the country had reached two children per woman. The following PNAD confirmed this trend and, according to the 2010 Demographic Census, the TFR in Brazil was 1.9. The fertility decline in Brazil was accompanied by a fall in the mean age of childbearing (MAC), suggesting a rejuvenation of the fertility schedule. The PNAD of the second half of the 2000s and the 2010 Demographic Census both indicated that there was a reversal in this trend towards a rising MAC.

Due to low quality birth registration and the absence of good birth histories, most fertility studies applied to Brazil focus in the analysis of traditional measures (e.g, total and age specific fertility rates, mean age at childbearing). These indicators are sensitive to changes in the timing of childbearing.

While in the past, demographers in developing countries were concerned with high population growth and the demographic transition, nowadays, preoccupations with low fertility and trends towards below replacement fertility are starting to become the important issues. This shift demands new fertility indicators less sensitive to changes in the timing of childbearing.

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These new fertility measures required the availability of good data sets. The simplest way to measure them is using birth registrations, where birth histories can be built. In most developing countries contexts – including Brazil– birth registrations are imprecise or incomplete, what hinders the estimate. For developing countries the fertility measurement is conditioned to the availability of household surveys and the kind of information available, their periodicity, and their statistical representation. Demographic censuses and other household surveys have fertility related information, but birth histories are only available in household surveys such as DHS. New fertility measures calculated using DHS[3] surveys are not robust due to sample size limitations in these data sets. Thus, the main challenge for studies in developing countries is to find useful ways to construct birth histories from demographic censuses data due to their large sample sizes. The challenge is to develop methodologies for creating birth histories from this type of source.

The Own-Children Method (OCM) was the first one to explore the household/ family relationships, allowing the determination of a 15 year series of TFR, ASTFR and mean age of childbearing. The method allowed the construction of a time series of fertility indicators, but it was a macro level method generating aggregate indicators rather than individual birth histories.

Two methodologies (Luther & Cho, 1986; Miranda-Ribeiro & Rios-Neto, 2006) were developed more recently to generate birth histories reconstruction at the micro (household) level. These methodologies were inspired on the old own child method (OCM) principle, but with micro level imputation algorithms to complete the incomplete birth histories[4]. The alternative fertility indicators series can be calculated after a birth history is constructed.

The main purpose of this work is to analyze recent fertility trends in Brazil with focus in aspects not explicitly accounted by traditional indicators. This focus aims to identify the role of tempo and quantum effects in the context of the fertility transition. The fertility indicators stressed in the analysis are the ones that correct distortions caused

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[3] Demographic and Health Surveys.

[4] The references mentioned in this paragraph give a complete description of the methods.

by tempo and parity composition effects. The series of TFR, PATFR, $PATFR_{ADJUSTED}$ (K-O) and PADTFR are presented[5].

This paper updates a methodology to build birth histories already calculated to the 2000 Brazilian Demographic Censuses. The Brazilian series covers the 1986-2000 (2000 Census) and 1996-2010 (2010 Census).

II – Methodology: Birth Histories

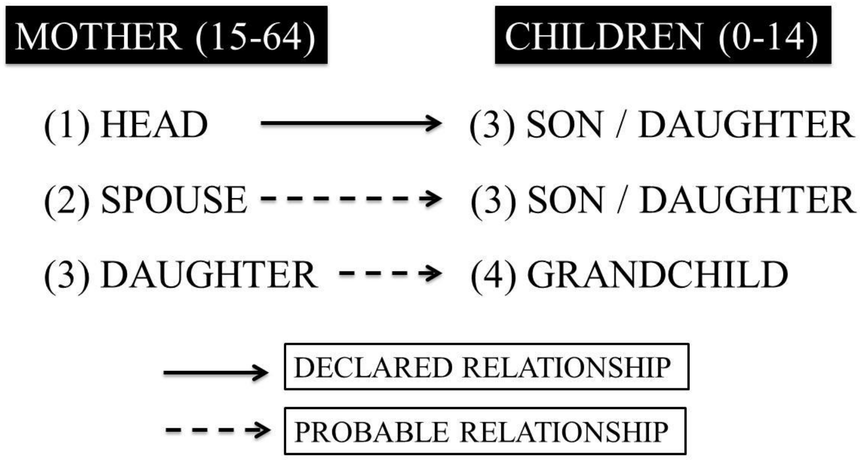
The method of birth histories' reconstruction is based on the allocation of children to mothers. This procedure is necessary when the census does not contain a variable that identifies the mother in the household. When such a variable exists, the allocation is direct. In its absence, the allocation is done by data manipulation, taking into account the relationship of each resident to the household or family head. Of the last five editions of the Brazilian demographic censuses, two contain the identification of the mother (1991, 2010) and the other three contain a variable allows the creation of an algorithm for the allocation.

The adopted procedure for allocation of children to mothers and subsequent checking of the results may be different among censuses due to differences in available variables. The basic variables used in allocation and testing are: age, sex, relation to head of household, total number of live births, total number of children alive at the time of the survey, and age of last live-born child. The basis of procedures for establishing the mother/child relationship is illustrated in Diagram 1.

[5] A formal definition of these indicators will be provided below.

Diagram 1

Possibilities to identify the mother/child relationship within a family, based on 'relationship to household/family head'



Own elaboration

Maternity is certain when the mother is the head of the family/household (1). When a woman is the spouse/companion of the head of family/household (2) or daughter of the head of family/household (3), then maternal relations are likely. In these cases, the likely sons and daughters are: child of head of household (4) and grandchild of head of household (5). While evidence leads one to believe that, in the majority of cases, a mother-child relationship exists between individuals in those categories, it is not an absolute certainty. In an attempt to minimize potential errors, consistency checks are made taking into consideration the ages of the children and the women, in addition to some characteristics of the reproductive history of the women.

Checks must guarantee that: (i) ages of mother and children are compatible (to the age at the beginning of the reproductive period and to the age of last born child); (ii) the number of allocated children is compatible to the number of children ever born and the number of surviving children.

A birth history can be understood as a history of fertility of a woman during a period in the past. Birth histories rely on a set of data collected in a single survey. These histories allows the allocation of births at the specific reference period of the survey. The information about the birth year of the children and the age of the women at the time of the survey allows for the calculation of the age of the women at the time of birth of each child, therefore entailing the estimation of fertility for periods prior to the survey. In addition, it is possible to determine the parity of the women in each year and the birth intervals, thus estimating measures of risk and those that take into account time between events.

In the Brazilian case, the leading survey at the national level with birth history of surveyed women is the Demographic Health Survey (DHS). The greatest difficulty in its utilization is the small sample size, which does not allow disaggregation by other variables. Another limitation is the small number of editions; there have only been three to date: one in 1986 for part of the country, and two nationally representative surveys in 1996 and 2006.

The advantages of using a birth history built from the manipulation of the data provided by the demographic censuses are listed below: (i) the large sample size – that allows disaggregation by region and by socioeconomic and demographic characteristics; (ii) the accuracy of the data – that guarantees the robustness for the results; and (iii) the number of editions in which the methodologies may be applied – which enables the creation of a long and continuous time series.

The birth histories reconstruction methodology based on the matching process aims to complete the birth histories of women between 15 and 64 years old, for the fifteen years prior to the census or survey used. In general terms, the process consists of looking for, in the complete birth histories, which family most closely resembles an incomplete birth history, based on comparison of several variables. The complete birth history that has the strongest relationship to the incomplete birth history determines the variables that will be imputed to complete the incomplete birth history. Only the ages of the omitted children are imputed.

In order to construct birth histories, it is necessary to apply the allocation procedure of children to mothers. After the allocation, the age of the child is transformed into a birth year and the database is restructured. Each line must contain the woman's selected variables and the information about her allocated children.

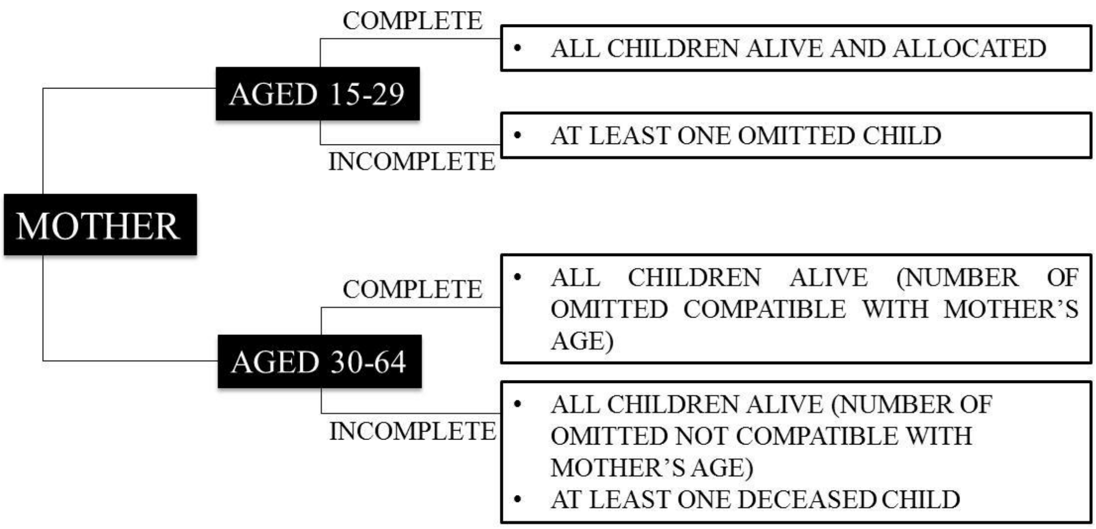
In determining the complete and incomplete birth histories, the women are classified in two age groups, from 15 to 29 years old and from 30 to 64 years old. We assume that the majority of children live with their mother until age 14. This assumption is important in defining the complete and incomplete birth histories of the two groups.

Supposing that the reproductive period begins at age 15, the women in the first group could potentially have children up to 14 years old. Thus, the birth histories of these women are complete if all the children are alive and allocated. On the other hand, the birth histories are incomplete if the number of allocated children is less than the number of live births. This condition includes women who have at least one deceased child and women whose children are all alive, but for whom it was not possible to complete the allocation.

For women in the age group 30-64, the definition of complete birth histories is different because they potentially have children older than 15 years old and, according to the assumption, have children that may live in another household. The first condition for having a complete birth history is that all the children are alive at the time of the survey. The second condition is that the total number of omitted children is compatible with the woman's age. Again, assuming that the reproductive period begins at 15 years old, a woman of 30, for example, may have only one omitted child, and this child must be older than 15; a woman of 31 could have two omitted children, one 15 years old and another 16 years old, and so on. Multiple births are disregarded. If the number of omitted children is greater, the birth history of the woman is considered incomplete. Another situation in which the birth history is considered incomplete is when the woman has at least one deceased child. Diagram 2 illustrates that possibility.

Diagram 2

Criteria for determining complete and incomplete birth histories



Own elaboration

The database of incomplete birth histories is increased by the women who have had at least one live birth while at the same time it was not possible to allocate any children for many reasons. Because the kinship relations to the head of household do not allow for it, or because the mother and child do not reside in the same household, also because the variable 'age of last live-born child' was unable to be determined.

Record linkage can be understood as a process of comparing two or more registries in order to determine if they refer to the same entity. In general, the process is performed in order to obtain a single, complete database, combining the existing partial information in each original file (Fellegi and Sunter, 1969). The first record in literature was presented by Halbert L. Dunn (1946) in which the author describes the importance of the linking record in assembling databases of vital statistics (Machado 2002, 2004). Newcombe et al. (1959) describe the problem of automatic linkage of registries and use, for the first time, the method of probabilistic matching. The work of Newcombe and Kennedy (1962) was motivated by an interest in biomedical and genetic research. Fellegi and Sunter (1969) further developed theoretic studies, producing an extensive bibliography on record linkage, introducing the mathematical and statistical foundation for *probabilistic record linkage*, which is still used today (Sousa et al. 2008).

There are two strategies for relating the data: the deterministic strategy and the probabilistic strategy. The deterministic strategy links pairs of registries in the database using a single, reliable identifier (such as a personal identification code). The probabilistic strategy is suggested for cases where there is not a single, reliable identifier, and as a result, must use probabilities to determine whether a pair of registries refers to the same individual (Machado 2002, 2004).

In the database of complete and incomplete birth registries, each line represents a woman and contains the selected census variables, in addition to variables constructed using the age and sex of allocated children. The pair formed by registries contained in the archives of complete and incomplete histories does not refer to the birth history of the same woman, but rather to women with similar reproductive characteristics.

The comparison is processed by the use of a *linkage software.* This study uses the free software RecLink II (Camargo Jr. and Coeli, 2000). The software was developed in C++ language with the Borland C++ Builder, version 3.0 programming environment

(*Borland International Inc., 1998; Reisdorph, 1998).* This software represents a database relationship system based on the technique of probabilistic record linkage according to the theory of Fellegi and Sunter (1969).

In order to complete the matching process, this study chose to use basic demographic variables and reproduction variables, in addition to place of residence, seeking a non-biased procedure in relation to socio-economic characteristics. The described procedure is based on the application done for the 2000 Demographic Census, but does not differ significantly from what was observed in other censuses.

In order to facilitate the description, the files used for comparison are named 'complete birth histories and incomplete birth histories' and the file created by the matching procedure is called 'imputed birth histories'.

The variables contained in the databases for matching are: (1) state of residence, (2) age of the woman, (3) number of living children, (4) age of last live-born child, (5) number of stillborn children, (6 to 20) 15 dummies indicative of childbirth, (21 to 35) 15 dummies indicative of sex of the child (in the case of multiple births, the sex variable corresponds to the sum of the values). For the 1991 Demographic Census, it is possible to discriminate the variable (5) by sex and add the variable 'children that live in other household', broken down by sex, for a total of 34 variables of comparison.

The first four variables (1 to 4) are used to organize the women in blocs and are designated 'blocking variables'. This ensures that pairs will be made up of women that live in the same state, have the same age, the same number of live-born children, and had their last child in the same year. The rest of the variables (5 to 35) are used to make comparisons between each incomplete birth history and all the complete birth histories of the same bloc and are called 'matching variables'.

The probabilities *mi* and *ui* were determined to ensure: (i) a positive score for the pairs that had at least half of the fields exactly equal; (ii) that the weighting factor had the same absolute value for successes and errors; (iii) that the weighting factor of the successes was positive. These conditions are satisfied when *mi* and *ui* are complementary and *mi* is greater than *ui*. In the event of an exact algorithm in which *mi* and *ui* assume the same values for all the variables, the value determined for the probabilities alters the final value of the scores, but does not change the relative classification of the pairs.

After the matching procedure, some situations were detected that were not previously imagined, for which specific procedures were adopted. The first situation occurs when the maximum weighted score repeats itself for various pairs of a single incomplete birth history, making it impossible to determine the ideal pair. In this case, a random selection is made, considering all the pairs with the maximum score. The second situation occurs when the matching does not determine any pair for an incomplete birth history. This happens when the incomplete birth history is the only one in a bloc. The adopted solution is to submit the histories without a match to a new matching procedure, using a less restricted bloc, without the variable 'state of residence'. In the recurring event of not generating a match, the variable 'age of woman' is also removed. Even so, some incomplete birth histories were not matched. Those histories represent 0.02% of the birth histories in the country in 2000 and it was decided to include them incomplete in the final database.

The final database of birth histories consists of all the women surveyed from 15 to 64 years of age, in order that it is possible to calculate all the measures. Women without children, those who originally had complete birth histories, those who had their birth histories imputed, and those who did not have their birth histories imputed due to the lack of a match.

III – Methodology: Calculation of Quantum, Tempo, and Parity Composition Effects

III.1 – Kohler and Ortega Method (K-O)

The birth history data sets allow the application of Kohler & Ortega method for estimation of quantum, tempo, and parity composition effects of fertility. Based on birth histories, we obtain the parity and age distribution of women. For every year, we generate the number of births by parity and age, then, we compute the birth intensities. Finally, the computed birth intensities are used to analyze fertility trends using the alternative fertility indicators. The series of birth intensities – or rates of first kind – is defined as the number of births of order "i" divided by the number of women of parity "i-1". It allows the application of the Köhler and Ortega (K-O) method (Ortega & Köhler, 2002). It also allows the calculation of other fertility indicators based on birth probabilities and fertility tables. The analysis of measures derived from the K-O model and from fertility tables enables the study of the tempo, and parity composition effects. These effects distort the traditional period TFR observed.

Diagram 3

Köhler & Ortega method: application steps.

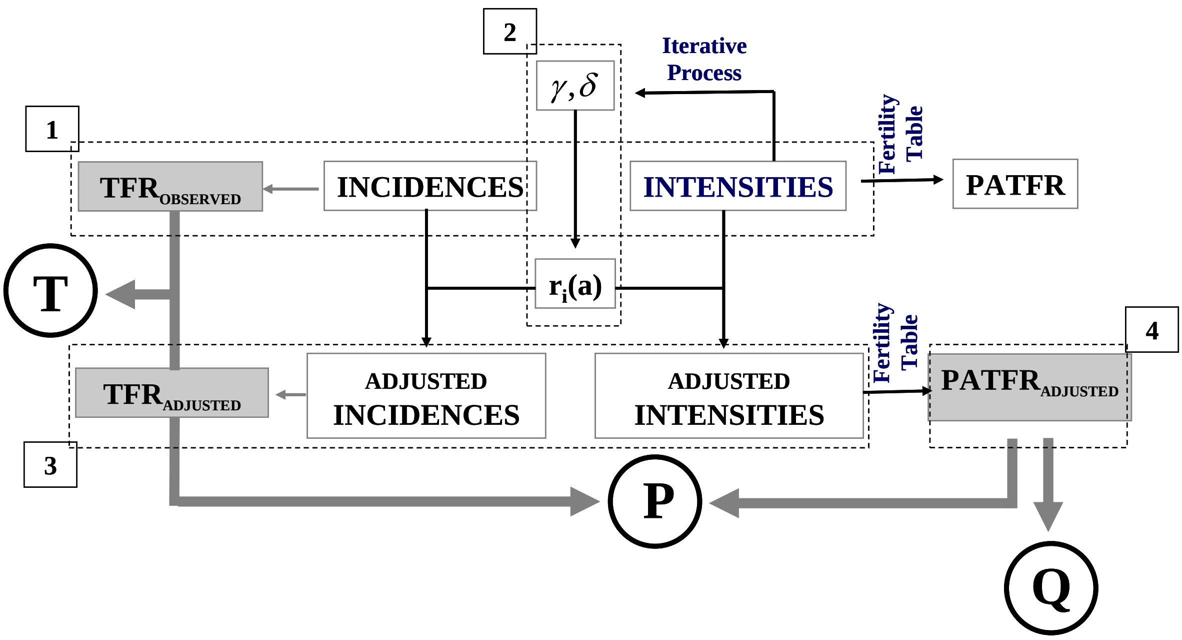


Diagram 1 presents the four steps of the K-O method application. Time is an implicit parameter of the method. The first step is the calculation of intensities and incidence rates by birth order. Using the incidence rates, the observed TFR can be calculated. The second step is the calculation of the parameters delta and gamma, using an iterative process defined by Köhler and Philipov (2001), it also includes the calculation of $r_i(a)$, the annual variation of the mean age of childbearing, controlled by birth order, "*i*", and age of mother, "*a*". The third step consists of using the $r_i(a)$ parameter in order to calculate the tempo adjusted incidence and intensity rates (by birth order). From the adjusted incidence rates, the adjusted TFR is then calculated. The fourth step consists of the calculation of the PATFR and $\text{PATFR}_{\text{ADJUSTED}}$, fertility tables, using the probabilities derived from intensities and tempo adjusted intensities, respectively, are used. A relation between observed and adjusted TFR determines the tempo effect; a relation between tempo adjusted TFR and tempo adjusted PATFR determines the parity composition effect; and the tempo adjusted PATFR is fertility´s pure quantum.

The formulas developed below are based on Ortega & Kohler (2002).

Birth intensities are defined as the number of births of order "i" divided by the number of women of parity "ï-1", as defined in (1):

$$m_c(a) = \frac{B_c(a)}{E_c(a)} \quad \textbf{(1)}$$

$B_c(a)$ are births of women aged a and class *c*.

$E_c(a)$ are women aged a and class *c* (parity "*ï-1*").

Incidence rates generate the age specific fertility rates:

$$f_c(a) = \frac{B_c(a)}{E\ (a)} \qquad \textbf{(2)}$$

$B_c(a)$ are births of women aged *a* and class *c* and $E\ (a)$ are women aged *a*.

The tempo effect $r_j(a)$ of parity "*j*" at age *a* is:

$$r_j(a) = \gamma_j + \delta_j(a - \overline{a}_j) \qquad \textbf{(3)}$$

Where γ_j and δ_j are the parameters gamma and delta, calculated iteratively following Köhler e Philipov (2001). Gamma is the annual change in the mean age at childbearing, while delta is the proportional change in the standard deviation and $\bar{a}_j$ é the mean age at the adjusted fertility function. The adjusted functions follow the two formulas below.

For intensities:

$$m_j'(a) = \frac{m_j(a)}{1 - r_j(a)} \qquad \textbf{(4)}$$

For incidences:

$$f_j'(a) = \frac{f_j(a)}{1 - r_j(a)} \qquad \textbf{(5)}$$

TFR e TFR_C (class c) are calculated by the formulas below:

$$TFR_C = \sum_a f_c(a) \qquad \textbf{(6)}$$

$$TFR = \sum_c TFRc = \sum_a f(a) \quad \textbf{(7)}$$

The adjusted TFR is calculated If the tempo adjusted incidence rates are used instead of the incidence rates in (6) and (7),. These adjusted measures are free from tempo effect.

The next step is to determine an indicator not affected by the parity composition fluctuations. This is a synthetic measure derived from fertility tables. In order to construct a fertility table it is necessary to calculate birth probabilities at age *a* and birth order i. Köhler & Ortega suggest the use of birth intensities because parity progression is a non renewable event. Birth intensity rates are transformed into probabilities in (8) and they become adjusted probabilities if one uses the adjusted birth intensities.

Thus the age and parity specific probability of birth is:

$$q_j(a) = 1 - \exp[-m_j(a)] \qquad \textbf{(8)}$$

The birth probabilities are the basis for the calculation of other measures in the table.

$$b_j(a) = D_j(a).q_j(a) \qquad \textbf{(9)},$$

Where $D_j(a)$ is the number of women of parity *j* and exact age *a* and $b_j(a)$ is the number of births of parity *j* to the women at age *a*.

An iterative procedure using formulas (9) and (10) allows the calculation of the number of women and births.

$$D_j(a+1) = D_j(a) - b_j(a) + b_{j-1}(a) \qquad \textbf{(10)}$$

When the last parity is parity *J*[6] then the two interactive formulas are:

$$b_J(a) = D_j(a) f_J(a) \qquad \textbf{(11)}$$

$$D_J(a+1) = D_J(a) + b_{J-1}(a) \qquad \textbf{(12)}$$

N is the number of women at the initial condition of the table (radix), that is to say the number of women at age "α" and parity "j=0". The number of women is null at the exact age "α" and parity "j>0"..

The mean number of births for women in the synthetic cohort is defined by (13).

$$b_{j1,j2}(a_0, a_1) = \sum_{a=a0}^{a1} \sum_{j=j1}^{j2} b_j(a) \qquad \textbf{(13)}$$

The completed fertility in the fertility table is given by identity (14). Rally and Toulemon (1993) call it Parity and Age Total Fertility Rate (PATFR) as in.

$$PATFR = b_{0,J}(\alpha, \omega) / N = b_{0,J}(\alpha) / N \qquad \textbf{(14)}$$

When PATFR is built based on tempo-adjusted intensities, it is a measure free from both tempo and parity compositional effects. This is called $\text{PATFR}_{\text{ADJUSTED}}$. The $\text{PATFR}_{\text{ADJUSTED}}$ is defined by Ortega and Köhler (2002) as the pure quantum measure, that is to say, the TFR that would be observed in the absence of tempo and parity composition effects.

Once the free tempo and parity compositional indicators are calculated, it is possible to calculate the measurement of tempo and parity effects.

Ortega and Köhler (2002) suggest identity (15) to estimate the tempo effect, *r*:

[6] Including parities *J* and above

$$r = 1 - \frac{TFR_{OBSERVED}}{TFT_{ADJUSTED}} \quad \textbf{(15)}$$

If r is positive, then the adjusted TFR is higher than the observed TFR. A positive tempo effect indicates that the fluctuations in the mean age at childbearing are diminishing the observed TFR and that women are delaying births. On the contrary, a negative tempo effect indicates an anticipation of births and that the fluctuations in the mean age at childbearing are inflating the observed TFR.

The measurement of parity composition effect is calculated similarly to the tempo effect. The inverted sign in identity (16) indicates that the parity composition effect is positive when it inflates the observed fertility (the opposite of tempo effects). .

$$d = \frac{TFR_{ADJUSTED}}{PATFR_{ADJUSTED}} - 1 \qquad \textbf{(16)}$$

When r and d are measured in terms of percentage, then they are interpreted as the missing or extra births generated by the tempo and parity composition effects respectively.

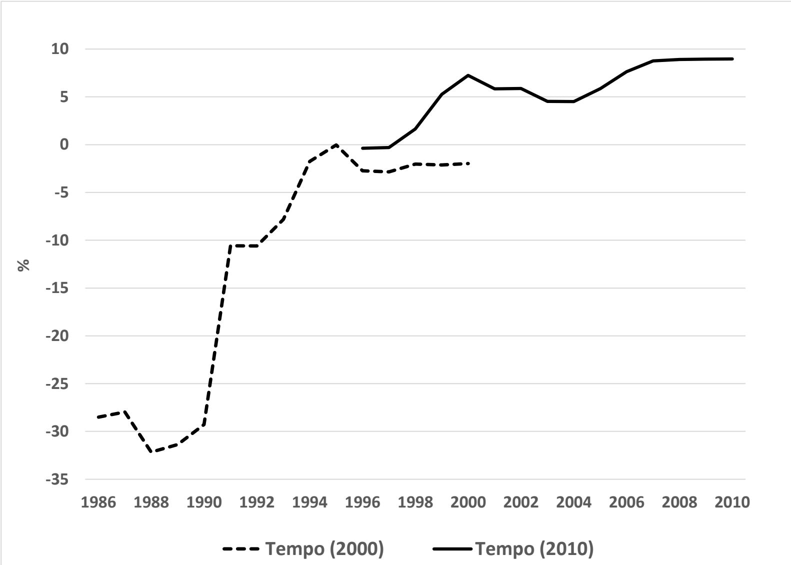
IV – Preliminary Results

Figures 1 to 4 depict the application of the K-O model to the 2000 and 2010 Brazilian Demographic Censuses.

The methodology reconstructs birth histories for a 15 years period, but some detected fluctuations in the intensity rates at the beginning of the series lead us to apply only a 10 year period in the application of K-O method. The year before the Census in the 2000 and 2010 Brazilian Census are, respectively, years 2000 and 2010. The series covers the 1986-2000 (2000 Census) and the 1996-2010 (2010 Census) periods.

Based on the application of the K-O model, we can say that during the analyzed period, Brazil moved from a context of negative tempo effect to one of positive. In other words, the observed TFRs were inflated in the beginning of the period due to the anticipation of births until the end of the 1990's, while these TFRs were deflated in the beginning of this century. The parity composition effect was positive during all period, reinforcing the negative tempo effect in the first part, and opposing the positive tempo effect in the second.

Figure 1 - Brazil, 1986 to 2010: *tempo* effect.



Sources: IBGE – 2000 and 2010 Brazilian Censuses.

Following Figure 1, we can see that the Brazilian tempo effect is negative during during the 1990's, approaching zero in the end of this decade. The tempo effect becomes positive, between 5% and 10% during the first decade of this century. Over the whole period, the tempo effect goes from a 20% inflation of TFR in the early 1990s to a 10% deflation in late 2000's.

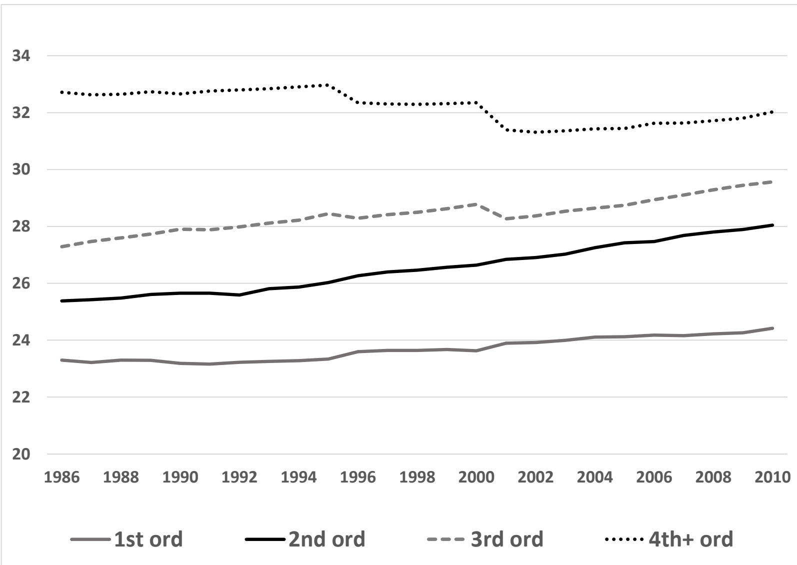
Figure 2 – Brazil, 1986 to 2010: parity composition effect (%).

Sources: IBGE – 2000 and 2010 Brazilian Censuses.

Figure 2 displays the parity composition effect for Brazil. The effect is positive in both decades, but the second half of each decade presents a lower positive effect. This positive parity composition effect goes in the same direction of the negative tempo effect during the 1990s, that is to say, tempo and parity composition effects favor a TFR that is higher than the pure quantum fertility. During the 2000's the tempo and the parity composition effects become positive, that is to say the tempo effect favor a TFR lower than the pure quantum fertility, while the parity composition effect still favors a higher TFR.

In Figure 3 we observe the mean age at childbearing for four birth orders in line with the calculation of PATFR. This measure is free from the parity composition effect, something that does not happen when mean ages are calculates from TFR. Thus, the fluctuations in the mean ages are only due to the tempo effect The mean age at childbearing for the first birth order between 1990 and 2010 slightly increases from 23 to above 24. The mean age at childbearing for the second birth order presents a more pronounced rise. Between 1990 and 2010, it rises from below 26 to 28. Around the same trend as in the previous case is observed for the mean age at childbearing for the third birth order. The mean age at childbearing for fourth birth order or higher slightly declines during the period.

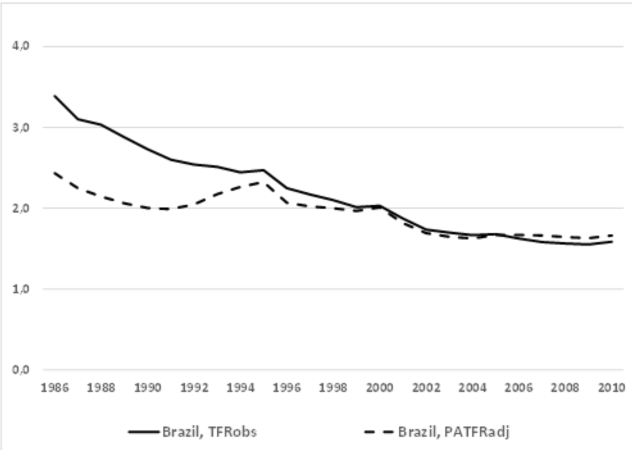
Figure 3 – Brazil, 1986 to 2010: mean age at childbearing (from PATFR), according to birth order.



Sources: IBGE – 2000 and 2010 Brazilian Censuses.

The distortions caused by tempo and parity composition effects on TFR can be evaluated by the comparison between observed TFR and $PATFR_{ADJUSTED}$. The $PATFR_{ADJUSTED}$ is the value of TFR when no changes in the mean age at childbearing and in the parity composition are observed. Figures 4 shows the TFR and $PATFR_{ADJUSTED}$ series for Brazil. We can see that the difference between TFR and $PATFR_{ADJUSTED}$ diminishes over time, at the same that the both TFR and the pure index (quantum) reach replacement level. This convergence between the two measures is due to the decline of both tempo and parity composition effects. There had been no tempo and parity composition effects, the fertility level in Brazil would be below 2.5 since 1987. Around 2000 there was no difference between the indicators with fertility close to 2, later fertility further declined to around 1.7, remaining at this level until the end of the decade. Towards 2010, quantum fertility was well below replacement and tempo fertility was on the rise. Observed and adjusted fertility were close because the parity composition effect played a compensational role. If the tempo effect continues on the rise and the parity composition effect declines, then the observed TFR may decline to very low levels, perhaps around 1.5.

Figure 4 - Brazil, 1986 to 2010: observed TFR and adjusted PATFR.



Sources: IBGE – 2000 and 2010 Brazilian Censuses.

V – Final Remarks

This paper provided the analysis of the recent fertility trends in Brazil, going below replacement level, while it identified the role of tempo and parity composition effects in order to estimate both pure quantum fertility and observed total fertility rate. The increasing tempo effect moving from a strong negative tempo effect to a positive tempo effect may suggest that observed total fertility rate will continue to decline between 2010 and 2030. This suggests an important scenario for the elaboration of future population projections.

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Appendix

Table 1 - Brazil, 1986 to 2010: tempo effect according to 2000 and 2010 Demographic Censuses.

Year	*Tempo (from 2000 Census) %*	*Year*	*Tempo (from 2010 Census) %*
1986	-28,5	**1996**	-0,4
1987	-28,0	**1997**	-0,3
1988	-32,2	**1998**	1,6
1989	-31,4	**1999**	5,3
1990	-29,3	**2000**	7,2
1991	-10,6	**2001**	5,8
1992	-10,6	**2002**	5,9
1993	-7,8	**2003**	4,5
1994	-1,8	**2004**	4,5
1995	0,0	**2005**	5,9
1996	-2,7	**2006**	7,6
1997	-2,8	**2007**	8,8
1998	-2,0	**2008**	8,9
1999	-2,1	**2009**	8,9
2000	-2,0	**2010**	9,0

Sources: IBGE – 2000 and 2010 Brazilian Censuses.

Table 2 - Brazil, 1986 to 2010: parity composition effect according to 2000 and 2010 Demographic Censuses.

Year	*Parity Composition Effect (from 2000 Census) %*	*Year*	*Parity Composition Effect (from 2010 Census) %*
1986	7,6	***1996***	10,1
1987	6,8	***1997***	9,6
1988	5,9	***1998***	10,0
1989	5,1	***1999***	9,4
1990	4,3	***2000***	10,4
1991	7,5	***2001***	9,5
1992	7,6	***2002***	9,0
1993	8,0	***2003***	8,0
1994	8,5	***2004***	7,3
1995	7,8	***2005***	6,9
1996	5,9	***2006***	5,4
1997	4,5	***2007***	4,3
1998	3,5	***2008***	4,4
1999	3,5	***2009***	4,6
2000	3,0	***2010***	4,7

Sources: IBGE – 2000 and 2010 Brazilian Censuses.

Table 3 - Brazil, 1986 to 2010: mean age at childbearing (from PATFR).

Year	*Mean age at childbearing*			
	1st birth order	*2nd birth order*	*3rd birth order*	*4th birth order*
1986	23,3	*25,4*	27,3	32,7
1987	23,2	*25,4*	27,5	32,6
1988	23,3	*25,5*	27,6	32,6
1989	23,3	*25,6*	27,7	32,7
1990	23,2	*25,6*	27,9	32,7
1991	23,2	*25,6*	27,9	32,8
1992	23,2	*25,6*	28,0	32,8
1993	23,3	*25,8*	28,1	32,8
1994	23,3	*25,9*	28,2	32,9
1995	23,3	*26,0*	28,4	33,0
1996	23,6	*26,3*	28,3	32,3
1997	23,6	*26,4*	28,4	32,3
1998	23,6	*26,5*	28,5	32,3
1999	23,7	*26,6*	28,6	32,3
2000	23,6	*26,6*	28,8	32,3
2001	23,9	*26,8*	28,3	31,4
2002	23,9	*26,9*	28,4	31,3
2003	24,0	*27,0*	28,5	31,4
2004	24,1	*27,3*	28,6	31,4
2005	24,1	*27,4*	28,7	31,4
2006	24,2	*27,5*	28,9	31,6
2007	24,2	*27,7*	29,1	31,6
2008	24,2	*27,8*	29,3	31,7
2009	24,3	*27,9*	29,4	31,8
2010	24,4	*28,0*	29,6	32,0

Sources: IBGE – 2000 and 2010 Brazilian Censuses.

Table 4 - Brazil, 1986 to 2010: PATFR and PATFRadj

Year	*Parity and Age Total Fertility Rate (PATFR)*	*Adjusted Parity and Age Total Fertility Rate (PATFRadj)*
1986	3,12	*2,43*
1987	2,85	*2,25*
1988	2,78	*2,14*
1989	2,65	*2,06*
1990	2,52	*2,00*
1991	2,41	*1,99*
1992	2,36	*2,05*
1993	2,35	*2,17*
1994	2,30	*2,26*
1995	2,35	*2,32*
1996	2,09	*2,07*
1997	2,04	*2,02*
1998	1,99	*2,00*
1999	1,92	*1,97*
2000	1,94	*2,01*
2001	1,73	*1,82*
2002	1,61	*1,69*
2003	1,59	*1,65*
2004	1,58	*1,63*
2005	1,59	*1,67*
2006	1,56	*1,67*
2007	1,53	*1,66*
2008	1,52	*1,64*
2009	1,51	*1,63*
2010	1,54	*1,66*

Sources: IBGE – 2000 and 2010 Brazilian Censuses.