CARACTERIZAÇÃO DOS NÍVEIS DE FECUNDIDADE NO BRASIL, 1970–2010

CHARACTERIZATION OF FERTILITY LEVELS IN BRAZIL, 1970–2010

Ernesto F. L. Amaral[1], Mariana Eugenio Almeida[2], Guilherme Quaresma Gonçalves[3].

1. PhD in Sociology/Demography. Associate Sociologist at RAND Corporation.
2. M.A. in Public Administration. Analyst at the Ministry of Labor and Employment of Brazil.
3. M.A. in Political Science. PhD student in Demography at the Universidade Federal de Minas Gerais

▶ **MAILING INFORMATION:** Ernesto F. L. Amaral | 1776 Main Street, P.O. Box 2138 | Santa Monica, CA | 90407–2138, USA | Phone: 00xx1(310)393-0411 extension 6151 | Email: eamaral@rand.org

Acknowledgments: We would like to thank Adriane Reams for editing this paper.

Resumo

Analisamos os Censos Demográficos do Brasil de 1970, 1980, 1991, 2000 e 2010, com o objetivo de investigar os fatores associados com a mulher ter tido filho nascido vivo no ano anterior ao censo. Estimamos modelos de regressão logística para mulheres entre 10 e 49 anos. Como variáveis independentes, selecionamos região de residência, localidade rural/urbana, presença de eletricidade, cor/raça, religião, estado conjugal, participação no mercado de trabalho, tempo de residência no município, informação se a mulher teve um filho nascido morto, idade, educação e parturição. Os resultados confirmam que a probabilidade da mulher ter tido filho no último ano é maior nas regiões Norte e Nordeste, assim como em domicílios sem eletricidade. Mulheres que tiveram maior chance de ter tido um filho são pretas/pardas, católicas, casadas, não participantes no mercado de trabalho, migrantes no curto prazo, tiveram filho nascido morto, estão entre 20 e 29 anos de idade, possuem baixa escolaridade e possuem mais filhos. Os padrões têm mudado ao longo do tempo, levantando importantes questões para análises futuras.

PALAVRAS-CHAVE: declínio da fecundidade. programa de planejamento familiar. brasil.

Abstract

We analyze the 1970, 1980, 1991, 2000, and 2010 Brazilian Demographic Censuses, in order to investigate the associated factors with a woman having had a live birth during the year prior to each census. We estimated logistic regression models for women aged 10–49 years. As independent variables, we selected region of residence, rural/urban location, presence of electricity, color/race, religion, marital status, labor market participation, time of residence in the municipality, information about whether they had a stillbirth, age, education, and parity. Our findings confirm that the probability a woman had a child is higher in the North and Northeast regions, as well as in households without electricity. Women that have a greater chance of having had a child are black/brown, Catholic, married, non-labor market participants, short-term migrants, experienced a stillbirth, between 20–29 years of

age, have less education, and have higher parity. Patterns have been changing throughout time, thus posing questions for further analyses.

KEYWORDS: fertility decline. family planning program. brazil.

Introdução

Since the 1970s Brazil has been experiencing a significant reduction in fertility rates.[1] This decline caused a severe reduction in the population growth rate, as well as a change in the age structure of the country. The most significant structural variation occurred at the end of the 20th century.[2] According to the Brazilian Institute of Geography and Statistics (IBGE), the total fertility rate (TFR) fell from 6.28 children per woman in 1960 to 5.76 in 1970, 4.35 in 1980, 2.85 in 1991, 2.38 in 2000, and 1.90 in 2010.[3] In 1960, the TFRs were already below five children per woman during this period in the metropolitan regions of Rio de Janeiro, São Paulo, and Porto Alegre. The 1970 census pointed to a drop in the TFR across the country, indicating that Brazil had begun a consistent and accelerated decrease in fertility. The decline spread to the interior of the Southeast region and the capital cities of the Central-West, North, and Northeast regions. Finally, the downturn reached the interior and rural areas of all Brazilian regions in the 1980s. In 2000, a substantial number of locations at the municipal level still reflected TFRs above four children per woman. However, during this same period there were municipalities where fertility had fallen below replacement level. In 2010, the TFR in Brazil was 1.9 children per woman. The variation in the timing and speed of the fertility transition led to differences in the age distribution across states and municipalities, as well as across different points in time.[4, 5] The North and Northeast regions historically have had lower socioeconomic indicators, as well as the highest fertility rates across the country.

In this paper, we analyze the 1970, 1980, 1991, 2000, and 2010 Brazilian Demographic Census microdata, in order to characterize the level of fertility in the country based on the categories of several household and individual variables. The next section elaborates on the fertility decline experienced by the Brazilian society, as well as on the sociopolitical context that existed while this decline occurred, which was a period characterized by a lack of family planning programs. Following this discussion, we present our data and the methods utilized. This includes a detailed explanation of the selected independent variables and the hypotheses of their association with fertility. Our dependent variable indicates whether a woman had a child during the 12 months prior to each census. Section 4 addresses our results and presents a discussion about the descriptive statistics and logistic regression models.

2. Background

2.1. Fertility decline

The process of fertility decline is associated with several socioeconomic and developmental variables, such as urbanization, industrialization, decline of infant mortality, female labor force participation, education, and access to contraceptive methods.[6] However, the level and pace of fertility decline varies across different socioeconomic and cultural contexts.[7] In Brazil, demographers have made certain efforts in an attempt to understand the variables associated with fertility decline in the country, which is a phenomenon that was not expected by most scholars.[8] Fertility presents different levels by several socioeconomic, cultural, gender, religious, and institutional characteristics. Among socioeconomic factors, economic decisions of the working class is a motivation for the reduction in the number of children born per family, as well as the inclusion of women in the labor market.[9] Women in high-skilled occupations tend to have lower parity and postpone fertility.[10, 11]

The country also experienced an expansion in the use of contraceptives, especially among the rural population.[12] However, this would not have been a contributing factor to the drop in fertility rates, because the government has never been able to implement universally effective family planning programs. Therefore, a general assumption exists that suggests that fertility declined because of a change in the behavior of the low-income population. Two phenomena are related to this concept and have been instrumental in the decrease of fertility in Brazil. The first factor concerns the increase in female labor force participation. This resulted in a decrease in the number of children in the household, resulting in a lack of incentive for large families. The second phenomenon concerns an increase in the cost of food in relation to the price of manufactured goods since the 1970s. This reduced the standard of living for low-income families and made circumstances more difficult for maintaining large families.

Between 1991 and 2000, the downturn in fertility rates did not occur uniformly among different socioeconomic segments of the population. A more rapid decline was identified among groups that had the highest fertility levels in 1991.[13] These groups consist of the poorest and least educated population, who are black women from rural areas in the North and Northeast regions.

In relation to cultural factors, there are other hypotheses for the reasons of fertility decline in Brazil, such as: the decrease in marital fertility, the increase in family planning within marriage, the increase of fertility control among groups with low socioeconomic status, the improvement of educational attainment, the increase in the possession of durable consumer goods, and the growth of female labor force participation among the poorest groups.[14]

Brazilian families have been experiencing transformations in living arrangements, with the increase of mono-parental households (specially female-headed households), households headed by LGBT parents, extended households, and one-person households.[15] These changes are accompanied by the decline of family size and in the number of unions, as well as by the increase of single elderly individuals, families with single parents, and the number of divorces. Studies have been adopting a gender perspective to understand fertility transition in Brazil.[6] This perspective is not opposed to previous analyses. The intention is to contribute to explain the process of decline of family size, including topics as patriarchy, social and gender division of labor, status and autonomy of women, and segregation and discrimination in the labor market. Studies have been also pointing to the association among religion, fertility, abortion, and sexual behavior in Brazil.[16-21] Protestant women tend to have lower fertility levels in comparison to catholic women.[21] Women who self-declared being traditional protestants presented the lowest levels of fertility. Women with no religion presented higher levels of fertility than catholic women.

Institutional changes also had an impact on fertility rates through government actions, structural processes, and the transformation of cultural behaviors.[22] Cultural changes are due to the implementation of a set of government policies resulting from a demand for fertility regulations.[8] For instance, offering the population incentives like financial credit, telecommunication services, social welfare, and health care contributed to the decline of fertility. However, unanticipated consequences of these policies arose, which included an increase in a couple's economic reasons for having a certain number of children; exposure to medical services; the separation between sexual activity and reproductive activity; and the transfer of social responsibility from the family to the government. The expansion of mass communication impacted fertility decline, especially during the rapid growth in television access after the late 1960s.[23, 24]

The lack of government family planning programs transferred the responsibility of fertility regulation to the private sector.[22, 25] The absence of public initiatives had detrimental consequences on fertility differentials across socioeconomic groups. For example, the poorer population was the most

affected by this situation, reflecting increased fertility rates in relation to the population with better socioeconomic status.[26] Recent studies point to significant fertility differences among micro-regions and social groups in Brazil.[4] The most important variables for explaining fertility decline in the country include the improvement of educational attainment and the increase in the availability of electricity between 1960 and 1991. Results indicate a significant relationship between the drop in fertility and socioeconomic changes. In relation to the pace of fertility decline, the previous transitions (Southeast and South regions) were slower than the most recent transitions in other regions.[5]

The increase in access to modern contraceptive methods had a measurable impact on the drop in fertility rates.[27] The use of contraceptive methods has gained ground in Brazil since the second half of the 1970s, mostly through the influence of private sector initiatives. During the period of the first fertility decline, pills and female sterilization were the predominant contraceptive methods used by women.[28] The majority of women have utilized out-of-pocket contributions to access contraception because of widespread family planning programs implemented by the public sector. The government actually created a frustrated demand for contraceptive methods by implementing regulations that created roadblocks to access.[28] Thus the decline of fertility in Brazil occurred independently from state sponsored interventions related to population policies. Overall, family planning programs have never achieved great social and political legitimacy in the country.

2.2. Absence of family planning programs

The post-World War II period was marked by a slowdown in the population growth of developed countries. However, developing countries, including Brazil, underwent a drop in mortality rates combined with high fertility rates. The idea that a birth control policy would solely result in a reduction of rapid population growth in countries like Brazil was widespread, mainly by scholars in the United States. However, Cuba was the only country that successfully implemented policies of birth control, although there has been a reduction in fertility rates in many Latin American countries.[8] In Brazil, the process of fertility decline occurred without any official governmental interventions and without the implementation of family planning programs to change the reproductive behavior of the population.[29]

Until the mid-1960s, an anti-fertility-control perspective prevailed in Brazil. The diffusion of pro-birth ideals started in the 19th century in Brazil and was related to the process of building national unity. This process was initiated with the proclamation of 1822, which declared Brazil's independence from Portugal. The force with which the anti-control idea spread throughout the country indicates the existence of a societal national consensus that predominated until the 1960s.

In 1964, a military coup took place in Brazil. The 1964–1985 military government was marked by an authoritarian political regime, suppressed public debate, heightened industrialization process, and increased socioeconomic inequality. In this context, new ideas emerged in favor of implementing birth control policies, thus surpassing the previous anti-control consensus. This resulted in the development of two significant factions of public opinion that included the "anti-birth coalition" and the "anti-control coalition." The first segment appealed to participants such as the United States government, which was concerned about the population explosion in developing countries. Brazilian military officials at the "Superior School of War" were worried about threats to national security due to population growth. Important businessmen wanted to promote economic growth, but high fertility rates could compromise their plans. Medical groups were also interested in the implementation of family planning programs. On the other hand, the "anti-control coalition" included the Catholic Church, which was against fertility control for moral reasons. Leftist groups viewed the anti-birth group as an anti-nationalist movement. Groups within the

military government were against family planning programs because they supported the occupation of rural areas in Brazil to increase national security. Expressions such as "new Malthusians," "family planning," and "responsible fatherhood" began being criticized. The second coalition was a reaction to the previous group and was characterized more as an "anti-control" faction, rather than as a "pro-birth" segment. The formation of these social forces generated a political stalemate, which remained in place for a long period.[29]

In the midst of this conflict, there was only one point of consensus between groups. Both factions asserted that developing countries could not wait for a natural decline in fertility during the short and medium terms. However, this idea was not publicly recognized as an agreement between the two groups. Neo-Malthusian groups advocated for the implementation of birth control policies to control population growth. Most demographers believed that couples would only be able to plan their offspring in a context of economic development occurring in conjunction with a decrease in social inequality and profound structural changes.[8]

The first initiatives for family planning programs in Brazil were conducted by civil organizations. The "Brazilian Society for Family Welfare" (BEMFAM) was created in 1965. This non-profit organization gained prominence in the country, mainly due to its operations in the Northeast. Meanwhile, the military government remained silent. The great legacy of BEMFAM goes far beyond the distribution of pills and intra uterine devices (IUD). The actions of this organization helped construct a discourse of conviction and an ideology that justified the need for family planning programs. Beginning in the mid-1970s, the political stalemate between the social forces began to change. During this period, family planning programs began being implemented throughout the country, but not by the government. BEMFAM played an instrumental role in disseminating the concept of family planning. The idea that women's health should be the priority of family planning programs was disseminated by the "Center for Research and Service for Integrated Maternal and Child Care" (CPAIMC).[29]

Gradually, women started claiming their right to exercise democratic control over reproduction.[29] The "Women's Movement" defended that the right to control fertility should be promoted by the state, but should not be imposed on the population. The increase of the presence of women in the political scenario was crucial to the emergence of a new vision regarding family planning. Thus, a new political paradigm for understanding family planning was established.[8] The debate was no longer about the relation of fertility control to economic growth or economic development. The discussion was concerned with women's reproductive freedom of choice regarding their desired number of children, as well as access to information and medical assistance.

However, the path to the implementation of the first government family planning initiative was an agonizing process. In 1974, Brazil participated in the World Population Conference in Bucharest, where it positioned itself on the side against birth control. However, the Brazilian government recognized that the provision of information about reproduction and contraceptives was a public sector duty. This event was the first time that the government recognized family planning as a fundamental human right. Subsequently, two initiatives confirmed the government's stance. The first was the implementation of the "Program for the Prevention of High Risk Pregnancy" and the second was the "National Program of Responsible Fatherhood." Both attempts failed, largely due to the resistance of the Catholic Church.[29]

In the 1980s, Brazil passed through a gradual return to democratic elections and an increase in organizations that discussed topics related to family planning, population issues and women's health. In 1983, the federal government requested a parliamentary commission of inquiry, which resulted in a favorable report on family planning programs. This analysis was virtually a copy of a speech given by Walter Rodrigues, the president of BEMFAM, at

a conference a few years earlier. Faced with this report, the Brazilian Ministry of Health considered the arguments of the "Women's Movement", and negotiated with the Catholic Church. The government also managed to remove the influence of pro-control groups. The resulting proposal was the "Program for Integrated Women's Health Care" (PAISM), which was launched in 1983. PAISM aimed at providing reproductive health care for women, including the provision of contraceptives funded by public health centers.[29, 30] In addition, policies were implemented to avoid the practice of cesarean births in conjunction with female sterilization. PAISM can be considered the Brazilian government's first official discourse on family planning. This program represents a triumph over the old political struggle between the "anti-birth" and "anti-control" coalitions.[29]

The military period was marked not only by major political, economic, and social changes, but also by a large drop in the fertility rates of the population. However, the fertility decrease was not due to governmental family planning programs aimed at controlling birth rates. Such public initiatives were only implemented at the end of the military regime.[29] During this time, the number of private hospitals increased, as did public funds for hospital services through the social security system. The demand for contraception and birth control took place in the private sector, but was publicly funded.[26] This process was possible because private hospitals had partnerships with the government healthcare system.

Following the 1994 World Population Conference in Cairo, with the democratic regime already in place, Brazil approved a family planning law in August 1997. This law legalized and regulated the use of sterilization in hospitals, as well as ensuring public access to other contraceptive methods. In 1998, a federal decree limited the number of cesarean sections that could be performed in public hospitals. However, the practice of female sterilization during cesarean births still prevails. The family planning law is not well known or enforced in some parts of the country.[31] There is a persistence of clientelism in Brazilian politics, related to the provision of reproductive health services, especially in the Northeast.[32] Female sterilization has been used as an instrument for buying votes, even when legal regulations are in place. The 1997 law did not succeed in altering the practice of cesarean sections and female sterilization in the country. Moreover, this law has not been able to supply women with the reproductive rights and services they demanded.[31, 32]

Brazil has not enacted an effective family planning program that would justify the decrease in fertility rates. Actions related to the provision of reproductive health services never achieved great social and political legitimacy. Nonetheless, the total fertility rate in Brazil has declined continuously since the 1970s. Although the absence of such policies may explain the differences in fertility rates among women of different socioeconomic levels[26], the lack in effectiveness of these initiatives implies that fertility decline is linked to factors unrelated to public interventions. Therefore, the next sections seek to investigate the main variables associated with fertility decline in Brazil.

3. Data and methods

This study utilizes microdata from the 1970, 1980, 1991, 2000, and 2010 Brazilian Demographic Censuses. The unit of analysis corresponds to women between 10–49 years of age. The main objective is to investigate variables associated with the information of whether a woman had a child born alive during the 12 months prior to each census (dependent variable). Initially, we examine the distribution of women by categories of independent and dependent variables (Table 1). Following this, we investigate the proportion of women who had a child born alive in the year prior to each census by categories of independent variables (Table 2). Finally, we utilize logistic regression models to analyze the association between the independent variables and the dependent variable. An initial set of models excludes race as an independent variable in the 1970, 1980, 1991, 2000, and 2010 censuses (Table 3). The second set of models uses race as

an independent variable in the 1980, 1991, and 2010 censuses (Table 4). The 1970 census does have information on race and the 2000 model did not converge when we used this variable. A third set of models adds parity as an independent variable, including only women with at least one child born alive at the time of the census, for 1980, 1991, 2000, and 2010 (Table 5). Women with no child at the time of the census are not considered in these last models, because they would perfect predict failure in our dependent variable.

We used a control for location of residence by establishing municipality as a cluster, which corrects for the standard error and adjusts the statistical significance. Moreover, our models took into account the sample design for each year, as well as the estimated robust standard errors. The following equation illustrates our binary logistic regression models estimated separately for each year. The dichotomous dependent variable (Y) equals one for women who had a child born alive in the year prior to the census and equals zero for other women. The *k* independent variables are represented by X_{ki}, which have information for each i woman:

$$Pr(Y=1|B) = p,$$

$$log\ [P/(1–P)]_i = \beta_0 + \beta_k X_{ki} + ui\ .$$

In terms of the independent variables, we selected household and individual characteristics. Among the household variables available in databases, we selected: (1) region of residence (North, Northeast, Southeast, South, and Central-West); (2) household location (rural or urban); and (3) presence of electricity (yes or no). We utilized these individual characteristics in our estimations: (1) color/race (white or black/brown); (2) religion (Catholic or non-Catholic); (3) marital status (single, married, or divorced/widowed); (4) woman works (yes or no); (5) time of residence in the municipality (0 to 4, 5 to 9, or 10+ years); (6) woman birthed stillborn child during her life (yes or no); (7) parity (1, 2, or 3+ children born alive); and (8) information about age and education was characterized into 24 age-education groups. The following section details the construction of the variables used in our analysis, as well as the hypotheses regarding their impacts on our dichotomous dependent variable (woman had child born alive in the previous year).

3.1. Household variables

Region of residence: according to the municipality of residence, we classified the geographic major-region of residence. We have five dichotomous variables for major-regions (North, Northeast, Southeast, South, and Center-West). Southeast is the region of reference in our regression models. **Hypothesis:** there are differences related to the number of children ever born among women of each major-region that are non-observable. The variables of major-regions control for these types of variations.[4, 5]

Household location: depending on the location, a household was classified by the Brazilian Institute of Geography and Statistics (IBGE) as either rural or urban. We created a variable that assigned the value of zero for households located in urban areas and one for households located in rural areas. **Hypothesis:** urban households have more advanced infrastructure, as a result of the better socioeconomic characteristics of these areas. Therefore, women in urban areas have lower odds of having had a child in the previous year than women living in rural areas.[4]

Electricity: the census questionnaires inquire if the household has electricity. We assigned the value of one to a household with electricity and zero otherwise. **Hypothesis:** The more advanced the household infrastructure, the better the socioeconomic status of women, and the lower the chance that she had a child in the previous year.[4]

3.2. Individual variables

Color/Race: women self-reported their color/race, based on the following classifications: (1) white; (2) black; (3) yellow; (4) brown; and (5) indigenous. Yellow and indigenous women were removed from the database, because of their small percentage

of representation in the overall population, which could lead to problems of heteroscedasticity. Information about color/race was transferred into a binary variable: white women were recoded as zero, and black/brown women were recoded as one. **Hypothesis:** white women have a lower probability of having had a child in the previous year, compared to black women, due to socioeconomic differentials by race.[21]

Religion: this variable was not categorized in the same manner as in the censuses. We grouped the religion variable into two categories. Women who declared themselves as Catholic were recoded as zero. Non-Catholic women were recoded as one. **Hypothesis:** Although there are differences across religions, non-Catholic women, on average, have lower chances of having had a child in the previous year, compared to Catholic women.[21]

Marital status: the categories of this variable differ throughout the censuses. We reclassified this information into three groups: (1) single women; (2) married women, which are used as the reference category; and (3) divorced/widowed women. **Hypothesis:** single and divorced/widowed women have lower chances of having had a child in the previous year, when compared to married women.

Participation in the labor market: the increase in female labor force participation in recent decades had a negative impact on fertility rates. We obtained information from censuses about whether women were working or not. **Hypothesis:** working women have lower chances of having had a child in the previous year, compared to women not participating in the labor market, precisely because of their priority to establishing a professional career.[10, 11, 15]

Time of residence in the municipality: women provided information about the amount of years that they had lived in the municipality. This information was categorized into three groups: (1) 0 to 4 years of residence in the municipality; (2) 5 to 9 years of residence in the municipality; and (3) 10+ years of residence in the municipality, which is the reference category in the statistical models. Due to differences among censuses, the categories for time of residence in the municipality for 1970 are: 0 to 4; 5 to 10; and 11+ years. **Hypothesis:** short-term migrants (0 to 4 and 5 to 9 years) have higher chances of having had a child in the previous year, compared to women with more years of residence in the municipality.[21]

Woman gave birth to a stillborn during her life: women older than 10 years of age were asked whether they had given birth to a stillborn at any time in their lives. Women who had given birth to a stillborn were classified as one, while other women were classified as zero. **Hypothesis:** women who had stillbirths have higher chances of having had a child in the previous year, compared to other women. This variable is a proxy for child mortality, which increases the odds of having another child.[4]

Parity: women provided information about the number of children ever born alive. This information was categorized into three groups: (1) one child born alive; (2) two children born alive, which is the reference category; and (3) three or more children born alive. Hypothesis: women with higher parity have higher chances of having had a child in the previous year, compared to women with lower parity.[25, 26]

Age-education groups: information on age and educational attainment was classified into age-education groups. Information on years of schooling was collected in differing manners throughout the censuses, and its classification into groups was determined by data available in the 2010 census. The four education groups are: (1) 0–3 years of schooling, which corresponds to less than the first phase of elementary education; (2) 4–8 years of schooling, which refers to up to a complete elementary education; (3) 9–11 years of schooling, which reflects some or complete secondary education; and (4) 12+ years of schooling, which corresponds to at least some college education. Women's age was classified into six groups, which relates to different milestone moments throughout the reproductive period: (1) 10 to 14 years of age;

(2) 15 to 19 years of age; (3) 20 to 24 years of age; (4) 25 to 29 years of age; (5) 30 to 34 years of age; and (6) 35 to 49 years of age. Finally, we used this information to create 24 age-education groups. Women with 15–19 years of age and 4–8 years of schooling serve as the reference category in the regression models. **Hypothesis:** women who are better educated and older in age have lower chances of having had a child in the previous year, compared to women with lower education and/or younger women.[1, 26]

4. Results and discussion

The variables used in this study can be described according to Table 1. In relation to the major-region of residence, the Southeast represents more than 40 percent of the population in all analyzed years. The Northeast represents 29.73 percent of the population in 1970 and drops to 26.70 in 2010. The South, Central-West and North regions reflect the lowest percentages of the population. There was an increase in the percentage of women living in urban households from 59.92% in 1970 to 86.15% in 2010. The same trend occurs in relation to the percentage of women living in households with electricity increasing from 50.42% (1970) to 98.81% (2010). In relation to the variables about women, there is a greater number of whites compared to non-whites (black/brown) with the exception of 2010, when 48.07% self-reported as being white and 51.93 % as being non-white. The percentage of Catholic women dropped from 91.69% in 1970 to 62.85% in 2010. In relation to marital status, most women were married in 1970 (56.42%), but this percentage dropped to 30.01 in 2010. At the same time, the percentage of single women increased from 38.72% in 1970 to 64.36% in 2010. There was a substantial increase in female labor force participation from 21.95% in 1970 to 43.56% in 2010. Most women lived in their municipality for at least 10 years. There was a decrease in the percentage of women who had given birth to a stillborn (5.29% in 1970 to 2.97% in 2010), which is consistent with the improvement in the health conditions of the country. Most women do not have a child born alive (52.62% in 1980 and 47.10% in 2010). The percentage of women with at least three children declined from 27.18% in 1980 to 16.97 in 2010, which is consistent with the overall fertility decline happening in Brazil. Regarding the dependent variable, there was a reduction in the percentage of women who gave birth in the year prior to the census, going from 12.66% (1970) to 4.26% (2010), which confirms the fertility decline that was observed in the country. In relation to the distribution of women by age-education groups (Table 1), we observe a tendency towards the improvement in educational attainment throughout time.

Table 2 indicates the percentage of women who had a child born alive in the year prior to each census by categories of independent variables. We observe a drop in these percentages throughout time in all major-regions. The regional differences that existed in 1970 still prevail in 2010. In rural households, the rate of women who had a child born alive in the previous year fell from 16.61% in 1970 to 5.41% in 2010. This drop went from 10.01 to 4.11% in urban areas. Thus, differentials between rural and urban households decreased considerably during the analyzed period. In terms of infrastructure, households with electricity had a decrease for women having a child in the previous year from 8.40% in 1970 to 4.21% in 2010. A substantial decline was also verified in households without electricity (from 16.98 to 7.94%), but these households represent a small fraction in 2010, as we previously observed in Table 1. In relation to individual variables, black/brown women have higher percentages of having had a child than white women for all years. There is no information about race in the 1970 census. Catholic women presented higher percentages of having had a child in the previous year compared to non-Catholic women between 1970 and 2000, but this trend reversed in 2010.

Married women present the highest percentage of having had a child in the previous year, compared to the other marital statuses. Since women are

having children out-of-wedlock, we observe a decrease in the differentials between the rates of single and married women. Women who participate in the labor market have lower chances of having a child compared to other women. However, even women not participating in the labor market presented substantial declines in the percentage of having a child over time.

Table 1. Percentage distribution of women by variables of interest, Brazil, 1970–2010.

Variables	Categories	1970	1980	1991	2000	2010
Household variables						
Region of residence	North	3.49	4.43	6.05	7.31	8.54
	Northeast	29.73	27.51	28.29	27.70	26.70
	Southeast	44.22	45.09	43.21	43.24	42.68
	South	17.33	16.67	15.80	14.70	14.35
	Central-West	5.22	6.30	6.65	7.05	7.73
Household location	Rural	40.08	28.66	22.14	16.44	13.85
	Urban	59.92	71.34	77.86	83.56	86.15
Electricity	Yes	50.42	70.92	86.56	94.64	98.81
	No	49.58	29.08	13.44	5.36	1.19
Individual variables						
Color/Race	White	—	56.72	53.19	54.94	48.07
	Black/Brown	—	43.28	46.81	45.06	51.93
Religion	Catholic	91.69	89.02	83.51	73.47	62.85
	Non-Catholic	8.31	10.98	16.49	26.53	37.15
Marital status	Single	38.72	49.34	44.46	61.05	64.36
	Married	56.42	46.59	48.80	33.68	30.01
	Divorced/Widow	4.86	4.07	6.74	5.27	5.63
Participation in the labor market	Yes	21.95	28.43	34.03	34.55	43.56
	No	78.05	71.57	65.97	65.45	56.44
Time of residence in the municipality[1]	0 to 4 years	12.82	5.63	3.69	12.58	10.47
	5 to 9 years	10.21	4.05	2.28	8.20	6.34
	10+ years	76.98	90.32	94.03	79.22	83.19
Woman had stillborn during her life	Yes	5.29	6.61	2.61	4.47	2.97
	No	94.71	93.39	97.39	95.53	97.03
Number of children ever born	0	—	52.62	47.18	46.00	47.10
	1	—	9.88	12.35	15.23	18.00
	2	—	10.33	14.13	16.91	17.94
	3+	—	27.18	26.33	21.85	16.97
Woman had a child born alive in the previous year	Yes	12.66	17.24	13.33	11.06	4.26
	No	87.34	82.76	86.67	88.94	95.74
Age-education groups						
10–14 years / 0–3 years of schooling		0.33	12.93	10.29	6.22	1.70
10–14 years / 4–8 years of schooling		0.22	6.53	7.03	9.23	11.21
10–14 years / 9–11 years of schooling		0.00	0.00	0.01	0.02	0.68
10–14 years / 12+ years of schooling		0.00	0.00	0.00	0.00	0.00
15–19 years / 0–3 years of schooling		12.93	6.09	3.83	1.94	0.69
15–19 years / 4–8 years of schooling		10.21	10.21	9.32	8.51	3.99
15–19 years / 9–11 years of schooling		1.37	2.45	2.50	5.39	7.86
15–19 years / 12+ years of schooling		0.06	0.11	0.12	0.20	1.01

Variables	Categories	1970	1980	1991	2000	2010
20–24 years / 0–3 years of schooling		10.45	4.98	3.22	1.97	0.84
20–24 years / 4–8 years of schooling		5.69	7.00	6.80	5.61	3.25
20–24 years / 9–11 years of schooling		1.62	2.81	3.52	5.53	6.46
20–24 years / 12+ years of schooling		0.36	1.01	1.00	1.44	3.30
25–29 years / 0–3 years of schooling		9.00	4.90	3.52	2.07	1.25
25–29 years / 4–8 years of schooling		3.98	5.20	5.88	5.29	3.43
25–29 years / 9–11 years of schooling		0.89	1.72	3.22	3.91	5.81
25–29 years / 12+ years of schooling		0.26	1.00	1.31	1.38	3.43
30–34 years / 0–3 years of schooling		8.57	4.83	3.45	2.39	1.75
30–34 years / 4–8 years of schooling		3.43	3.86	5.31	5.12	3.69
30–34 years / 9–11 years of schooling		0.62	1.05	2.38	3.18	4.62
30–34 years / 12+ years of schooling		0.17	0.70	1.23	1.32	2.87
35–49 years / 0–3 years of schooling		21.28	13.01	10.83	7.77	7.53
35–49 years / 4–8 years of schooling		7.28	7.47	9.84	12.15	9.80
35–49 years / 9–11 years of schooling		1.03	1.34	3.22	5.97	9.11
35–49 years / 12+ years of schooling		0.26	0.80	2.17	3.39	5.72
Sample size (women)		5,479,926	8,378,269	4,937,251	6,364,833	6,355,398
Population size		20,766,599	33,990,961	43,306,563	54,100,698	60,670,928

[1] The categories for time of residence in the municipality for 1970 are: 0 to 4; 5 to 10; and 11+ years.
[2] Number of children ever born in this table is related only to 1980–2010 censuses, in order to be comparable to results in Table 5.
Source: 1970, 1980, 1991, 2000, and 2010 Brazilian Demographic Censuses.

Short-term migrants have higher rates of having a child in the previous year, mostly women who have lived in the municipality between zero and four years, compared to the other ones. Women who experienced a stillbirth during their lifetime have higher percentages of having had a child in the previous year, as was anticipated by our hypothesis. Considering only women with at least one child born alive at the time of the census, the percentage of women who had a child in the previous year has been decreasing over time for all categories of number of children ever born. These percentages are higher for women with lower parity, because they might not have reached the desired number of children.

In Table 2, we also verify that more-educated women tend to have lower percentages of having had a child in all age groups between 1970 and 2000. However, in 2010 better-educated women had lower rates only up to the 25–29 age group. Among older women (30–34 and 35–49 years) in 2010, those with higher level of education present higher percentages of having had a child in the previous year. This is probably due to the postponement of fertility experienced by the 9–11 and 12+ schooling groups.

Results from our logistic regression models, predicting whether women had a child born alive in the year prior to each census, are expressed in Table 3. Controlling for all independent variables, we observe that women in the North and Northeast regions are more likely to have had a child in the previous year, compared to the Southeast region. However, these differentials decrease throughout time. The South region presents lower chances in previous years, compared to the reference category, but this relationship inverts in 2000 and 2010. The trend of the Central-West region compared to the Southeast oscillates over time. Women living in rural households presented higher chances of having had a child in 1970 and 1991, compared to those in urban areas. However, this result was not confirmed in 1980, 2000, and 2010, where the odds were a little below one unit. As expected, women living in households with electricity presented lower chances of having had a child before the census in all years,

compared to other women. Following the course of our initial hypothesis, non-Catholic women presented lower chances of having had a child, compared to Catholic women. In relation to marital status, single and divorced/widowed women have lower chances of having had a child in the previous year, compared to married women.

Table 2. Percentage of women who had a child born alive in the previous year by categories of independent variables, Brazil, 1970–2010.

Variables	Categories	1970	1980	1991	2000	2010
Household variables						
Region of residence	North	16.42	23.52	17.97	14.68	5.63
	Northeast	15.53	19.84	14.84	12.08	4.63
	Southeast	10.28	15.54	11.87	10.03	3.82
	South	12.33	15.42	12.73	10.36	3.95
	Central-West	14.98	18.35	13.48	10.98	4.40
Household location	Rural	16.61	21.20	16.99	13.97	5.14
	Urban	10.01	15.64	12.28	10.48	4.11
Electricity	Yes	8.40	15.01	12.54	10.68	4.21
	No	16.98	22.66	18.38	17.85	7.94
Individual variables						
Color/Race	White	—	15.77	12.33	9.93	3.79
	Black/Brown	—	19.16	14.45	12.42	4.68
Religion	Catholic	12.81	17.41	13.51	11.17	4.20
	Non-Catholic	10.94	15.78	12.37	11.01	4.35
Marital status	Single	0.46	1.63	2.03	9.79	3.92
	Married	21.64	34.17	23.73	14.17	5.37
	Divorced/Widow	5.54	12.65	12.42	5.78	2.19
Participation in the labor market	Yes	4.95	11.81	10.15	7.98	2.79
	No	14.82	19.36	14.96	12.67	5.39
Time of residence in the municipality[1]	0 to 4 years	15.22	22.66	18.55	15.56	6.31
	5 to 9 years	13.89	21.86	14.33	13.73	5.12
	10+ years	12.07	16.69	13.09	10.38	3.96
Woman had stillborn during her life	Yes	19.91	28.73	17.88	14.07	4.96
	No	12.69	16.42	13.20	10.91	4.23
Number of children ever born	0	—	46.44	36.03	28.73	10.75
	1	—	37.04	25.17	19.01	7.10
	2	—	32.17	20.20	15.86	6.21
	3+					
Age-education groups						
10–14 years / 0–3 years of schooling		3,01	0.00	0.19	0.35	0.35
10–14 years / 4–8 years of schooling		0,89	0.00	0.25	0.32	0.22
10–14 years / 9–11 years of schooling		0,00	0.00	1.62	1.35	0.41
10–14 years / 12+ years of schooling		0,00	0.00	0.00	0.00	0.00
15–19 years / 0–3 years of schooling		5,64	12.59	14.43	21.08	8.62
15–19 years / 4–8 years of schooling		2,17	7.44	10.05	13.11	8.96
15–19 years / 9–11 years of schooling		0,43	2.58	4.32	5.72	3.12
15–19 years / 12+ years of schooling		0,13	1.63	2.33	1.95	0.77

Variables	Categories	1970	1980	1991	2000	2010
20–24 years / 0–3 years of schooling		23,18	41.96	37.23	36.88	12.29
20–24 years / 4–8 years of schooling		14,23	32.34	29.84	31.75	13.35
20–24 years / 9–11 years of schooling		5,93	16.24	16.80	15.42	8.53
20–24 years / 12+ years of schooling		2,80	8.73	8.13	5.11	2.47
25–29 years / 0–3 years of schooling		26,71	43.96	32.73	26.90	9.45
25–29 years / 4–8 years of schooling		17,65	35.02	26.33	23.76	9.37
25–29 years / 9–11 years of schooling		14,01	29.76	22.58	18.34	8.05
25–29 years / 12+ years of schooling		10,77	25.71	18.29	12.08	5.03
30–34 years / 0–3 years of schooling		22,96	35.81	23.76	16.97	5.76
30–34 years / 4–8 years of schooling		12,81	25.00	16.43	14.21	5.54
30–34 years / 9–11 years of schooling		10,42	24.57	16.32	13.41	5.92
30–34 years / 12+ years of schooling		10,12	25.25	17.75	14.42	6.73
35–49 years / 0–3 years of schooling		10,40	15.99	9.35	5.51	1.39
35–49 years / 4–8 years of schooling		4,77	8.43	5.37	3.99	1.53
35–49 years / 9–11 years of schooling		3,21	7.40	5.12	3.84	1.63
35–49 years / 12+ years of schooling		3.15	8.15	5.12	4.09	2.25
Sample size (women)		5,479,926	8,378,269	4,937,251	6,364,833	6,355,398
Population size		20,766,599	33,990,961	43,306,563.2	54,100,698	60,670,928

[1] The categories for time of residence in the municipality for 1970 are: 0 to 4; 5 to 10; and 11+ years.

[2] Number of children ever born in this table is related only to 1980–2010 censuses and to women with at least one child born alive at the time of the census, in order to be comparable to results in Table 5.

Source: 1970, 1980, 1991, 2000, and 2010 Brazilian Demographic Censuses.

However, these marital status differentials decreased throughout time, as is indicated by odds ratios that are closer to one unit in recent years. This result is an indication of an increase in women having children out-of-wedlock throughout their reproductive lifetime during the last decades. Women who participate in the labor force are less likely to have had a child in the year prior to the census. Moreover, the impact of employment on fertility became stronger in more recent years, as was exposed by odds ratios being farther away from one unit. Short-term migrants reflect higher chances of having had a child in the previous year, compared to women living in their municipality for at least 10 years, as was expected by our initial hypothesis. These differentials, relating to time of residence in the municipality, increased in recent years. Women who experienced a stillborn during their lifetime have higher chances of having had a child in the previous year, with increasing impacts over time. This result is consistent with the hypothesis that child mortality increases the odds of fertility rates. Table 3 exposes the coefficients for age-education groups. We observe higher odds for women between 20–24 and 25–29 years of age, compared to the reference group. Moreover, better-educated women have lower chances of having had a child in the previous year. However, among the older age groups (30–34 and 35–49 years), better-educated women are more likely to have had a child. This is an indication of an ongoing fertility postponement to later reproductive ages.

Table 3. Odds ratios and exponentials of robust standard errors from logistic regression models predicting whether women had a child born alive in the previous year with cluster for municipality of residence, Brazil, 1970–2010 (without race variable).

Independent variables	1970	1980	1991	2000	2010
Household variables					
North region	1.465***	1.675***	1.320***	1.268***	1.232***
	(0.0445)	(0.0498)	(0.0565)	(0.0376)	(0.0301)
Northeast region	1.402***	1.475***	1.212***	1.040***	1.039***
	(0.0264)	(0.0304)	(0.0245)	(0.0123)	(0.0127)
Southeast region	ref.	ref.	ref.	ref.	ref.
South region	0.964*	0.883***	0.967***	1.056***	1.114***
	(0.0185)	(0.0181)	(0.00950)	(0.0133)	(0.0111)
Central-West region	1.072***	1.049	0.955	0.990	1.106***
	(0.0231)	(0.0493)	(0.0318)	(0.0248)	(0.0113)
Rural household	1.029***	0.963***	1.129***	0.960***	0.964***
	(0.00904)	(0.00788)	(0.0124)	(0.0117)	(0.00898)
Electricity	0.667***	0.677***	0.795***	0.708***	0.695***
	(0.00761)	(0.00587)	(0.0111)	(0.00858)	(0.0145)
Individual variables					
Catholic religion	ref.	ref.	ref.	ref.	ref.
Non-Catholic religion	0.971***	0.981***	0.944***	0.982***	0.977***
	(0.0110)	(0.00551)	(0.00583)	(0.00502)	(0.00596)
Single	0.0114***	0.0354***	0.0557***	0.590***	0.600***
	(0.000503)	(0.00140)	(0.00101)	(0.00745)	(0.00938)
Married	ref.	ref.	ref.	ref.	ref.
Divored/Widow	0.304***	0.411***	0.609***	0.608***	0.602***
	(0.00377)	(0.00463)	(0.00738)	(0.00639)	(0.0192)
Woman participates in the labor market	0.797***	0.729***	0.679***	0.500***	0.394***
	(0.0234)	(0.0155)	(0.00612)	(0.00246)	(0.00355)
0 to 4 years of residence in the municipality[1]	1.094***	1.087***	1.099***	1.314***	1.316***
	(0.0185)	(0.0245)	(0.0102)	(0.0183)	(0.0150)
5 to 9 years of residence in the municipality[1]	1.068***	1.134***	0.997	1.210***	1.173***
	(0.0159)	(0.0354)	(0.0121)	(0.00787)	(0.0111)
10+ years of residence in the municipality[1]	ref.	ref.	ref.	ref.	ref.
Woman had stillborn during her life	1.154***	1.103***	1.089***	1.386***	1.371***
	(0.00858)	(0.00728)	(0.0124)	(0.00955)	(0.0196)
Age-education groups					
10–14 years / 0–3 years of schooling	0.596***	—	0.0401***	0.0219***	0.0340***
	(0.0315)		(0.00155)	(0.000668)	(0.00211)
10–14 years / 4–8 years of schooling	0.547***	—	0.0580***	0.0212***	0.0218***
	(0.0608)		(0.00277)	(0.000611)	(0.000848)
10–14 years / 9–11 years of schooling	—	—	0.257***	0.0913***	0.0419***
			(0.0769)	(0.0232)	(0.00396)
10–14 years / 12+ years of schooling	—	—	—	—	—

Variables	Categories	1970	1980	1991	2000	2010
15–19 years / 0–3 years of schooling		0.960*	1.025*	1.107***	1.627***	0.928**
		(0.0232)	(0.0151)	(0.0148)	(0.0181)	(0.0298)
15–19 years / 4–8 years of schooling		ref.	ref.	ref.	ref.	ref.
15–19 years / 9–11 years of schooling		0.428***	0.540***	0.612***	0.448***	0.355***
		(0.0297)	(0.0202)	(0.0130)	(0.00725)	(0.00507)
15–19 years / 12+ years of schooling		0.158***	0.373***	0.396***	0.157***	0.0944***
		(0.0795)	(0.0374)	(0.0408)	(0.0119)	(0.00573)
20–24 years / 0–3 years of schooling		1.252***	1.859***	1.545***	3.448***	1.395***
		(0.0349)	(0.0337)	(0.0174)	(0.0349)	(0.0246)
20–24 years / 4–8 years of schooling		1.291***	1.820***	1.350***	2.964***	1.650***
		(0.0310)	(0.0257)	(0.0143)	(0.0214)	(0.0199)
20–24 years / 9–11 years of schooling		1.082***	1.348***	1.062***	1.385***	1.152***
		(0.0285)	(0.0270)	(0.0162)	(0.0162)	(0.0159)
20–24 years / 12+ years of schooling		0.732***	0.876***	0.725***	0.450***	0.357***
		(0.0382)	(0.0367)	(0.0193)	(0.0142)	(0.00925)
25–29 years / 0–3 years of schooling		0.988	1.279***	0.857***	2.045***	1.020
		(0.0315)	(0.0239)	(0.0103)	(0.0239)	(0.0202)
25–29 years / 4–8 years of schooling		0.863***	1.182***	0.741***	1.858***	1.103***
		(0.0283)	(0.0202)	(0.00847)	(0.0251)	(0.0182)
25–29 years / 9–11 years of schooling		1.002	1.370***	0.834***	1.565***	1.047***
		(0.0202)	(0.0294)	(0.0112)	(0.0200)	(0.0154)
25–29 years / 12+ years of schooling		1.052*	1.478***	0.902***	1.131***	0.766***
		(0.0308)	(0.0387)	(0.0192)	(0.0291)	(0.0166)
30–34 years / 0–3 years of schooling		0.736***	0.805***	0.493***	1.086***	0.599***
		(0.0274)	(0.0168)	(0.00740)	(0.0170)	(0.0130)
30–34 years / 4–8 years of schooling		0.508***	0.631***	0.366***	0.955**	0.632***
		(0.0255)	(0.0132)	(0.00504)	(0.0184)	(0.0155)
30–34 years / 9–11 years of schooling		0.525***	0.779***	0.444***	1.016	0.737***
		(0.0177)	(0.0207)	(0.00787)	(0.0164)	(0.0129)
30–34 years / 12+ years of schooling		0.643***	1.054*	0.626***	1.297***	0.976
		(0.0253)	(0.0331)	(0.0102)	(0.0200)	(0.0166)
35–49 years / 0–3 years of schooling		0.286***	0.261***	0.158***	0.289***	0.131***
		(0.0112)	(0.00658)	(0.00291)	(0.00485)	(0.00327)
35–49 years / 4–8 years of schooling		0.173***	0.165***	0.103***	0.231***	0.161***
		(0.0133)	(0.00791)	(0.00218)	(0.00399)	(0.00401)
35–49 years / 9–11 years of schooling		0.139***	0.169***	0.114***	0.249***	0.187***
		(0.00655)	(0.0102)	(0.00304)	(0.00506)	(0.00455)
35–49 years / 12+ years of schooling		0.163***	0.239***	0.139***	0.310***	0.300***
		(0.00994)	(0.0107)	(0.00317)	(0.00669)	(0.0113)
Sample size (women)		5,479,924	6,876,652	4,964,960	6,430,347	6,355,409

[1] The categories for time of residence in the municipality for 1970 are: 0 to 4; 5 to 10; and 11+ years.

Note: Empty cells are due to the absence of women in these categories, as well as to perfect prediction of failure or success. Exponentials of robust standard errors in parentheses. * Significant at p<0.1; ** Significant at p<0.05; *** Significant at p<0.01.

Source: 1970, 1980, 1991, 2000, and 2010 Brazilian Demographic Censuses.

We added information about the color/race of women in our regression models (Table 4). Results are illustrated for 1980, 1991, and 2010, because the 1970 census did not have information on race and the models for 2000 did not converge. Results suggest higher chances of having had a child among black/brown women, compared to white women. However, these differentials have been decreasing over time.

Table 4. Odds ratios and exponentials of robust standard errors from logistic regression models predicting whether women had a child born alive in the previous year with cluster for municipality of residence, Brazil, 1980, 1991, and 2010 (with race variable).

Independent variables	1980	1991	2010
Household variables			
North region	1.536***	1.244***	1.202***
	(0.0473)	(0.0541)	(0.0293)
Northeast region	1.373***	1.148***	1.017
	(0.0288)	(0.0232)	(0.0125)
Southeast region	ref.	ref.	ref.
South region	0.918***	1.001	1.141***
	(0.0191)	(0.0102)	(0.0117)
Central-West region	1.021	0.930**	1.093***
	(0.0467)	(0.0300)	(0.0115)
Rural household	0.977***	1.135***	0.963***
	(0.00750)	(0.0129)	(0.00900)
Electricity	0.692***	0.799***	0.699***
	(0.00571)	(0.0116)	(0.0145)
Individual variables			
White	ref.	ref.	ref.
Black/Brown	1.240***	1.187***	1.105***
	(0.0109)	(0.00805)	(0.00644)
Catholic religion	ref.	ref.	ref.
Non-Catholic religion	0.982***	0.941***	0.973***
	(0.00558)	(0.00546)	(0.00586)
Single	0.0352***	0.0553***	0.596***
	(0.00141)	(0.00100)	(0.00939)
Married	ref.	ref.	ref.
Divorced/Widow	0.407***	0.604***	0.602***
	(0.00457)	(0.00725)	(0.0193)
Woman participates in the labor market	0.722***	0.676***	0.395***
	(0.0158)	(0.00626)	(0.00356)
0 to 4 years of residence in the municipality[1]	1.093***	1.102***	1.317***
	(0.0233)	(0.0103)	(0.0151)
5 to 9 years of residence in the municipality[1]	1.132***	1.000	1.174***
	(0.0334)	(0.0125)	(0.0112)
10+ years of residence in the municipality[1]	ref.	ref.	ref.
Woman had stillborn during her life	1.094***	1.081***	1.364***
	(0.00691)	(0.0123)	(0.0195)

Independent variables	1980	1991	2010
Age-education groups			
10–14 years / 0–3 years of schooling	—	0.0394***	0.0340***
		(0.00154)	(0.00211)
10–14 years / 4–8 years of schooling	—	0.0587***	0.0220***
		(0.00276)	(0.000856)
10–14 years / 9–11 years of schooling	—	0.263***	0.0424***
		(0.0788)	(0.00402)
10–14 years / 12+ years of schooling	—	—	—
15–19 years / 0–3 years of schooling	1.003	1.089***	0.929**
	(0.0148)	(0.0148)	(0.0296)
15–19 years / 4–8 years of schooling	ref.	ref.	ref.
15–19 years / 9–11 years of schooling	0.559***	0.629***	0.359***
	(0.0192)	(0.0129)	(0.00514)
15–19 years / 12+ years of schooling	0.399***	0.421***	0.0970***
	(0.0392)	(0.0435)	(0.00583)
20–24 years / 0–3 years of schooling	1.820***	1.521***	1.395***
	(0.0331)	(0.0174)	(0.0245)
20–24 years / 4–8 years of schooling	1.821***	1.351***	1.649***
	(0.0254)	(0.0143)	(0.0199)
20–24 years / 9–11 years of schooling	1.385***	1.083***	1.158***
	(0.0257)	(0.0163)	(0.0161)
20–24 years / 12+ years of schooling	0.929*	0.754***	0.366***
	(0.0359)	(0.0198)	(0.00924)
25–29 years / 0–3 years of schooling	1.253***	0.843***	1.019
	(0.0236)	(0.0104)	(0.0202)
25–29 years / 4–8 years of schooling	1.184***	0.742***	1.103***
	(0.0203)	(0.00855)	(0.0182)
25–29 years / 9–11 years of schooling	1.411***	0.850***	1.052***
	(0.0293)	(0.0118)	(0.0156)
25–29 years / 12+ years of schooling	1.564***	0.943***	0.784***
	(0.0368)	(0.0189)	(0.0164)
30–34 years / 0–3 years of schooling	0.790***	0.484***	0.598***
	(0.0166)	(0.00731)	(0.0130)
30–34 years / 4–8 years of schooling	0.634***	0.366***	0.632***
	(0.0133)	(0.00508)	(0.0155)
30–34 years / 9–11 years of schooling	0.804***	0.453***	0.741***
	(0.0212)	(0.00838)	(0.0131)
30–34 years / 12+ years of schooling	1.105***	0.653***	0.999
	(0.0331)	(0.0111)	(0.0174)
35–49 years / 0–3 years of schooling	0.257***	0.156***	0.131***
	(0.00639)	(0.00286)	(0.00327)
35–49 years / 4–8 years of schooling	0.168***	0.104***	0.162***
	(0.00780)	(0.00215)	(0.00403)

Independent variables	1980	1991	2010
Age-education groups			
35–49 years / 9–11 years of schooling	0.177***	0.117***	0.189***
	(0.0105)	(0.00305)	(0.00465)
35–49 years / 12+ years of schooling	0.252***	0.144***	0.308***
	(0.0114)	(0.00320)	(0.0121)
Sample size (women)	6,812,361	4,937,251	6,355,398

[1] The categories for time of residence in the municipality for 1970 are: 0 to 4; 5 to 10; and 11+ years.
Note: Empty cells are due to the absence of women in these categories, as well as to perfect prediction of failure or success. Exponentials of robust standard errors in parentheses. * Significant at p<0.1; ** Significant at p<0.05; *** Significant at p<0.01.
Source: 1980, 1991, and 2010 Brazilian Demographic Censuses.

We included parity of women in our regression models, considering only women with at least one child born alive at the time of the census (Table 5). In general, results remained the same as in Tables 3 and 4. However, some coefficients changed in the new models. In 1980, women in the North region had the highest changes of having had a child in the previous year, compared to the Southeast region (Table 4). For 1980 and 1991, Table 5 indicates that women in the Northeast region presented the highest changes of having had a child in the previous year. In 2000 and 2010, women in the North and Northeast regions inverted their coefficient, indicating lower changes of having had a child in the previous year, compared to the Southeast region. In terms of marital status, Table 5 shows smaller differences in the odds of having had a child in the previous year between single and married women, compared to previous models. In 2000, the changes of having had a child are higher for single than for married women. These results might be related to the exclusion of women with no child at the time of the census from Table 5, who are mostly composed of Southeast residents and single individuals.

In relation to parity, women with higher number of children ever born have higher chances of having had a child in the previous year, compared to women with lower parity, following our initial hypothesis. Differentials between women with one child and those with two children increased over time, while differentials between women with at least three children and those with two children decreased over time.

Table 5. Odds ratios and exponentials of robust standard errors from logistic regression models predicting whether women had a child born alive in the previous year with cluster for municipality of residence, Brazil, 1980, 1991, 2000, and 2010 (with race and parity variables, only for women with at least one child).

Independent variables	1980	1991	2000	2010
Household variables				
North region	1.294***	1.070	0.842***	0.857***
	(0.0477)	(0.0504)	(0.0200)	(0.0152)
Northeast region	1.378***	1.129***	0.937***	0.901***
	(0.0352)	(0.0248)	(0.0185)	(0.0149)
Southeast region	ref.	ref.	ref.	ref.
South region	0.880***	1.000	1.010	1.035*
	(0.0178)	(0.0143)	(0.0197)	(0.0208)
Central-West region	0.897**	0.811***	0.761***	0.897***
	(0.0456)	(0.0319)	(0.0388)	(0.0344)
Rural household	1.090***	1.207***	1.092***	0.945***
	(0.00980)	(0.0180)	(0.00912)	(0.00802)
Electricity	0.667***	0.746***	0.700***	0.784***
	(0.00659)	(0.0135)	(0.00760)	(0.0152)

Independent variables	1980	1991	1991	2010
Individual variables				
White	ref.	ref.	ref.	ref.
Black/Brown	1.204***	1.129***	1.053***	0.960***
	(0.00983)	(0.00730)	(0.00482)	(0.00551)
Catholic religion	ref.	ref.	ref.	ref.
Non-Catholic religion	0.954***	0.933***	0.965***	0.958***
	(0.00574)	(0.00560)	(0.00433)	(0.00479)
Single	0.781***	0.911***	1.243***	0.982***
	(0.0131)	(0.0141)	(0.00593)	(0.00680)
Married	ref.	ref.	ref.	ref.
Divorced/Widow	0.374***	0.549***	0.591***	0.572***
	(0.00794)	(0.00873)	(0.00787)	(0.0183)
Woman participates in the labor market	0.732***	0.693***	0.556***	0.433***
	(0.00616)	(0.00454)	(0.00320)	(0.00406)
0 to 4 years of residence in the municipality[1]	1.170***	1.110***	1.199***	1.200***
	(0.0431)	(0.0126)	(0.00793)	(0.00923)
5 to 9 years of residence in the municipality[1]	1.142***	0.949***	1.076***	1.052***
	(0.0455)	(0.0137)	(0.0113)	(0.00989)
10+ years of residence in the municipality[1]	ref.	ref.	ref.	ref.
Woman had stillborn during her life	0.919***	0.988	0.969***	0.980
	(0.00419)	(0.0110)	(0.00697)	(0.0135)
Woman with one child born alive	0.863***	0.854***	0.676***	0.690***
	(0.0130)	(0.0127)	(0.00561)	(0.00841)
Woman with two children born alive	ref.	ref.	ref.	ref.
Woman with three or more children born alive	1.708***	1.424***	1.545***	1.455***
	(0.0156)	(0.0143)	(0.0116)	(0.0112)
Age-education groups				
10–14 years / 0–3 years of schooling	—	1.847***	2.468***	1.672***
		(0.198)	(0.233)	(0.164)
10–14 years / 4–8 years of schooling	—	1.618***	3.311***	2.231***
		(0.162)	(0.293)	(0.105)
10–14 years / 9–11 years of schooling	—	0.450	1.059	1.558***
		(0.289)	(0.649)	(0.254)
10–14 years / 12+ years of schooling	—	—	—	—
15–19 years / 0–3 years of schooling	0.663***	0.820***	0.837***	0.858***
	(0.0120)	(0.0187)	(0.0152)	(0.0219)
15–19 years / 4–8 years of schooling	ref.	ref.	ref.	ref.
15–19 years / 9–11 years of schooling	1.546***	1.085*	1.183***	1.234***
	(0.0809)	(0.0460)	(0.0253)	(0.0195)
15–19 years / 12+ years of schooling	1.248	0.871	0.767**	1.015
	(0.243)	(0.197)	(0.100)	(0.0782)

Independent variables	1980	1991	1991	2010
Individual variables				
20–24 years / 0–3 years of schooling	0.190***	0.234***	0.219***	0.298***
	(0.00289)	(0.00536)	(0.00293)	(0.00785)
20–24 years / 4–8 years of schooling	0.246***	0.255***	0.244***	0.331***
	(0.00297)	(0.00497)	(0.00253)	(0.00471)
20–24 years / 9–11 years of schooling	0.432***	0.343***	0.349***	0.459***
	(0.00690)	(0.00784)	(0.00412)	(0.00630)
20–24 years / 12+ years of schooling	0.666***	0.416***	0.416***	0.641***
	(0.0210)	(0.0174)	(0.0127)	(0.0132)
25–29 years / 0–3 years of schooling	0.0830***	0.0953***	0.0836***	0.144***
	(0.00144)	(0.00256)	(0.00153)	(0.00331)
25–29 years / 4–8 years of schooling	0.0971***	0.0960***	0.0950***	0.156***
	(0.00183)	(0.00251)	(0.00176)	(0.00345)
25–29 years / 9–11 years of schooling	0.172***	0.144***	0.154***	0.228***
	(0.00302)	(0.00388)	(0.00281)	(0.00347)
25–29 years / 12+ years of schooling	0.307***	0.252***	0.268***	0.417***
	(0.00667)	(0.00867)	(0.00877)	(0.00857)
30–34 years / 0–3 years of schooling	0.0457***	0.0495***	0.0406***	0.0742***
	(0.000779)	(0.00124)	(0.000886)	(0.00215)
30–34 years / 4–8 years of schooling	0.0426***	0.0409***	0.0429***	0.0800***
	(0.000888)	(0.00113)	(0.000987)	(0.00230)
30–34 years / 9–11 years of schooling	0.0656***	0.0587***	0.0660***	0.124***
	(0.00124)	(0.00177)	(0.00147)	(0.00245)
30–34 years / 12+ years of schooling	0.107***	0.101***	0.129***	0.267***
	(0.00296)	(0.00341)	(0.00486)	(0.00849)
35–49 years / 0–3 years of schooling	0.0141***	0.0154***	0.0110***	0.0161***
	(0.000230)	(0.000339)	(0.000193)	(0.000489)
35–49 years / 4–8 years of schooling	0.0101***	0.0110***	0.00991***	0.0202***
	(0.000283)	(0.000226)	(0.000198)	(0.000576)
35–49 years / 9–11 years of schooling	0.0117***	0.0135***	0.0131***	0.0274***
	(0.000516)	(0.000297)	(0.000307)	(0.000711)
35–49 years / 12+ years of schooling	0.0180***	0.0176***	0.0189***	0.0526***
	(0.000605)	(0.000655)	(0.000587)	(0.00246)
Sample size (women)	4,043,567	2,602,961	3,447,000	3,437,160

1 The categories for time of residence in the municipality for 1970 are: 0 to 4; 5 to 10; and 11+ years.
Note: Empty cells are due to the absence of women in these categories, as well as to perfect prediction of failure or success. Exponentials of robust standard errors in parentheses. * Significant at p<0.1; ** Significant at p<0.05; *** Significant at p<0.01.
Source: 1980, 1991, 2000, and 2010 Brazilian Demographic Censuses.

The findings related to fertility postponement suggest that the TFR might continue to decrease to even lower levels in future years and plunge below the replacement level. One question that arises from our study is whether women in other education groups are going to experience the same fertility postponement. This effect might become even more intense with the ongoing improvement in the population's educational attainment, as well as the increase in female labor force participation.

5. References

1. Wong LR, Perpétuo IHO. Uma visão transversal e longitudinal de quatro décadas de queda de fecundidade no Brasil. In: Saúde B-Md, editor. Pesquisa Nacional de Demografia e Saúde da Criança e da Mulher - PNDS 2006: Dimensões do Processo Reprodutivo e da Saúde da Criança. Brasília: Ministério da Saúde e Centro Brasileiro de Análise e Planejamento (CEBRAP); 2009. p. 71-86.

2. Martine G, Carvalho JAM, Arias AR. Mudanças recentes no padrão demográfico brasileiro e implicações para a agenda social. Texto para Discussão, Instituto de Pesquisa Econômica Aplicada (IPEA). 1994;345.

3. IBGE. Censo Demográfico 2010: Resultados Gerais da Amostra. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística (IBGE); 2012.

4. Potter JE, Schmertmann CP, Cavenaghi SM. Fertility and development: evidence from Brazil. Demography. 2002;39(4):739-61.

5. Potter JE, Schmertmann CP, Assunção RM, Cavenaghi SM. Mapping the timing, pace, and scale of the fertility transition in Brazil. Population and Development Review. 2010;36(2):283-307.

6. Alves JED. Questões demográficas: Fecundidade e gênero. Textos para Discussão, Escola Nacional de Ciências Estatísticas (ENCE). 2004;9.

7. Bongaarts J, Casterline J. Fertility transition: Is sub-Saharan Africa different? Population and Development Review. 2013;38(Sup. 1):153-68.

8. Carvalho JAM, Brito F. A demografia brasileira e o declínio da fecundidade no Brasil: Contribuições, equívocos e silêncios. Revista Brasileira de Estudos de População. 2005;22(2):351-69.

9. Berquó E. Algumas indagações sobre a recente queda da fecundidade no Brasil. In: Patarra NL, editor. Familia, reproducción de la población y dinámica de la sociedad capitalista. São Paulo: Consejo Latinoamericano de Ciencias Sociales (CLACSO); 1983. p. 207-28.

10. Dias Júnior CS, Verona APA. Comportamento reprodutivo das mulheres trabalhadoras urbanas brasileiras. Teoria & Sociedade. 2009;17(2):10-29.

11. Dias Júnior CS. Diferenciais no comportamento reprodutivo das mulheres brasileiras: Uma análise a partir dos grupos ocupacionais. Dados. 2010;53(1):233-65.

12. Carvalho JAM, Paiva PTA, Sawyer DR. The recent sharp decline in fertility in Brazil: Economic boom, social inequality and baby bust. Working Paper, Latin America and Caribbean Regional Office, Population Council. 1981;8.

13. Berquó E. Fecundidade em declínio: Breve nota sobre a redução no número médio de filhos por mulher no Brasil. Novos Estudos, CEBRAP. 2006;74:11-5.

14. Merrick TW, Berquó ES. The Determinants of Brazil's Recent Rapid Decline in Fertility. Washington, DC: National Academy; 1983.

15. Almeida ME. Bem-estar social e gênero: O Estado entre a família e o trabalho no Brasil. Belo Horizonte: Fundação João Pinheiro (FJP); 2013.

16. Coutinho RZ, Miranda-Ribeiro P. Religião, religiosidade e iniciação sexual na adolescência e juventude: Lições de uma revisão bibliográfica sistemática de mais de meio século de pesquisas. Revista Brasileira de Estudos de População. 2014;31(2):333-65.

17. Carvalho AA, Verona APA. Religião e fecundidade: Uma análise do nível e padrão de fecundidade segundo grupos religiosos no Brasil em 2006. Horizonte. 2014;12(36):1086-113.

18. Ogland CP, Verona AP. Religion and attitudes toward abortion and abortion policy in Brazil. Journal for the Scientific Study of Religion. 2011;50(4):812-21.

19. Verona APA. Explanations for religious influence on adolescent sexual behavior in Brasil: Direct and Indirect effects. Revista Brasileira de Estudos de População. 2011;28(1):187-201.

20. Verona APA, Dias Júnior CS. Religião e fecundidade entre adolescentes no Brasil. Pan American Journal of Public Health. 2012;31(1):25-31.

21. McKinnon S, Potter JE, Garrard-Burnett V. Adolescent fertility and religion in Rio de Janeiro, Brazil in the year 2000: the role of Protestantism. Population Studies. 2008;62(3):289-303.

22. Faria V. Políticas de governo e regulação da fecundidade: Consequências não antecipadas e efeitos perversos. In: ANPOCS, editor. Ciências Sociais Hoje. São Paulo: Vértice; Associação Nacional de Pós-Graduação e Pesquisa em Ciências Sociais (ANPOCS); 1989. p. 62-103.

23. Faria VE, Potter JE. Televisão, telenovelas e queda da fecundidade no Nordeste. Novos Estudos, CEBRAP. 2002;62:21-39.

24. Rios-Neto ELG. Television, value constructs, and reproductive behavior in Brazilian 'excluded' communities. XXIV General Population Conference of the International Union for the Scientific Study of Population (IUSSP); August 18-24; Salvador: IUSSP; 2001.

25. Hopkins K, Amaral EFL, Mourão ANM. The impact of payment source and hospital type on rising cesarean section rates in Brazil, 1998 to 2008. Birth. 2014;41(2):169-77.

26. Amaral EFL, Potter JE. Políticas de población, programas gubernamentales y fecundidad: una comparación entre el Brasil y México. Notas de Población. 2009;87:7-33.

27. Martine G. Brazil's fertility decline, 1965-95: A fresh look at key factors. In: Martine G, Das Gupta M, Chen LC, editors. Reproductive Change in India and Brazil. Oxford: Oxford University Press; 1998. p. 169-207.

28. Potter JE. The persistence of outmoded contraceptive regimes: the cases of Mexico and Brazil. Population and Development Review. 1999;25(4):703-39.

29. Fonseca Sobrinho D. Estado e População: uma História do Planejamento Familiar no Brasil. Rio de Janeiro: Editora Rosa dos Tempos; Fundo de População das Nações Unidas (FNUAP); 1993.

30. Osis MJD. Paism: Um marco na abordagem da saúde reprodutiva no Brasil. Cadernos de Saúde Pública. 1998;14(Sup. 1):S25-S32.

31. Berquó E, Cavenaghi S. Direitos reprodutivos de mulheres e homens face à nova legislação brasileira sobre esterilização voluntária. Cadernos de Saúde Pública. 2003;19(Sup. 2):S441-S53.

32. Caetano AJ, Potter JE. Politics and female sterilization in Northeast Brazil. Population and Development Review. 2004;30(1):79-108.