Title: Fertility transition in Brazil: a cohort analysis of anticipation, postponement and recuperation

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Introduction

In Europe, the cohorts born after the Second World War changed considerably its reproductive pattern, postponing their motherhood to advanced ages of the reproductive span (Sobotka et al., 2011). Currently, this trend has been studied through notions of postponement – decline in fertility at younger ages – and subsequent recovery or compensatory increase in fertility at older ages (Goldstein et al. 2009; Sobotka et al., 2011). Due to this postponement process, the fertility age structure in Western Europe became aged, since women started investing in education and in their professional careers and only later they decide about motherhood (Lesthaeghe, 2001; Bongaarts, 2002; Sobotka et al. 2009). In despite of fertility delay, many authors believe that recovering levels of fertility to replacement is possible. However, this will largely depend on the recovery ability of the cohorts at older ages of the reproductive span, and policies adopted by the countries where fertility is below replacement level (McDonald, 2000; Lesthaeghe, 2001; Billari and Kohler, 2002; Billari, and Liebroer Philipov, 2006; Kohler, Billari and Ortega, 2006; Goldstein, 2006, Neyer, 2006).

Like Europe, the Brazilian fertility transition has been well documented in numerous studies (Perpetual and Aguirre, 1998; cited Merrick and Berquó 1983; Carvalho Paiva and Sawyer 1981; Paiva 1987; Faria 1989; Alves 1994; Potter, 1994). All these studies showed that this fertility decline was the result of the interaction of a complex set of transformations of economic, social and institutional order.

The first the main component of the decline would have been the reduction of marital fertility and the increase of fertility control inside the marriage. According to Merrick and Berquó (1983), the marital fertility decline happened due to widespread fertility control in poor regions of the country and within low socioeconomic groups. These groups have experienced many socioeconomic changes, such as increased education, ownership of consumer durables and participation of women in the labor market, which would have promoted norms favorable to smaller family sizes. Faria (1989) emphasizes the institutional changes. According to him, a set of government policies has generated great cultural shifts that have widespread across the country, developing the demand for fertility control. Faria (1989) argues that the government policies such as promoting consumer credit, development of telecommunications, unification social security and health care systems resulted in many unanticipated behaviors, like: strengthening of *economic calculus* as standard guidance in defining the number of children; increase population exposure to medical culture; disconnecting – in terms of values and norms – the sexual activity from the reproductive activity and replace the social responsibility of provide health and pension, from the family to the Federal State.

As result, all these changes forced, in a small period of time, the national fertility to strongly decline from 6.3 TFR in 1960 to close to replacement level in 2000. According to the IBGE (2010), the recent level of fertility in the country declined from a value slightly above replacement in 2000 (TFR 2.3) to a TFR of 1.9 in 2010. Based on DHS (2006), between 2006-2002, with the exception of Northern urban, all major urban areas of the country present fertility below replacement level. Furthermore, in Brazil, unlike the European reproductive behavior, we

find an early fertility behavior. In other words, the fertility is very concentrated at young ages, with a high proportion of teenage mothers from low socioeconomic status, with the fertility mode located at the age group of 20 to 24 years old (Milk and Gupta, 2001; Berquó and Cavenaghi, 2005; Rios-Neto, 2005; Miranda and Potter, 2010). Moreover, according to Rios-Neto (2005), recent data-sets indicate a further pattern of fertility rejuvenation and concentration at young ages of reproductive span. In this context, this paper aims to study the future fertility prospects of Brazil major regions based on a cohort analysis. The cohort fertility analysis is preferable for many reasons. First, in contrast to period fertility trends, the measurement of the *quantum* and *tempo* changes in cohort fertility is straightforward (Ryder, 1951; Frejka and Calot 2001; Sobotka et al. May 2011). Second, the cohort approach does not need any recourse to statistical constructs such as a synthetic cohort, and consequently, it does not have to cope with the many problems related to it (Sobotka et al., 2011). Finally, each birth cohort can shift births to younger or older ages, its completed cohort fertility rate (CTFR), conventionally measured at age 50, gives an unbiased measure of the cohort fertility level. This kind of analysis deserves extremely attention in Brazil, where the period fertility does not present the same postponement pattern, as identified in many Western European countries; also because the country is now presenting TFR below replacement level.

Thus, we are planning to study Brazilian cohort fertility development based of two methods. First, we will apply the Basic Benchmark Model, developed by Frejka and Calot (200); Frejka and Sardon (2004), in order to analyze the past and present cohort developments. Second, we will apply the new method of Cohort Fertility Forecasts, implemented by Myrskylä et al. (2012), to study the future prospects of cohort fertility in Brazil.

Data and Methods

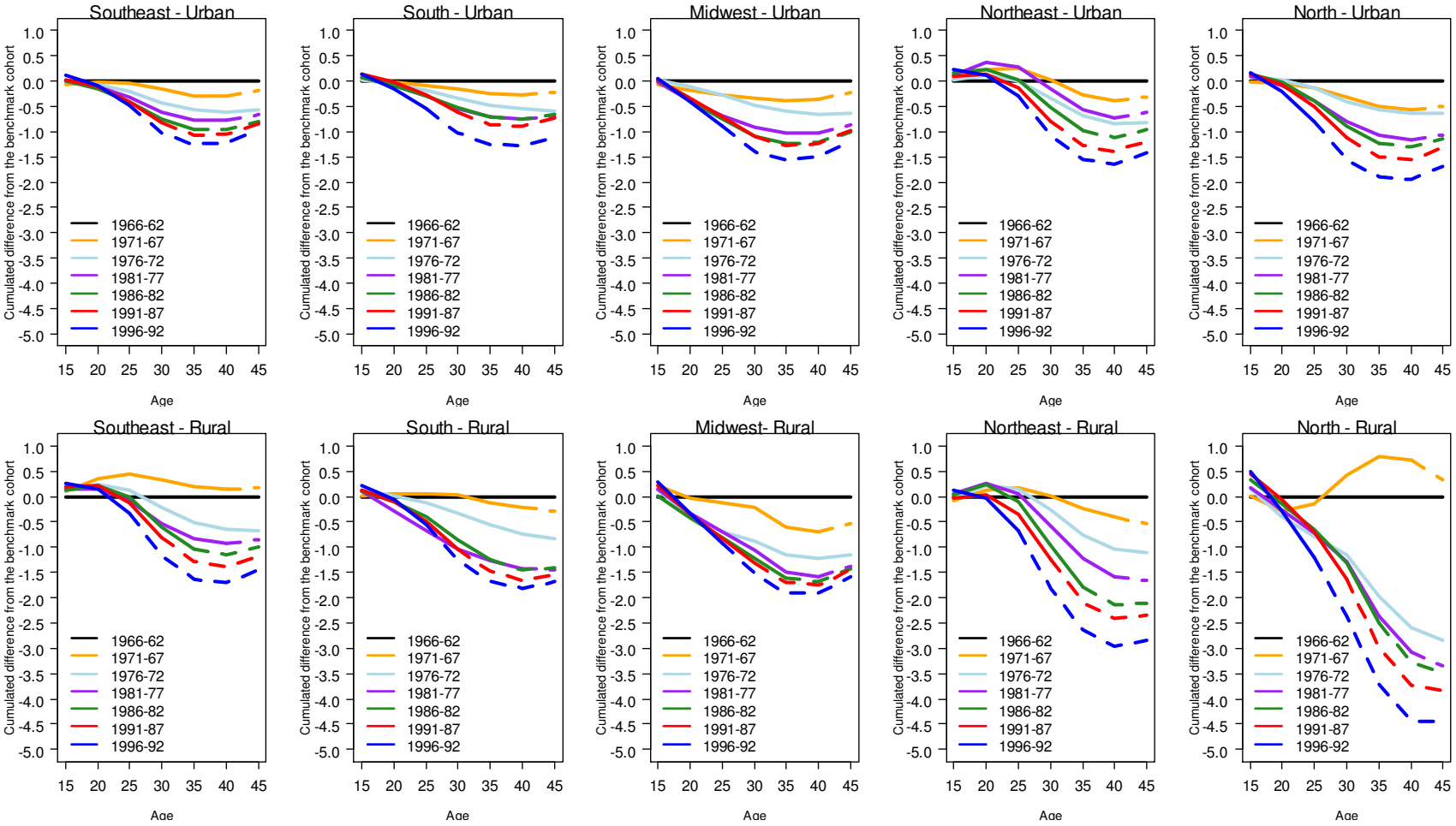
We make use of micro-census data from 1980, 1991, 2000 and 2010, in the five macro regions of the country, North, Northeast, South, Southeast and Midwest. Based on the census reproductive information, first we will re-construct the fertility history of the woman in each region, applying the so-called “own-children” analysis to recover information on the reproductive history of women. The next step is to apply a basic benchmark model used by Frejka and Calot 2001, Frejka and Sardon (2004), Bosveld (1996) and Lesthaeghe (2001). The method of benchmark cohort analyzes the reproductive behavior of cohorts in a context of postponement transition and recuperation. The postponement is measured by cumulating absolute or relative fertility declines across all ages when fertility has fallen, while recuperation is measured by cumulating absolute or relative fertility increases across all ages when fertility has increased relative to the reference cohort (Sobotka et al. 2011).

In order to study the future trends in fertility, we will apply the New Cohort Fertility Forecasts, developed by Myrskylä et al. (2012). The new method for forecasting completes the childbearing of cohorts that are still in their 30s and 40s. According to Myrskylä et al. (2012), the method is based on limited extrapolation of age-specific trends and allows the age-specific trend observed over the last 5 years to continue for another 5 years. The forecasting model is embedded in a more general family of forecasting models; allowing both a straightforward comparison to other models within the same family, and estimation of the forecast uncertainty.

Preliminary results

The following analyses are preliminary results of an analysis conducted by Lima (2012). Based on birth history information presented in DHS-surveys (1996, 2006), he re-constructs the reproductive history of cohorts and compares their evolutions relative to a reference cohort. The benchmark is the cohort of mothers who initiates their reproduction in 1966-1962. This is a good start period, because the trigger of fertility decline in Brazil was pulled in the mid-1960s (Carvalho, 1974; Carvalho & Wong, 1996).

Figure 1: Cohort Fertility analysis based on Basic Benchmark Model, benchmark cohort – 1966/1962



Source: DHS-2006 and DHS 1996. Estimate by the Lima (2012)

The figure 1 brings the results of the analysis. Note that, some cohorts (with part of dashed lines) in their 30s and 40s have not yet completed their fertility history. For these cohorts, Lima (2012) linearly forecast their complete childbearing in function of fertility levels below these ages.

Assuming that cumulative fertility of cohorts follows a sigmoid function, Lima (2012) applied an exponential transformation in the cumulative fertility of cohorts. After taking the anti-log of the regression coefficients, he estimates the complete fertility of these cohorts.

By comparing the cohort fertilities with benchmark cohort of 1966-62, it is observe that, with the exception of urban Midwest, the cumulative fertility of the cohorts has increased and concentrated at young ages of the reproductive span. This concentration is more pronounced in rural areas of the country and in the urban Northeast. Moreover, there is a considerable drop in the levels of cohort fertility until age 35 (especially in urban areas of South, Southeast and Midwest). After this age, we see slight signs of fertility recovery. However, in the rural areas of North and Northeast fertility decline is more pronounced than the other regions. In the case of the Northeast, much of this decline can be explained by the high levels of fertility concentrated at young age groups of low status socioeconomic. In the North, we can expect less reproductive recovery since these cohorts are still in the transition process. Another important point is the accentuated reduction of cohort fertility after mid-1960s, which is lower in the South and Southeast regions. One explanation is that these two more developed regions might have started their fertility transition prior the reference cohort.

Future research analysis

We expect to continue analyze these regional differences in cohort fertility, but this time using a large sample size, such as census. Working with census can improve our analysis since we can study fertility anticipation, postponement and recuperation according to selected social, economic and cultural variables commonly present in censuses. It is also expected to forecast the cohort fertility for these regions using the Cohort Fertility Forecast, developed by Myrskylä et al. (2012). In this way, we can not only replicate the above exercises, but also produce confidence intervals to the cohort fertility forecasts.