THE TRANSITION TO LOW FERTILITY IN BRAZIL

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ABSTRACT

Raquel Zanatta Coutinho: The Transition to Low Fertility in Brazil
(Under the direction of S. Philip Morgan)

In Brazil, the Total Fertility Rate went down from 4.26 children per women in 1980 to 1.91 in 2010. Internal disparities exist, however, regardless of the low value results at the macro level. For most socio-demographic groups, fertility rates are now lower than the desired family size, suggesting that women are, on average, having fewer children than they wish. In this dissertation, I use data from the Brazilian Demographic and Health Survey from 1986 and 1996, and from the Pesquisa Nacional de Demografia e Saude of 2006. I analyze these sources to decompose and analyze fertility rates using a framework that explains fertility rates at the aggregate level, based on a measurement of the Desired Family Size based on six parameters: *unwanted fertility, replacements for child mortality, sex preferences, tempo effect, involuntary infertility,* and *competing preferences.* By outlining and operationalizing these components across time, the first chapter illuminates the factors that contribute to low fertility in Brazil, and describes how they vary by socio-demographic characteristics (race, religion, education, wealth, geographic macro-region, and place of residence). For example, I find that unwanted pregnancies disproportionately affect the fertility rates for women of low education and low income. I also see that overtime, competing preferences are making women having fewer children than desired. The second chapter explores variations in gender preference for different socio-demographic groups

using responses to questions about the ideal number of children and their composition available at the same databases. I present evidence of a preference for balance, although indifference regarding the composition has also been gaining momentum. I also find evidence of a secondary daughter preference that is small, but pervasive. The third chapter investigates factors that compete with childbearing. In brief, I find that women who work, have a college degree and take longer to marry are facing more challenges when it comes to having the number of children they desire. I also find that although women are postponing their fertility, they still hope to achieve it. In sum, findings from this dissertation elucidate macro-level, structural elements that explain variability in fertility outcomes, and considers the conjunctures that lead a women to either have more or fewer children than her desired target.

To my parents, Maria Teresa and Marcelo,

My most cheerful supporters.

To my second mother Cecilia (*in memoriam*),

I hope you accept this PhD as yours.

To my husband, Andre,

My encouragement and inspiration.

To my son, Theodor,

The most beautiful chapter of my life.

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O correr da vida embrulha tudo.
A vida é assim: esquenta e esfria, aperta e daí afrouxa, sossega e depois desinquieta.
O que ela quer da gente é coragem.

(Guimarães Rosa – Grande Sertão: Veredas)

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LIST OF ABBREVIATIONS

ASE	Asymptotic Standard Error
BA	Bachelor Degree
BEMFAM	Sociedade Civil Bem-Estar Familiar no Brasil
CDD	Center for Disease Control
CEB	Children Ever Born
CEBRAP	Brazilian Center for Analysis and Planning
CNJ	Conselho Nacional de Justica
DFC	Desired Family Composition
DFS	Desired Family Size
DHS	Demographic and Health Survey
DSR	Desired Sex Ratios (DSR)
EPSEM	Equal probability of selection method
F_C	Competing preferences
F_I	Involuntary infertility
F_R	Replacements for child mortality
F_{SP}	Sex preference
F_T	Tempo effect
F_U	Unwanted fertility
IBGE	Instituto Brasileiro de Geografia e Estatística
LA	Latin America
PCA	Principal Component Analysis

PNAD	Pesquisa Nacional por Amostra de Domicílios
PNDS	Pesquisa Nacional de Demografia e Saude
PPS	Probability proportion to size
PSM	Propensity Score Matching
RRI	Relative Risk Ratio
SDT	Second Demographic Transition
SRLB	Sex Ratio at Last Birth
TCA	Theory of Conjunctural Action
TFR	Total Fertility Rate
TV	Television
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
VCR	Video Cassette Recorder.

CONTEXTUALIZING THE BRAZILIAN FERTILITY TRANSITION

Until recently, policymakers in developing countries were concerned about the contribution of high fertility rates to rapid population growth and to poor urban and socioeconomic conditions (Bongaarts, 2001). Today, low fertility is a widespread phenomenon. More than half of the world's population lives in a country where fertility is below replacement level (Morgan, 2003; Morgan and Taylor, 2006). Brazil is now one of them (Potter, Schmertmann, Cavenaghi, 2002; Carvalho and Brito, 2005; Potter et al. 2010). Total Fertility Rates went down from 5.8 children per women in 1960 to 1.91 in 2010 (Brasil, 2010). This decline in fertility represents a cultural change without any foreseeable return, instigating the convergence of all social groups to smaller family sizes (Carvalho, 1998)[1].

Aside from distal factors such as economic development, modernization, industrialization, urbanization, mass education, rural exodus, and increased participation of women in the labor market, researchers attribute the primary proximate determinant of the decline in fertility to an increased usage of contraceptive methods, especially female sterilization (Curtis and Diamond, 1995, Potter, 1999; Potter, Schmertmann, and Cavenaghi 2002). Sterilization helped women restrict fertility at higher orders (Bongaarts, 1999) and caused a rejuvenation in fertility rates, which would be even more important for women without high

[1] Later, different requirements were put into practice to regulate sterilization, especially after research had shown how unnecessary C-sections were being used in order to obtain authorization and get the procedure and how in certain regions of Brazil, sterilizations were offered as an electoral good by politicians. For a complete review on sterilization in Brazil, see Caetano and Potter (2004).

school education (Alves and Cavenaghi, 2009). That, on top of the relative increase in the participation of low order births for the fertility rates caused a negative tempo effect inflating the Brazilian TFR (Miranda-Ribeiro, Rios-Neto and Carvalho, 2013).

Researchers found that 75% of women engaged in a conjugal union before age 24; and 75% of women who were sterilized did so before age 25. As a result, a significant percentage of women gave birth to all their children by age 30 (Miranda-Ribeiro, Rios-Neto and Carvalho, 2013), a very early start that seemed nothing like the profiles observed in Europe (Alves and Cavenaghi, 2009). As Bonifacio (2011) points out, what makes Brazil unique is that it was possible to achieve low fertility even with adolescent childbearing and an early age at marriage.

But a different phenomenon began to take place: the birth control pill gained traction as a method of contraception, and women no longer had to rely on irreversible methods to control their fertility, allowing women to wait longer to start having children and to space the births over time. They were also no longer tied to the obligation to have a minimum number of children before accessing contraception (Caetano and Potter, 2004).

Surprisingly, around the year 2010, researchers started to notice changes to Brazilian fertility rates. First, a reduction in teenage fertility rates was observed (Silva and Surita, 2012). Second, the tempo effect got closer to zero suggesting the stabilization of the mean age at childbearing (Miranda-Ribeiro, Rios-Neto and Carvalho, 2013). A small postponement of fertility for upper class and high educated women was also recorded. The mean age at childbearing changed from 28.7 to 30 between the years 2000 and 2007 (Alves and Cavenaghi, 2009).[2] The percentage of women having children by age 30 has been consistently decreasing ever since (Rosero-Bixby, Castro-Martín, Martín-García, 2009).

In Brazil, important differences persist regardless of the low value at the aggregate level. The total fertility rate in 2006 in Brazil reached 1.8, below replacement level, and fell to 1.1 for women with at least 12 years of education (Ministério da Saúde,2008). Those with 0 to 3 years of education still had a TFR of 3.14 children but with downward trends[3]. This polarized behavior is also a reflection of the high levels of inequality, despite the recent improvements. Brazilian HDI has shifted from 0.557 in 1985 to 0.633 in 1995 and to 0.699 in 2005. The most recent is of 0.730 in 2012 (UNDP, 2013).

Variations by region, income level and race/ethnicity have also been reported in recent years. White women had a TFR of nearly half a child less than blacks (TFT=1.53 for whites and 1.98 for blacks) in the year 2006. For the same year, women with a per capita income equal to 1/4 of the Brazilian minimum wage had a TFR of 4.8 in 2006, while women with a per capita income equal to the minimum wage had a fertility rate below replacement starting in the early 2000´s (Berquó and Cavenaghi, 2006). Other variations, such as regional disparities, are also pronounced. For example, inhabitants of the north region had a TFR of 2.28 while those of the south had a TFR of 1.69. Even controlling for socio-economic status, research indicates that regional differentials exist (Alves and Cavenaghi, 2009). The most recent census in the year

[2] Alves and Cavenaghi utilized a more recent dataset (Census and PNAD) when compared to Bonifacio (2011), who used the same data I am using, the Brazilian PNDS.

[3] Demographers even started to suggest that Brazilian fertility might follow three distinct profiles: a South-European, with a late start and very low levels (followed by women in the labor force who belong to the upper income group), an American profile (earlier fertility and around replacement rate followed by women with low or medium education levels), and a French profile (composed of women of high education with late start and 2 children) (Alves and Cavenaghi, 2009).

2010 confirms that regional differences are still remarkable, although the gaps have been narrowing (Miranda-Ribeiro and Garcia, 2012)[4].

Importance

That gaps between socio-demographic groups have been narrowing suggests that at the level of intention, fertility might not be as varied among social groups as outcomes are. It is possible that the degree of preference implementation is what has now been keeping women at different rates. While much descriptive analysis has explored fertility variation, other than unwanted fertility and tempo effect, little attention has been paid to what drives fertility differentials in Brazil and the mechanisms of these social influences. Thus, it is still unclear whether in Brazil younger cohorts seems to be having different aspirations and behaviors regarding marriage, family and career or if they are facing obstacles to achieving their desires.

By exploring fertility variation and its components across time in Brazil, this paper illuminates the factors that contribute to low fertility, how these factors combine to form the total fertility rate throughout the years and how they vary by socio-demographic characteristics (race, religion, education, geographic macro-region, and place of residence). This series of papers answer some questions that have remained open in the recent literature exploring the same topic (Bonifacio, 2011; Carvalho, 2014). Some of these questions pertain to socio-demographic differences in fertility (Paper 1), such as what makes less educated and rural women bear more children - do they still have higher fertility ideals or are there other factors influencing their

[4] For more information on Brazil´s fertility decline, see Carvalho and Brito (2005) and Alves and Correa (2003). For more complete descriptive data on Brazil´s fertility in the last decade, see Miranda-Ribeiro and Garcia (2012) and Alves and Cavenaghi (2009).

fertility rates? Other questions relate to the degree of preference implementation when women are faced with mediators between her desired family size and her actual behavior (Papers 2 and 3). The two factors that will be explored in depth in this work are gender preferences (i.e. the desired sex composition of your children) and competing preferences for motherhood (i.e. other life choices that compete with childbearing causing women to review her desired intentions downwards, such as prolonged education, career and lack of partner[5]).

In the following paragraphs, I will briefly introduce the Theory of Conjunctural Action and the Bongaarts Proximate Determinants of Fertility, which are respectively the theoretical and methodological frameworks I use to explore the determinants of low fertility in Brazil.

Theoretical and Methodological Frameworks

The Theory of Conjuntural Action

From a sociological perspective, the number of children a women will have during her lifetime is shaped by societal influences, but is also influenced by the individuality of biographies and the resources, or *materials*, through which women could successfully achieve their ideals. The Theory of Conjunctural Action (TCA) (Johnson-Hanks et al. 2011) explains this interplay. The mechanism through which the influences operate is defined as s*chemas,* the expected ideas and behavior one learns by induction or direct exposure overtime through socialization and interaction. Characteristics such as religious affiliation or place of residency provide women with different ideal family sizes and compositions.

[5] Morgan and Taylor (2006) also sees revising fertility upward as a possibility. One example I can think of is by joining a new religious group or falling in love with a man who wishes more children than yourself.

In Brazil, the ideal number of children seems to be contingent upon structural influences. For example, women in rural areas have higher desired family sizes when compared to urban women. In terms of gender preferences, schemas also help couples make reproductive decisions, for example, in rural areas sons are more useful than daughters, and so a couple might decide to continue childbearing until a son is born.

But since fertility has been going down and differences in population subgroups narrowing, there are reasons to believe that the desired family sizes and compositions are more similar among all segments of society, demonstrating either a weakening of societal norms or a convergence of schemas toward low fertility targets or replacement level. Nonetheless, the number of children ever born, or the total fertility rates, continue to be different among the various segments, suggesting that materials resources (e.g. resources), such as access and implementation of contraceptive methods, could have been more important in defining fertility than the social structures that govern this ideals. This explains, for example, how women with higher income have much smaller unwanted pregnancy rates, although they might have desired family sizes that are similar to their less educated counterparts'.

But the differences cannot be attributed solely to a variation in materials or schemas. The life course is embedded in a social context which brings about *conjunctures* that might affect existing plans and make, for example, women take different decisions than expected. While unemployment might delay fertility for some, it might be just the right excuse to start having children for others. "Demographic models of family change and variation have tended to assume that social actors have enormous freedom in choosing the form of their families (Becker, 1981; Bongaarts, 2001 in Johnson-Hanks, 2011 p. 17)". Thus, circumstances may as well shape behavior and also need to be taken into account. Since fertility is a path-dependent decision, what women imagine as an ideal number of children and how many children she ends up having can vary. It is their experiences prior, during and after each birth that will shape the final number of children ever born (Morgan and Taylor, 2006).

For instance, a qualitative study of Brazilian women identified several situations in which life didn't go as planned (Carvalho, 2014). In Carvalho's sample, while some women took longer than expected to get married, others ended up with unwanted pregnancies. In both cases, fertility didn't go as women had anticipated. Carvalho (2014) also finds, for example, that women changed their minds about the ideal number of children or ideal sex composition after having their first child or after getting married.

The Bongaarts Proximate Determinants of Fertility

Many theoretical and methodological models are available for researchers of low fertility (Morgan and Taylor, 2006). In 2001, Bongaarts[6] described a theoretical model that aimed at explaining fertility rates at the aggregate level (TFR) as a result of the multiplication of six parameters by the Desired Family Size (DFS). The first group of parameters is composed of factors that enhances fertility related to desired family size: *unwanted fertility* (F_U), *replacements for child mortality* (F_R), and *sex preference* (F_{SP}). The second group is composed of factors that decrease fertility related to desired family size: *rising age at childbearing* (tempo effect which would be the number of children that a women would have had if they had not waited, or the F_T), *involuntary infertility* (which includes the inability to have a child and also an inability to find a

[6] Bongaarts, J. (2001). Fertility and reproductive preferences in post-transitional societies. Population and Development Review, 27(Suppl), 260–281

suitable partner, the F_I), and *competing preferences* for child (set to 1 when childbearing is universal, the F_C). Thus,

$$TFR = DFS * (F_U * F_R * F_{SP}) * (F_T * F_I * F_C)$$

If woman realizes her fertility intention, TFR=DFS.

Different values for each parameter is what causes women that have the same fertility ideals to end up with different fertility outcomes. By exploring fertility variation and the different values for the above components across time it is possible to understand what has been driving fertility decline and how different socio-demographic characteristics (age, race, marital status, religion, education, geographic macro-region, and place of residence) behave in the presence of the same factors. Using decompositions and proximate determinant models has been proved to be a valuable tool to aide conceptualization, explore variations, revise theories and of course, produce what Morgan and Taylor (2006) call "what we know", or what all scientists can agree on regardless of their theoretical stand point.

By putting the TCA and the Bongaarts' framework together, I am claiming that desired family sizes are influenced by different schemas and thus it can be unique to socio-demographic characteristics. However, materials, conjunctures and other schemas will clash producing biographies that are unique, yet part of a multitude of trajectories that represents women's possibilities towards motherhood.

CHAPTER 1: AN APPLICATION OF THE BONGAARTS PROXIMATE DETERMINANTS OF FERTILITY FOR BRAZIL

INTRODUCTION

Until recently, policymakers in developing countries were concerned about the contribution of high fertility rates to rapid population growth and to poor urban and socioeconomic conditions (Bongaarts, 2001). Today, low fertility is a wide spread phenomenon. More than half of the world's population lives in a country where fertility is below replacement level (Morgan, 2003). Brazil is now one of them (Carvalho & Brito, 2005; Potter et al. 2010). The total Fertility Rate (TFR) went down from 6.16 children per women in 1940 to 1.9 in 2010 (BRASIL, 2012). Some internal disparities exist, however, regardless of the low value at the aggregate level. For example, in 2010, while fertility was 1.24 children per women for those with more than 12 years of education, those who had between 0 and 3 years of education had a TFR of 3.14 children. Other variations by region, income level and race/ethnicity have also been reported recently. White women had a TFR of nearly half a child less than Blacks (TFT=1.53 for Whites and 1.98 for Blacks) in the year 2006. For the same year, women with per capita income equal to 1/4 minimum wage, had a TFR of 4.8 in 2006, while women with per capita income equal to minimum wage, already had fertility below replacement in the early 2000´s (Berquó and Cavenaghi, 2006). Regional variations are also pronounced. Inhabitants of the North region had a TFR of 2.28 while those of the South had a TRF of 1.69. Even controlling for socio-economic status, these regional differentials remain (Alves and Cavenaghi, 2009) moreover the most recent Census, in the year

2010, confirms that these persist, although the gaps have been narrowing (Miranda-Ribeiro and Garcia, 2012)[7].

Determining the causes and consequences of the fertility transition and the fertility decline below replacement has kept many generations of demographers busy (Mason, 1997). Nevertheless, it is for a good reason. Scholars need to know variations in desired fertility but also how often people are able to implement their fertility preference and the reasons why observed fertility departs from desired family size. In contemporary developed countries it is common to find that desired family size is higher than total fertility rates (Bongaarts, 2001). Besides, the unwanted long term consequences of fertility below replacement, such as population aging and decreasing rates of growth that turn negative with time, could be problematic in some countries. European and some Asian countries, for example, start to feel the first signs of an unbalanced age structure. Lutz et al (2003) demonstrate that the effects so far have been small in Europe, but each additional decade that fertility remains below replacement represents a decline from 25 to 40 million people (in the absence of immigration or changes in current mortality rates).

Much of the decline might actually be an effect of postponement of fertility, as argued by Bongaarts and Feeney (1998), the so called “tempo effect”. If this is true, one might see reversals in fertility rates in the future, when women stop further postponement (Morgan, 2003). However, some of these women might not have time (or the desire) to “recuperate” postponed fertility and others might decide to never have children at all. Thus postponement can generate a “quantum effect” (Caldwell and McDonald, 2006; Lesthaeghe and Willems, 1999). In fact, research shows that changes do not seem to be only a timing effect, but a reduction in the number of births,

[7] For more information on Brazil´s fertility decline, see Carvalho and Brito (2005). For complete descriptive data on Brazil´s fertility in the last decade, see Miranda-Ribeiro and Garcia (2012) and Alves and Cavenaghi (2009).

which can have severe implications for the “lowest-low” fertility countries (Myrskyla et al. 2012).

Different from trends observed in Europe, Brazilian fertility remains early (Rios-Neto et al. 2005; Alves and Cavenaghi, 2009). In fact, Brazilian research suggests that any ‘tempo effect” might have been negative – a shift to younger ages at birth may have depressed the observed TFR (Miranda-Ribeiro et al. 2006). According to the authors, the mean age of childbearing that was 29.5 in 1970 dropped to 26.5 in 1994. Part of this decline is due to a decline in higher parity births as can be seen in Table 1.1 (borrowed from Bonifacio, 2011). That means the mean age at childbearing would be higher if women were continuing to have children throughout her reproductive life.

More than half of all women in the 20-25 age group were already mothers in 2006 (BEMFAM, 1987 and 1997; Ministerio da Saude, 2008). The same data shows that 25% of the women who got sterilized, did so before the age of 25, putting an end to their reproductive period at ages before women in Europe were having their first child. The only signs of postponement in Brazil are found among women of higher education levels[8] (Ministerio da Saude, 2008).

The mean age of childbearing has increased modestly in the last decade (Miranda-Ribeiro and Garcia, 2012). Drawing on Lesthaegue and Willems (1999) and after observing postponements for the second child, Miranda-Ribeiro and Garcia (2012) suggest that Brazil is entering the second phase of the demographic transition, where after fertility levels decline for all ages and parities, women start postponing fertility. The authors also suggest that there is an

[8] Among the more educated, the age decreased between the decades 1980 and 2000 and had a slight increase in the following decade, reaching 28.2 in 2010.

unexplored variation in fertility that should be understood if one wishes to predict Brazil's future fertility.

Factors associated with fertility decline could be different for each country, and the speed of the decline tied to each country's internal disparities. The substantial differences in the European transition makes studying low fertility in Brazil an opportunity to understand how interactions and changes in social institutions and in preferences shape Brazil's fertility. Thus, this chapter explores fertility variation and its components across time in Brazil, shedding light on the factors that contribute to low fertility, how they vary by socio-demographic characteristics (race, religion, education, wealth, geographic macro-region, and place of residence), and how these factors combine to produce the total fertility rate and its variation across groups and time period. My work uses the Demographic and Health Survey data from 1986, 1996 and 2006 to decompose Total Fertility Rates into parameters that represent factors that enhance or reduce fertility in relation to the values of desired family size using the framework provided by Bongaarts (2001). I will decompose the TFR for each year separately, and also decompose the TFR by socio-demographic characteristics. My work shows the usefulness of this method for understanding low fertility and its variation.

METHODOLOGICAL AND THEORETICAL FRAMEWORKS

The proximate determinants of fertility are the biological and behavioral factors through which social, economic and environmental variables, the so called "indirect" or 'distal' determinants, affect fertility (Bongaarts and Potter, 1983, p.1). Generally, these factors assess fertility in an environment where regulation is being deliberately practiced, thus the fertility rates depart from natural fertility. They were first described in a theoretical paper by Davis and Blake

(1956) and further developed by Bongaarts (1978) who was the first to introduce measurements to the proximate determinants.

In their application of the framework, Bongaarts and Potter (1983) conceptualized the Total Fertility Rate as being a result of natural fertility, multiplied by four parameters that would decrease it. The first parameter is age at first marriage, which identifies the onset of exposure to the risk of socially sanctioned childbearing, which could also happen during cohabitation depending on the country. This rate is impacted by the mean age at marriage, existence of marital dissolution, and proportion of the population who ever marries. The second parameter is contraceptive use. The prevalence, type and effectiveness of the method will affect fertility because some are more effective than others, usually depending on the amount of human action needed before the sexual act[9]. Thus, changes in the pattern of contraceptive behavior with age, time, and cohort will likely have an impact. Rate of Induced abortion is the third parameter. Note that abortion will not only prevent birth, but will make women return to ovulation quicker, so abortions do not avert full birth at population level, but half a birth. Duration of Postpartum Infecundability is the fourth parameter, which is estimated based on the duration of breastfeeding. Summing up, in a context of high fertility, the TFR is expected to be equal to the natural fertility in the absence of any form of regulation, or in other words, in the absence of those parameters. Note how it is possible that two populations with the same TFR could have different values for the parameters, which could help policy makers identify priorities and make better informed decisions.

[9] Condoms and spermicides, which requires action right before the penetration will have worse effectiveness when compared to sterilization, which is a once in a life time event, or the pill, which needs to be taken daily but it is not necessarily linked to the sexual intercourse. Intended fertility may also have an impact because choice of contraceptive may depend on the desire to have future children and in the desired birth interval, if any.

For contexts in which fertility is around or below replacement level, a new equation was put together in Bongaarts (2001). The reason why low fertility needs a separate model is because the main parameters of the Bongaarts and Potter (1983) proximate determinants are not as defining of fertility in a context of universal contraceptive use, abortion access, and disentangling of childbearing from marriage. So, when low fertility is a result of desire, factors such as marital fertility, natural fertility, and length of breastfeeding or biological maximum are crossed out from the vocabulary. This new approach and conceptual framework received the name of the Proximate Determinants of Low Fertility (Bongaarts, 2001). It is calculated in the same way as the one above, but its parameters are very different because they represent factors that enhance or decrease observed fertility relative to fertility desires.

There are now six parameters of the Proximate Determinants[10] that are responsible for fertility (TFR) being different from Desired Family Size (DFS) and for their variations over time. They can be divided into factors that enhance fertility relative to the desired family size and factors that reduce fertility relatively to desired family size (Morgan and Hayford, 2009). The first group of factors is composed of additional or surplus fertility due to *unwanted fertility* (F_U), *replacements for child mortality* (physiological replacement, volitional replacement, hoarding, the F_R), and *sex preference* (F_{SP}). The second group is composed of *rising age at childbearing* (tempo effect which would be the number of children that a women would have had if they had not postponed, or the F_T), *involuntary infertility* (which includes the inability to have a child and also an inability to find a suitable partner, the F_I), and *competing preferences* for child (set to 1 when childbearing is universal, the F_C). Thus,

$$TFR = DFS * (F_U * F_R * F_{SP}) * (F_T * F_I * F_C)$$

[10] For more information on what could affect each determinants and how they affect one another, see Bongaarts (2001).

If woman achieves her fertility intention, TFR=DFS.

This new methodological model dialogues well with a theoretical framework presented by the Theory of Conjuncture Action (Johnson-Hanks et al, 2011) which postulates that the desired family size and the number of children a woman will have during her lifetime is shaped by societal influences. The mechanisms through which these influences operate are defined as s*chemas,* the expected ideas and behavior one learns by induction or direct exposure overtime through socialization and interaction. They are also shaped by the *materials*, which are the resources that allow women to achieve their intentions.

But the differentials cannot be blamed solely on the differences in materials or schemas. The life course is embedded in a social context which brings about conjunctures that might affect existing plans and make, for example, women take different decisions than *a priori* expected. Thus, in addition to schemas and intentions, circumstances may also shape behavior and as such should also to be taken into account.

By putting the TCA and the Bongaarts' framework together, I argue that desired family sizes are influenced by different schemas that value smaller family sizes and are unique to socio-demographic characteristics. Thus, these major influences, when happen in regularity, can be conceptualized and measured at the aggregate level as the mean level of individual responses in order to understand what components of a society motivate behavior. Nevertheless, by understanding and conceptualizing a series of conjunctures that women cannot anticipate when reporting their Desired Family Size, the model is also useful to explain variability among social groups, or what "constrains" behavior, explaining fertility trends and differentials, shedding light on the fertility transition and explaining the mismatch between observed fertility and desired family size (Dharmalingan et al. 2014).

An article by Dharmalingam et al. (2014) applies the approach to Indian data. They used three waves of DHS to calculate rates and reconstruct family histories, desired family size, fertility preferences, contraceptive use and household economic conditions. In the case of India, the authors looked for factors that could account for the differences in desired and observed family size and the schemas that say that low fertility and small families are legit and desirable. While desired fertility has been decreasing over the years, unwanted fertility is still high and the use of reversible contraceptive is still low. They also found decrease in son preference, indication of transition from hoarding to replacement children mortality strategy - which could be a sign of mortality decline in general - , and strong tempo effect (increase of age at childbirth). As a result, largely cultural factors were blamed for the diversity in their TFR ranging from 4 to 1.8 births per women.

In the case of Brazil, the ideal number of children seems to be contingent on these structural influences; for example, women in rural areas have higher desired family sizes compared to urban women. But since overall fertility has been going down and differences in population subgroups are narrowing, there are reasons to believe that the desired family sizes and compositions are much more alike among all segments of society, demonstrating either a weakening of societal norms or a convergence of schemas toward low fertility targets or replacement level.

Some institutional changes that began to appear in the last decades could also have played a role in how women and couples plan their family schedules. For example, religious composition, such as increasing secularization and the decline of the influence of the Vatican[11]

[11] The number of self-declared Catholics in Brazil has declined precipitously in the past half-century. According to the 2010 Census, the percentage dropped from 95% in 1940 to 64.6% in 2010 (Brasil, 2012). The reduction in Catholics is attributed to an increase in the growth of Pentecostal churches, as well as an increase in the number of people without religious affiliation

could explain the increase in use of contraceptives which could lead to a decrease in unwanted fertility (F_U). The increasing participation of women in the labor market and increasing participation of women as household heads (37.4% of them were females in the year 2010) (Itaborai, 2003; PNAD s/d) could have made motherhood more complicated, reflecting an increase in the competing preference (F_C). Along with that, the possible effects of the expansion of the middle class and the relevant public policies such as cash transfers and increasing opportunities of college admission by means of education quotas for more social disadvantage youth (Rios-Neto, 2005) deserve further investigation. Increasing education and income might support new schemas that could decrease ideal family sizes. Other changes might also improve access to resources ("materials" in the TCA framework) that guarantee that new preferences be acted upon, such as access to contraception.

In the following paragraphs, I will present the TFR, the DFS and the six parameters contained in the Bongaarts (2001)'s Proximate Determinants of Low Fertility, as well as the methods I will use to estimate them. After decomposing the parameters, one will be able to understand how much of the decrease in TFR in Brazil is a change of preference possibly driven by ideational changes surrounding the meaning of childbearing (reflected in smaller DFS) or an inability of women to fulfill their reproductive expectations, possibly due to institutional changes or a lack of institutional change to accommodate new necessities of life.

(Coutinho and Golgher, 2014). In the same period, the proportion of Protestants increased from 3% to 22.2%, while those who self-reported themselves as without religious affiliation increased from 1% to 8% of the total (Brasil, 2012).

CONCEPTUALIZATION, DATA AND MEASUREMENTS[12]

Total Fertility Rate (TFR)

To measure Total Fertility Rate (TFR), I calculated the fertility rates of the last 3 years preceding the surveys – DHS and PNDS, (1986, 1996, 2006). The number of children born in the last 36 months is divided by the women-years lived of exposure age 15-49 by 5 year age group interval. Because in 3 years women might have been part of two different age groups, by using the technique of the Century Month Code, it is possible to take into account the contribution that women gave to each age group; for example, a women age 21 at the time of the interview had spent one year of her life at the age group comprised between 20 and 24 and two years in the group comprised of 15-19 years old, so she contributes with her "risk of having a child" to two different ages.

Desired Family Size (DFS)

Desired family size (DFS) is conceptualized as "target fertility" and is measured by the response given to the following questions, which are different for women who had and who had not had any children yet (includes current pregnant): "Se pudesse voltar atrás, para o tempo em que não tinha nenhum filho, e pudesse escolher o número de filhos para ter por toda a vida, que número seria este?", which translates as "if you could go back in time to the time when you did not have any children and could choose the number of children you could have throughout your

[12] Formulas were based on Dharmalingam et al 2014.Throughout the Results section, I will use footnotes to present new ways to calculate the parameters for future reference.

whole life, what number would it be?”, and “Se pudesse escolher exatamente o número de filhos que teria em toda a sua vida, quantos teria?”, which translates “if you could choose the exact number of children to have throughout your whole life, what number would it be?”. Women who answer “up to God” were excluded from the sample together with their births. Besides being a small fraction of the sample, they do not matter for the analysis since they do not have any target fertility. The desired number of children reported by all women will be averaged and the result will stand as the Desired Family Size (DFS). In the absence of longitudinal data that could capture preferences before the onset of pregnancy, it is important to keep in mind that target family size might be biased due to ex *post* rationalization, or women who adjust their preferred family size to the size of the family they have. However, if women were really rationalizing their responses, the DFS would equal the TFR. That is not the case.

Unwanted Fertility (F_U)

Many women report having more children than they wanted, especially in midtransitional societies. In many developing, countries this is the main reason why observed fertility exceeds desired family size. In postransional countries, as couples are increasingly able to implement their fertility preferences, unwanted childbearing is less sizable (Bongaarts, 2001).

Barros and Wong (2012) analyzed women of different union types in Brazil and found that the proportion that has ever used contraception is close to 100%. However, women in stable relationships have lower probability of using contraception, and for those who are low educated this proportion is even lower. Curtis (2012) evaluated Brazil´s contraceptive use and concluded that despite the near universality of contraceptive use, 29.7% of births in the five years before the 2006 PNDS were reported as mistimed (wanted later) and 17.8% were reported as unwanted

(Ministerio da Saude, 2008), confirming that this would be an important proximate determinant. This pattern is commonly found in other low fertility countries, which is a sign of contraceptive failure and inconsistent contraceptive use.

Lacerda et al. (2005) found evidence of unmet need for contraceptive in Brazil in the year 2002. They used the methodology developed by Westoff and Ochoa (1991) in which the group who has unmet need for contraception is composed of sexually active women who were not using contraception at the time of the interview, but had demonstrated desire to postpone or limit their childbearing. That includes pregnant women or women with amenorrhea for which the last pregnancy was unintended or untimed.

The first thing to have in mind when calculating unwanted pregnancy is the fact that the number might be underestimated because of *ex post* rationalization of children, and the stigma associated with reporting a child as unwanted (Dharmalingam et al. 2014). In the lack of longitudinal data that would allow for the capturing of *ex post* rationalization, the strategy used will be to consider as unwanted any birth of a living child in the last 36 months where the women responds that prior to getting pregnant she wished to have no more children. The question posed to the respondents is: “Quando ficou grávida do <nome da crianca>, estava querendo engravidar naquele momento,queria esperar mais, ou não queria ter (mais) filhos?”, which translates as “At the time you became pregnant with <name of child>, did you want to become pregnant then, did you want to wait until later, or did not want more (children) at all?”. The ratio of unwanted children born in the last 3 years to all children born in the last 3 years is added to 1 to be transformed into the first parameter F_u.

Replacement Effect of Child Mortality (F_R)

Parents "bear children not for the rewards accruing from the birth itself, but principally for the rewards expected to accrue from surviving children" (Preston, 1978, p. 9). Replacements for child mortality usually take three strategies: physiological replacement – refers to the rapid return to ovulation after death of child; volitional replacement – refers to having an additional child giving that one has died; and hoarding – having a high fertility due to the anticipation of a child loss). Preston (1978) discusses whether improvements in life expectancy and lower infant mortality contributed to the decrease in fertility given that the increase in the probability of survival motivated parents to control fertility. One of the possible mechanisms to improve survival was breastfeeding which delays return of ovulation, reduce environmental contamination, and increase birth spacing (Knodel and van de Walle, 1967).

Following Dharmalingam et al. (2014), the Total Replacement Effect (F_R) of child mortality on fertility is estimated by a technique proposed by Olsen (1980) and Trussell and Olsen (1983). First, they selected women aged 35-49 years, who, according to them, have already completed or are close to completing their fertility. Secondly, they selected the number of children ever born, n_i, and the number of children already dead d_i. Then, they estimated the proportion of dead children: $p_i = d_i / n_i$. After this, they regressed d_i on p_i and estimated the predicted values $E[d_i]$. Later, they regressed n_i on this predicted values.

The effect of the rate of replacement on fertility at the aggregate level is given by the replacement rate multiplied by the corresponding Infant Mortality Rate (IMR). The IMR was calculated by me using the same DHS and PNDS data for the years 1986, 1996 and 2006, for the years preceding each survey, and applying the same filters as for the groups being studied. If the replacement of fertility takes on a number of 10%, for example, the Index of F_R=1.10.

Sex Preference (F_{SP})

Parents may have a preference for a family of a particular size, and also of a specific sex composition. A commonly chosen family size is the one composed of two children, with one son and one daughter. If the number is achieved but the composition is not, parents may continue to have births, therefore leading to higher fertility (Bongaarts, 2001). Gender preferences are a tricky phenomenon because they usually make fertility higher in order to go toward one´s compositional goals. However, in contexts of low fertility, not many will endlessly have more births to realize a preferred gender composition. In some social contexts this “intensification” of sex preference might encourage sex-selective abortion. Sex selective abortion could allow woman to realize low fertility and a preferred gender composition.

According to Dharmalingam et al (2014), in traditional patriarchal institutions (e.g., India), sons are more valued than daughters for their greater economic utility and due sociocultural logic. In Latin America, as emphasized by Bongaarts (2001), this effect might be smaller, or even favorable to females or to a gender balance. Souza et al. 2011 found evidence that the probability of having a third child is higher for women whose first two children are the same sex, as described by Angrist and Evans (1998 in Souza et al 2011). For women who had two children of different sexes, the likelihood of having a third was 47.04% in 1990; while those who had two children of the same sex in the household had a 51.16% probability of having a third child. In 2000, the probabilities were 38.50% and 42.12%, respectively.

In the Brazilian DHS and PNDS, women reported the exact number of daughters and sons they would like to have in an ideal situation, the ideal sex composition of the household. They were asked: “Quantos destes filhos (as) você gostaria que fossem homens, quantos que fossem mulheres, e quantos não importaria o sexo?”, which translates to “how many of these children [desired number cited above] would you like to be male, how many to be female and how many of you would not care about the sex?”. Technically, this would be a good indication of sex preference; however, because desire does not always translate into accomplishments, and because there could be ex post rationalization, observed sex ratios at birth and parity progression are better indicators of the impact of sex preference on fertility (Bongaarts, 2013). Sex ratios at birth can tell whether women have been using any sort of sex selection mechanism, such as selective abortion. Parity progression, or Sex Ratio at Last Birth (SRLB), shows if the progression to the next birth depends on the sex composition of preceding births, a proxy for sex-selective stopping behavior. They are estimated by calculating the probability of having a second child giving the sex of the first, and the probability of having a third child giving the sex of the first two.

Although Bongaarts (2013) finds evidence of strong sex selection for male offspring’s in Asia, this is not the case in Brazil, where the only kind of abortion practice that is allowed by law is of those pregnancies due to rape or when they represent risk for the mother’s health. Besides, sex ratio at birth is considered at normal level, around 104 in 2010, so even if unsafe abortions are being practiced, which they are, they are not motivated by the sex of the child. Sex preferences in

Brazil can only be achieved through births of higher parity with the intention of household composition, reflecting in an increase of TFR when comparing with the DFS[13]

Dharmalingam et al (2014) operationalized this enhancing effect on fertility using the following procedure, which was based on estimating the counterfactual, "What would happen to fertility if all sex preferences were to disappear suddenly?" The authors propose to estimate whether or not a respondent wants an additional child by parity and sex composition of existing children[14]. The measure is defined by the following relationship: $\frac{\sum_i C_i P_i}{\sum_i P_i}$, where C_i is the lowest[15] proportion of individuals among the different composition who do not want any more children at each parity *i and sex composition*, and P_i is the number of persons at each parity and sex composition. The result of this division demonstrates the percentage of increase in TFR due to sex preferences.

Tempo Effect (F_T)

Historically, in the beginning of the twentieth century, the relative participation of women age 40 and over in childbearing was high since women continued to have children throughout her life. Thus, it was not unusual to see 45 year olds having babies, but those babies used to be of much higher parity. When birth control is intensified and fertility declines, women

[13] Analysis indicate mixed balance preferences, followed by daughter preference in Brazil. This is the topic of my second dissertation chapter.

[14] I used all children born alive, disregarding that some might have died and the mother could be trying to replace a certain gender.

[15] The wording is incorrect in the original article. It says "highest".

voluntarily stop childbearing because they have already fulfilled their reproductive goals (Morgan, 1991). So, births of women age 45 and over goes from 10% to 3-4% (Billari et al. 2007) in the United States. Later, when women start to delay fertility, the rates of births at age 40 more than doubled between 1971 and 2000, becoming even more common to have a late first birth (Billari et al. 2007).

Menken (1985) discusses the issue of delaying childbearing. Women have been delaying entrance into marriage, or waiting until they have achieved their personal goals before having a child. However, some will have to change their intentions, voluntarily or in involuntarily because of union disruption (Menken, 1985). As discussed above, postponements of fertility (tempo effect which would be the number of children that a women would have had if they had not postponed) affect fertility rates negatively and the reason why this happens is because despite the apparent simplicity of the TFR, it is subject to misinterpretation. The indicator is estimated with data from a specific period, i.e., from women aged 15 to 49 in the same year. If there is a rising age at childbearing, the estimates decrease the TFR because births of successive cohorts are spread over a longer time period, the tempo effect (Bongaarts, 2001).

The tempo (F_T) effect on fertility is calculated with the Bongaarts and Feeney (1998) method. The result is an adjusted TFR without postponement of fertility and done by parity specific rates.

$$TFR_i^{'} = TFR_i \ /(1-m_i),$$

Where $TFR_i^{'}$ is the adjusted TFR for birth order *i*, TFR_i is the observed TFR by birth order, and m_i is the annualized rate of change in mean age at childbearing at order *i* between the beginning and end of the period.

The total fertility rate is the sum of the fertility rates by birth order (see below).

$$TFR^{'} = \sum_{i} TFR_i^{'}$$

The ratio between the TFR and the TFR' will provide a percentage that represents the effect of postponing fertility (by pushing the mean age at childbearing) on the observed TFR. For the years 2006 and 1996, the rate of change in the mean age at childbearing were calculated using the previous survey. I used the 1996 to calculate the rate of those of 2006, and 1986 to calculate the rate of those of 1996. For the year of 1986, however, due to the absence of any prior survey from which I could derive the annualized rate of change, the change in the mean age at childbearing was calculated using the same DHS (1986), but investigating births occurred between 72 and 36 months before the survey.

Involuntary infertility (F_I)

Involuntary infecundity stands for the effect of the inability to have a child (physiological or disease-induced) and the effect of union disruption or the inability to find a suitable partner on fertility. Dharmalingam et al (2014) estimates this parameter by looking at the percentage of women in their last age group (45-49) who were childless (2%).

Ideally, one could separate both effects in two different parameters.

For the first parameter, one could easily evaluate whether a women is infertile by using a variable available in the DHS and PNDS surveys that inquired women about whether they did not have any child because they were infertile. It is equally easy to track if a women is old enough to be a mother, but have never been married or cohabited. A problem with the first measure is that perceived sterility might be higher than actual and the exaggeration of infertility might be a myth one has to break. Menken (1985) explains how couples nowadays are not trying long enough before they consider themselves infertile. In fact, if they had tried for at least two years, a large proportion of them would have got pregnant.

A problem with the second measure is that differently from India, marriage is not universal in Brazil, childbearing is often non-marital, and unmarried women are not expected to bear children, so many of them might not even know whether they could in fact bear children and their childlessness could be voluntary. Thus, this estimator might not fully represent the involuntary childlessness in Brazil and might not fully capture the socio-economic nuances that could impact involuntary infertility.

So, I will estimate the involuntary infertility based on the proportion of women aged 40-49 (or 40-44 in the case of 1986) who are or have been previously married or cohabiting and who have never had any child ever born. The proportion of women in the sample who fall into this category will be used as a parameter in the equation to decrease the value of TFR.

Although biological infertility could be higher for some social groups as demonstrated by Tavares et al. (2013) disease-induced sterility would be small in more recent years, and would only kick in after women achieved a certain age, by the time she had already had many children, so the values for the parameters should not be very different for all women[16]. Any differences between social groups will be more a result of social sterility (for example, some social groups might be more exposed to union disruption).

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[16] Tavares et al (2013) analyzed the female Disability-Adjusted Life Years (DALY) and concluded that there are many conditions (some of which are linked to childbearing) that could lead a women to have living or reproductive impairments. Some of these conditions are unsafe abortions, puerperal infection, and high blood pressure. Those could directly impact fertility rates in case a women acquired those conditions before setting an end to their reproductive life. Authors estimate that the incidence of infections, for example, is as high as 7.2% (usually set to 5% as it is common to perform C-section in Brazil where antibiotics are administered to patients as a prophylactic measure). Moreover, it is still difficult to measure the impact on fertility. Authors also found that those disabilities are worse for women who live in the most vulnerable regions of the state where the study was conducted, which confirms that biological sterility has social causes, such as poverty, lack of health care, among others.

Competing Preferences (F_C)

The article by Dharmalingam et al (2014) estimate that because marriage is universal in India, other life priorities should not influence fertility rates, so they set the value to the parameter to be equal to 1. However, I have enough evidence to believe that Brazilian women are feeling pressured by their other responsibilities and foregoing maternity more often than in the past. Following the suggestion of Dharmalingam (2014), a parameter Bongaarts (2001) called Competing Preferences will be measured as a residual of the equation TFR-DSF that cannot be explained by the other five parameters explained above:[17].

$TFR = DFS * F_U * F_R * F_{SP} * F_T * F_I * F_C$, where unwanted fertility (F_U), child replacement (F_R), and sex preference (F_{SP}) are above one, rising age at childbearing (F_T) can be below or above one, and involuntary infertility (F_I), and competing preferences (F_C) are below one.

Given $\frac{TFR}{DFS} = F_U * F_R * F_{SP} * F_T * F_I * F_C$,

I estimate the F_c factor with the residuals of the estimate:

$$F_C = \left(\frac{TFR}{DFS}\right)\left(\frac{1}{F_U * F_R * F_{SP} * F_T * F_I}\right).$$

In other words, how much of the difference between TFR and DFS cannot be explained by the parameters estimated in the equation.

Thus, competing preferences are conjunctures that will interfere with a women ability to have the children she desired and that will negatively impact her maternity prospects. For example, women who work and have to invest in their careers sometimes have to decrease their original

[17] Exploring Competing Preferences more in depth is the topic of my third dissertation chapter.

desired family sizes in order to climb the ladder at work. Other factors such as higher education aspirations and the pursuit of life goals are also examples of situations women not always anticipate when planning their desired family size. Although the wording "preference" makes it sound like women are happily choosing a new plan over the old one, this is not always true. Prolonged singlehood, inflexible work schedule, lack of affordable childcare are other situations might make a women think twice before getting pregnant, representing conjunctures that will make a women revise her fertility goals.

Competing Preferences seem to be an important factor shaping Brazilian fertility rates because motherhood is not universal and there are many factors that could compete with it. Several studies have documented the differences between mothers and non-mothers in terms of wage, type of occupation and labor force participation in Brazil. Paulo (2012) models the female hourly wage comparing mothers and non-mothers aged 22 to 34. Independent of education, non-mothers have much higher wage in the three periods analyzed (1984, 1988 and 2009), and the difference is higher for women of high education which suggest that the penalties and cost of opportunities is higher for these women. Junior (2008) found associations between occupation and fertility. Women who worked in positions of direction and managerial, as well as women with bachelor degrees in general, postpone fertility and tend to control fertility by parity much more. Women with low skill occupations tend to have a more "flexible" relationship with work, with worse pay and no benefits or formal contract of work. In those types of work, wages do not improve with experience, so women can leave for maternity and return with apparently low penalty to their careers (England, 1991 in Junior 2008). Santiago also found that high educated women have lower odds of having three children when compared to low educated, suggesting, once again, that women might think about the costs of opportunities.

Interestingly, Souza et al. (2011) investigated the effect of having children on the female labor participation by parity (1, 2, and 3) and found that children impact participation at every order, but the negative effect of first and second child became weaker with time, and the effect of high birth order (3) increased. This demonstrates how women would have children regardless of her labor participation. It is her career that will dictate her final parity.

Covariates

The TFR and the DFS, as well as the 6 parameters utilized in the framework, were explored according to socio-demographic variable hereby called covariates. They come from the two waves of the DHS (1986, 1996) and the PNDS (2006) and are factors that shape fertility intentions and outcomes:

a) Wealth Index: Continuous 5-level variable ranging from 0 to 4, being 4 the wealthiest category. See Appendix 1: Chapter 1 for details.
b) Predicted final education level: 0 to 3; 4 to7; 8 – 10; 11; and 12 or more. Estimated based on the probability that a women aged 15 to 24 would finish her current education level and enter the next levels of education until college. See Appendix 1: Chapter 1 for details.
c) Urbanicity or place of residence: 1=Urban, 2=Rural.
d) Geographic macro-region (North=1, Northeast =2, Southeast =3, South=4, Central-West=5 – except for 1986 for which Central West is added to North).
e) Religion (Catholic=1, Protestants=2, None=4).
f) Achieved Years of Education: 0 to 3; 4 to7; 8 – 10; 11; and 12 or more. Refers to the years of education at the time of the interview.

g) Race (White=1, Black and Brown=2). The DHS 1986 did not have a variable for race.

Data

I used data from the two most recent waves of the Brazilian DHS of 1986 and 1996 and the Pesquisa Nacional de Demografia e Saude of 2006. These databases are nationally representative, cross-sectional, and have the following sample sizes respectively: 5892, 12612 and 15575. Although the PNDS is not a DHS, it contains many of the same questions needed to decompose the fertility rates. I focus my analyzes on women (15-49) and their children born in the last 3 years. The DHS and the PNDS programs have developed standard procedures, methodologies, and manuals to guide the survey process and make countries and years comparable. Sample procedure for the DHS and the PNDS followed specifications of the *equal probability of selection method* (EPSEM) and the *probability proportion to size* (PPS).

The DHS 1986 was coordinated by Sociedade Civil Bem-Estar Familiar no Brasil (BEMFAM), and was inserted in a research conducted by the Demographic Health Surveys (Macro International Inc) and the Center for Disease Control (CDD, US). The DHS 1996 was coordinated by BEMFAM with the help of the Instituto Brasileiro de Geografia e Estatística (IBGE), Macro International Inc., Agência Norte Americana para o Desenvolvimento, UN Population Fund and UNICEF. The Pesquisa Nacional de Demografia e Saude (CEBRAP 2006), was coordinated by the Brazilian Center for Analysis and Planning, and the Brazilian Health Ministry and was funded by UNESCO. Data were collected in the five Brazilian geographic regions (four regions for 1986), in urban and rural areas, as well as urban slums. Original survey databases have already been published and are available at http://bvsms.saude.gov.br/bvs/pnds, and at http://dhsprogram.com/data/available-datasets.cfm.

I applied weights (v005) to expand the sample size when appropriate. Missing data for covariates was treated as random and deleted from the analyses.

RESULTS AND DISCUSSION

General model

A descriptive analysis of the sample can be found in Table 1.1. Although there are different sample sizes for the 3 DHS years and the socio-demographic groups, I opted for including all women in the analysis because of sample size and because missing values for the calculation of one parameter does not compromise the analysis of the others.

The values for the Total Fertility Rate, the Desired Family Size and for the six parameters for the Bongaarts Proximate Determinants of fertility for each year and socio-demographic groups can be found in Table 1.2. When the factor helps to increase fertility, parameters will take the values higher than 1. When impacting negatively, they will take the value below 1. The most powerful the parameters are, the further from 1 their values are going to be.

The box below (Box 1) presents the amount of variance explained, the value of the r-square, with the inclusion of each parameter by survey year. The unit of analysis is each socio-demographic group studied. These were obtained by a step-wise regression of the TFR with forward selection of the remaining parameters in the following order: *Desired Family Size* (DFS), *unwanted fertility* (F_U), *replacements for child mortality* (F_R), *sex preference* (F_{SP}), *Tempo effect* (F_T), *involuntary infertility*, and *competing preferences* (F_C).

Box 1: Explained variance with model parameters, 1986, 1996 and 2006

TFR	1986	1996	2006
DFS	0.573	0.387	0.459
$DFS \times F_u$	0.848	0.788	0.694
$DFS \times F_u \times F_{sp}$	0.882	0.794	0.727
$DFS \times F_u \times F_{sp} \times F_r$	0.883	0.852	0.740
$DFS \times F_u \times F_{sp} \times F_r \times F_t$	0.891	0.858	0.740
$DFS \times F_u \times F_{sp} \times F_r \times F_t \times F_i$	0.907	0.867	0.741
$DFS \times F_u \times F_{sp} \times F_r \times F_t \times F_i \times F_C$	1.000	1.000	1.000

As can be seen, a great deal of the variance can be explained by adding those parameters to the model (r-squares are 0.91 for 1986, 0.87 for 1996 and 0.74 for 2006) which suggest that the Bongaarts model works well for Brazilian data. All parameters seem to contribute well for the explanation of the TFR, however, after family size preferences, unwanted fertility adds the most predictive power to the model, followed by competing preference estimated as a residual. Note how the importance of this residual grows over time, suggesting the necessity of studying it more in depth and finding new ways to estimate it.

Parameters

The first thing to be observed with Table 1.2 is the fact that there is a reversal between fertility outcome and fertility intentions represented by desired family size, as predicted by Bongaarts (2001) and as expected, since this is a characteristic of a society undergoing fertility transition. Brazilian women start the period having more children than they desire, and finalize the transition having fewer children than they wish. In general, women in 1986 wanted 2.79 and were having 3.21 children, in 2006 they wanted 2.1 but were having 1.87.

Below, I will discuss the main findings for each parameter separately. Graphs will be utilized to summarize each of them to facilitate the interpretation and illustrate the findings, shedding light on what might be behind the reversal between intentions and outcomes, and the disparities that have existed or persisted within social groups.

1 -Total fertility rates in Brazil

In Brazil, between the years 1986 and 2006, the TFR dropped from 3.21 children per women to 2.49 in 1996 and to 1.87 in 2006 as can be seen in Table 1.2.

By analyzing levels of TFR according to social groups, one can see that fertility is closely tied to wealth: the largest the wealth group, the lower the fertility. However differences have been narrowing. For example, women of the lowest wealth index had a TFR of 6.39 in 1986, but it was down to 2.84 in 2006. The richer group started with a TFR of 2.05 in 1986, and in 2006 are close to 1 child per women.

The decline in time happened for all social groups, with the exception of Middle School. They declined from 2.33 to 1.85 followed by a small recuperation to 1.99.

It is clear that those with the higher fertility in the beginning of the period are the ones for whom the rates have declined the most, showing a clear sign of convergence around replacement level. In spite of that, fertility continues to be higher for those with low education, low wealth index, those who live in rural areas, in the North and Northeast macro regions, and for Blacks. Those without religious affiliation used to have the highest fertility among religious groups (4.22 in 1986), but then converged to lower levels.

All four macro regions were above the replacement level in 1986 and slightly above in 1996. In 2006, three of them were below replacement, and only the Central-West and North region showed values slightly above replacement.

It is important to notice that although education and wealth are associated and many of the fertility trends are the same, the relationship is not perfectly linear, which produces different estimates for both when analyzing the parameters. In fact, the Kendall's tau-b measure of association is of 0.46 in 1986, 0.42 in 1996 and 0.37 (ASE<0.01), possibly reflecting the fact that education has become less selective over the years with the increase in mean level of education for the Brazilian population. Because this is not a multivariate analysis, comparisons between two social indicators (for example, comparing high educated with high wealth) should be done with extreme caution because these might contain the same group of people. So, I will only make comparisons within these groups.

In the following paragraphs, the presentation of the results of the other parameters will help explain the differences in TFR among other social groups.

2 - Desired family size

There is a clear tendency toward decline regarding Desired Family Size (DSF), as can be seen in Table 1.2. It is easy to conclude that the most important driver of the decline in TFR is women's desire to have smaller families. Although the value declined from 2.79 to 2.10, the most popular family size continued to be 2. The percentage who answered 3 children declined from 25% in 1986 to 15% in 2006. The percentage who desired 1 increased from 10% in 1986 to 15% in 2006 (*percentages not shown*). This finding is consistent with evidence from other countries that shows that as TFR declines, DFS remains around replacement level (Bachrach, 2001; Morgan, 2001).

Desired family size declines steadily as education and wealth increase, and from year to year. For example, in 1986 it varied from 3.13 for the lowest wealth index and 2.70 for the higher. Put into a time perspective, DFS also seem to converge around replacement level: in 2006, women's preference was for a 2.34 fertility for the lowest wealth index and 2.11 for the higher.

An interesting phenomenon seems to occur for women of the highest levels of education (both predicted and achieved): while DSF decreases with education until High School (1.92 in

2006), women who have proceeded to higher levels of education (college or beyond) have the desire for more children (above 2.10). These could be related to expected improvements in income – highly educated women might know they could afford more children, so they want more children. However, when one looks at their fertility rates, these women are having fewer children than the other groups.

A second hypothesis is that women who proceed to higher education levels have the desire for more children because they are part of a selected group who sees beyond the economic value and costs of children and could be motivated by other ideational reasoning surrounding motherhood, such as personal fulfillment. In this case, the schemas of motherhood being fulfilling could be more important than the schemas of smaller family sizes.

Another hypothesis does not explain why they would want more children, but explains why they end up having fewer. College women might face conjunctures that compete with childbearing, like career and prolonged education. The estimates for competing preferences (as will be explained later in this chapter), strengthens this hypothesis. High educated women have one of the highest values for competing preferences, which impacts the fertility rates.

The relationship between DSF and urbanicity was as expected. Inhabitants of urban areas not only have fewer children than rural areas, they also wish smaller family sizes. These could be explained by the fact that rural areas might have fewer obstacles to have a larger family, such as more space, less violence, cheaper costs of living, agricultural and familiar work, among others. Paulo (2012) also had found that the motherhood penalty is more severe for mothers in cities. The values for competing preferences in the case of this chapter, for example, are much lower for rural areas.

Region does not seem to be an important source of variation for desired family size, with the exception of the Center-West for more recent years, a largely agrarian region.

Some interesting fact is the difference for DSF regarding religion. People without religious affiliation have lower values for desired family sizes at every year. It is possible that the Christian doctrine “grow and multiply” is really making a difference regarding family formation by valuing schemas of bigger family sizes.

Race does not seem to be an important source of disparities for ideal family size. Both Whites and Blacks wish to have the same number of children in 1996 and 2006, so the differences in TFR between the two groups have to come from some other parameter. Unfortunately, race was not contemplated by the survey in 1986.

Once again, the most important findings is that the values for desired family sizes get closer to the value of the TFR in the year 1996 and then depart from it in the year 2006. The difference between the two in number of children can be observed in Figure 1.2. The main reproductive concern of Brazilian women, which used to be how to be able to regulate their fertility to meet their reproductive goals, have changed to being able to have all the children they have planned.

3 - Unwanted fertility

Although unwanted fertility has declined in every year for every social group, it is still very high, in accordance with the findings from Curtis (2012). The value declined from 34% to 19% of all children born in the last 3 years preceding the surveys. The different levels of unwanted fertility seem to be behind the different TFR of the social groups, representing the different levels of materials (resources) that each socio-demographic groups have available.

As expected and can be seen in Table 1.2 and Figure 1.3[18], this percentage is improving, but is higher for women of low education level (predicted and achieved) and low wealth index, also in agreement with what Barros and Wong (2012) had found. The lowest proportion of unwanted pregnancy is in the South (better averages in terms of economic development) and much lower for women of higher educational level and higher wealthy index. These numbers confirmed what the literature has demonstrated, that education and wealth can facilitate access and information about contraception. They are also important to show how sexual and reproductive health should continue to be a priority for governments and policymakers.

No religious differences were found in unwanted fertility, so the theory that secularization has improved access to information and utilization of contraceptives cannot be supported. The existing differences in TFR according to religion must come from some other parameter.

Blacks' and Whites' rates of unwanted childbearing have declined and differences between the races have narrowed. This improvement, together with the improvements for low wealth and low educated could be a result of the reproductive health policies that were implemented in Brazil in the last decades such as free distribution of contraceptives, awareness campaigns and even the high rates of sterilization (Caetano, 2004). Some of these policies were specially design to target minorities and low income women in order to spread the knowledge that the smaller families are more successful (Amaral and Potter, 2015).

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[18] Note how the values for unwanted fertility hereby analyzed and available at Table 2 are actually underestimated. As stated in the Methods section, Dharmalingan et al (2014) utilizes the percentage of unwanted children as the Bongaarts Parameter because, according to them, the percentage unwanted should be added to 1. Suppose that 30% of children were unwanted:
30/30+70=0.30 + 1= 1.3
Thus, for Dharmalingan et al. (2014), if 30% of the children born in the last 3 years are unwanted, the Fu parameter that should be used to multiply DFS equals to 1.3.
However, if 30% of the children is unwanted, that means that the proportion of unwanted children over the children who were wanted is actually much bigger:
30/70= 42.8,
So the DFS should be increased by 42.8%, not 30%, and the Fu parameter should be of 1.428.
In addition, there are other measures of unwanted fertility that could have been used, such as Unwanted Fertility Rates. In order to keep comparability with Dharmalingan et al (2014), I utilized the same measurement.

Regarding macro region, unwanted childbearing has decline is all of them, with the exception of the North, where it has increased slightly from 1.16 to 1.21. As has happened with some states in the analysis of Dharmalingan (2014), it is common to observe a decline in unwanted births for places that are more advanced in the transition, but it is even more common that in a first moment, especially in the middle of the fertility transition, to observe an increase in unwanted pregnancies – since women need to feel the necessity of controlling fertility before actually beginning to control. The higher TFR for rural could also be explained by the larger value for unwanted fertility, an indication that they might lack access to contraceptives.

These findings are of extreme importance for research because it shows Brazil still has a long way to go in regards to sexual and reproductive health. This finding is also relevant because as fertility is already low, further increases in economic development and education levels could reduce unwanted fertility by increasing access to materials (resources) such as information and access to contraceptives, and consequently, reduce fertility rates. Unless, of course, women of higher education level are able to have the surplus children they plan. Policymakers should be attentive to this findings, as this could be the hope for an aging country.

Although Unwanted Fertility seems to be picking up the effect of Sex Preferences (because a women might be more likely to declare a birth as unwanted if it's a different sex than she wished), the two parameters are not associated. The values for the Pearson correlation among them by year are: 0.17 (1986), -0. 20 (1996) and 0.37 (2006).

4 - Child replacement

The results for the effect of child mortality and replacement on fertility at the aggregate level for the three years and the social groups can be found in Table 1.2 and in Figure 1.4. The value is in decline for all groups from 1.08 in 1986 to 1.03 in 2006, which means that mortality no longer plays an important role in the number of children ever born by women. In fact, infant mortality rates dropped from 69.18 per thousand in 1986, to 37.5 per thousand in 1996 to 24.9 per thousand in 2006.

My findings thus suggest that mortality and subsequent replacement do not explain much variations in levels of TFR for the 3 survey years and most children are surviving. So the schemas that regulate fertility behavior and norms in case of high mortality (i.e.: by having extra children) will start to disappear from women's minds soon, if haven't done so.

5 - Sex preferences

At the country level, desired sex composition of the offspring does not seem to significantly impact the fertility rates of women. The estimates are around 1.04 in Table 1.2[19]. However, the parameter might help explain variations within social groups. The numbers should be observed with caution due to the potential inflation effect caused by the small sample sizes certain population groups for each parity and composition.

When they are analyzed separately, it is easy to perceive that the sex composition has helped to keep fertility at different levels, at least for some groups of women. This is the case for

[19] Note how the values for Sex Preference hereby estimated and available at Table 2 are overestimated. As stated in the methods section, Dharmalingan et al (2014) estimated sex preference using the number of persons at each parity and sex composition. I argue that the formula utilized should be as follow: $\frac{\sum (C_{ii} - C_{ij})P_{ij}}{\sum (1 - C_{ij})P_{ij}}$ where C_{ij} is the lowest proportion of individuals among the different composition who do not want any more children at each parity I based on the sex composition and C_{ii} is the highest proportion of individuals among the different composition who do not want any more children at each parity *i*. Therefore, $(C_{ii} - C_{ij})$ is the proportion of children for each composition and parity that are only wanted due to unmet sex composition. If one adds those children who only are desired due to the sex composition of their previous siblings for each parity, $\sum (C_{ij} - C_{ii})P_{ij}$, one will observe that the total is the number of children that are wanted only because their parents did not achieve their desired composition. This number, divided by the total number of wanted children, will tell how much of the DFS is increased by sex preferences.

women without religious affiliation, for the Northeast region, for the lowest wealth group and for 5-8 years of education in 1986, even though the effect seems to be reduced in the most recent years. In 1996, the effect of sex preferences seem to lower down, but women of the highest predicted education group pick up a large effect possibly due to small sample sizes at parity of 3 children and because fertility is very well controlled for this group, so whatever children are being born in excess, it possibly has more chances of being due to sex composition than unwanted pregnancies. In 2006, the large values for low educated women are in evidence.

6 – Tempo Effect

Table 1.2 also brings the values for the parameters of Tempo. Due to its specificities, it is worth mentioning that that tempo effect in Brazil could help inflate or deflate the fertility rates as can be seen in Figure 1.6. When tempo is below 1, women are postponing fertility, which means the mean age of childbearing by birth order is increasing. When tempo is above 1, women are having children earlier when compared to previous decades. In average, the Brazilian population is anticipating their fertility, but it is important to notice that some groups of women, such as the low educated who have always had a very low age at the time of having their first child, are now beginning to postpone having children– or, to be more specific, they are moving their first child from adolescence to early adulthood. This could be reflecting new schemas being presented to them, such as the necessity of prolonged education, or simply, the attempt of authorities to make more resources available for teenagers to prevent pregnancies.

It is also possible to see an inversion in the effects of education: in 1986 and 2006, increases in education meant early fertility, but in 2006, women of all levels of education started to postpone having children.

There are two explanations for this finding. The first is that women in Brazil, in contrast to Europe, have their children early and start to limit their fertility in their early adult years, instead of postponing their fertility. While highly educated would stop, poor women would continue to have children, giving the impression that fertility was early for high educated. The other explanation is that all women are stopping their reproduction at lower parities and not necessarily moving to the third or fourth child. This agrees with the findings from Ministerio da Saude (2008), and the relatively low mean age at childbearing for some groups means that there is potential for continuous decline.

7 - Infecundity and Involuntary Childlessness

Unable to estimate biological involuntary infertility, I estimate the proportion of women who are or have been previously married and never had children ever born. Table 1.2 show the results for the three years. Notice that the value of the parameters seem to be stable over time and without larger, significant differences when all groups are compared (around 0.95). This is a conservative estimate as it is assumed that all married women wanted to have children.

While the parameters stay around 0.95 for all groups and years, for the highly educated it goes down to 0.83 in 1986 as can be seen in Figure 1.7, showing that this estimate is capturing the effect of another parameter besides biological infertility. This is because biological sterility should not be sensitive to any schema, resources or conjunctures. It should be equal in all groups or maybe higher for low educated and low wealth according to Tavares et al. (2013). I argue that this difference for highly educated is capturing the effect of social infertility (union interruption or inability to find a suitable partner), or even competing preferences. This certainly helps explain some of the differences in TFR for highly educated compared to other groups.

This fact alerts to a necessity of creating a different parameter to estimate involuntary childlessness in future works, especially because I have observed a decrease in fertility rates and it is possible that many couples who are married do not want any children.

8 - Competing preferences

So far, I have discussed six items in the equation proposed by Dharmalingam et al (2014) to explain the unexpected differences between actual TFR and DFS also described by Bongaarts (2001) with the exception of competing preferences. These parameters have helped to elucidate what the main sources of differences regarding TFR among social groups are, but some of the difference remains unexplored.

The estimated values for the F_C parameters can be found in Table 1.2 and observed in Figure 1.8. It is important to remember that because the F_c value depart from 1 on a negative basis (the higher the competing preference, the more negative the number is), higher values of competing preferences produce smaller F_c values. Note how this value is more negative for higher wealth index and high education. Recently, women have increased their rates of participation in the labor market, and have also been more responsible for households (Itaborai, 2003; PNAD s/d). Findings using data from the decades between 1990 and 2010 has found that children substantially decrease a women's participation in the labor market (Souza et al. 2011).

The same authors also found that the effect of the birth of the first child had a stronger effect on a mother's labor market participation in 1990 than in 2000. They do not find much of an effect for the birth of the second child in 1990, suggesting that families would make an adaptation in order to foster an economy of scale. In 2000, however, the second child starts to have a significant impact..

Inhabitants of urban areas also have more competing preferences because having a child implies higher costs, and requires someone to stay home with the baby or provide childcare. In 2006, however, the values become the same. It is also more negative for Whites and for members of Protestant religions in 1996 and 1986, but because this is residual in the Bongaarts model, there are other latent variables that could be playing a role in the competing preferences for these groups. Likewise, it is troublesome to compare values for the residual over time because the residual in 1986 could be picking on the effect of other variable that do not exist in 2006, for example.

No significant trend can be observed by geographic region.

While the exploration of Competing Preferences will be done in a future chapter, I finish this analysis by plotting the residual of the equation hereby called Competing Preference against common competing factors: years of education. In the graph below (Figure 1.9), the population mean values for years of education for each socio-demographic characteristic (i.e. Black, Catholic, Rural) were plot against their correspondent value for Competing Preference (F_c) available at table 1.2 for the three survey years.

One can see how plotting the residual (F_c) with their correspondent population mean of years of education produces a negative linear correlation. That means the higher the mean level of education of a certain socio-demographic group, the lower their F_c value (the higher the competing preference).

Figures 1.10, 1.11 and 1.12 bring the F_c values plot against population means for the years 1986, 1996 and 2006 separately.

In Figures 1.10, 1.11 and 1.12, notice how the relationship between mean years of education and competing preferences has become more flat in 2006. This factor either means that education attainment has become less competitive with fertility over time (women of all levels of education are able to maintain their desired fertility rates), or that education attainment has become less selective (more women are achieving higher levels of education). Future papers will illuminate competing preferences and look for better ways to measure and understand its influence.

CONCLUSION

I analyzed fertility transition in Brazil using the low fertility model idealized by Bongaarts (2001), modelled by Dharmalingan et al (2014), under the lenses of the Theory of Conjunctural Action (Johnson-Hanks et al, 2011). In summary, fertility in Brazil is declining quickly and has been below replacement level since the first decade of year 2000. The desired number of children is also declining, but less remarkably, and can be considered the main factor behind the decline of the TFR representing an overall schema for smaller family sizes.

In the period between 1986 and 2006, a qualitative change in fertility occurred in Brazil, as women used to have more children than desired and then they have fewer. While DSF decreases with education until High School, women who have proceeded to higher levels of education (college or beyond) have the desire for more children.

The relationship between fertility and Tempo is a complex one. At the same time it is possible to observe postponements, especially for groups for which the fertility was very low, one observes a stopping behavior at low parities that might be the responsible for the negative tempo effect. For the first group, schemas of small family sizes and schemas that contribute to the importance of education and career might be causing women to put family plans after personal goals. For the second group, women who have their first child at a very early age (such as during teenage years) might face conjunctures that make them assertive regarding their fertility behavior and stopping fertility early.

Among the six factors proposed by Bongaarts (2001), unwanted fertility is still the factor that most contributes to a surplus number of children. Unwanted fertility, which reflects a lack of access to materials and resources that allow a woman to control her reproductive behavior, continues to be lower for the highly educated and for women in the highest wealth groups. This suggests that education and wealth are the most important parameters for fertility across various social groups. Further increases in economic development and education levels could reduce unwanted fertility, and drop fertility rates even more. Unless, of course, women of higher education levels become able to have the children they consider to be ideal.

Competing preferences also seem to be an important factor behind women not achieving their desired number of children, especially women of higher education. Literature suggests that these trends are associated with socio demographic changes in Brazil, such as modernization, urbanization, increase in schooling levels, increase in the proportion of uniparental households, increase in the participation of females in the labor force, among others, which could be another sign that fertility could go even lower. Thus, policymakers should look at the necessities of different groups to make sure reproductive goals are met. In this paper, competition was measured as a residual of the equation, but future work should explore this parameter further, looking for better ways to measure it. Future work should also consider more deeply the conjunctures, or the reasons why women revise their goals, considering whether it refers to the pursuit of life goals (competition) or to systematic social constrains (constrains), such as lack of affordable childcare or discrimination against mothers in the workplace. In the lights of the TCA, research should also add another parameter, one that allows women to revise her goals upwards, such as the effect of a new relationship after a divorce, the use of reproductive technology that increases chances of having twins, etc.

Demographers could also use the Bongaarts' (2001) model to predict how changes in a certain population parameter could affect fertility, for example, level of education. If the mean level of education increase, how much less unwanted fertility can we expect? On top of that, how would the Competing Preferences decrease fertility even more? The existing TFR is not only a change in preference in ideal family sizes, but an inability of women to fulfill their reproductive expectations. Nevertheless, it is somehow a relief to know that women continue to wish to reproduce around replacement level and solving the issues of fertility in Brazil is just a matter of reproductive rights and opportunities.

As a conclusion, this useful framework has been proven valuable for understanding variation in transition and post-transition fertility. As reported by Dharmalingan et al (2014), the Bongaarts Proximate Determinants of Fertility posits that fertility is driven by a series of components and those different components could be responsible for different fertility rates. The model seems to be working well given that the parameters together account for between 70 to 90% of the observed variation in TFR across time. The results are also consistent with fertility trends observed in the literature, helping to tell a story of overall fertility, but with some specific differences according to social-demographic groups related to different levels of the specific parameters being measured.

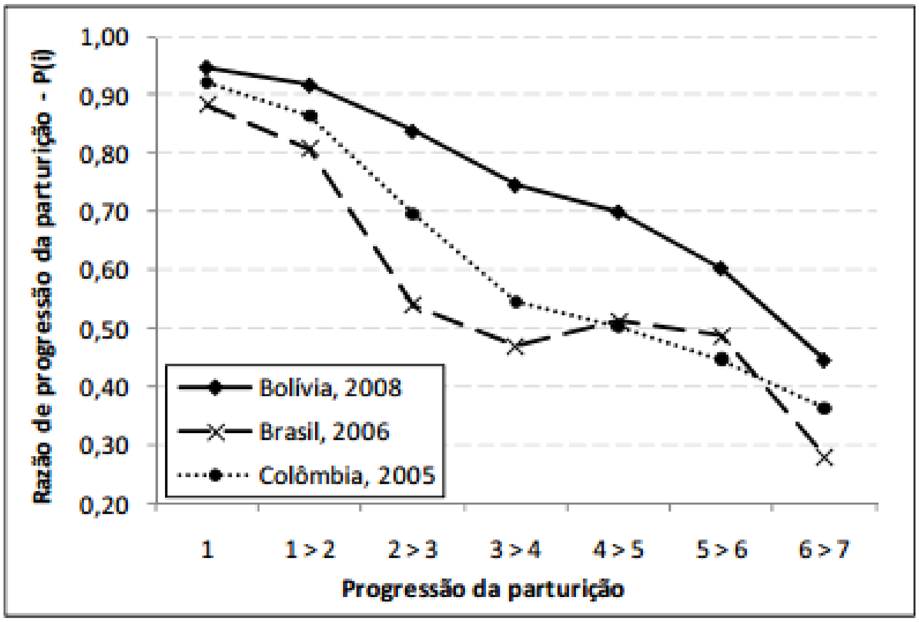
TABLES

Table 1.1: Characteristics of the Brazilian DHS 1986 and 1996 and PNDS 2006 samples utilized in this chapter.

		1986			1996			2006		
		n	%	cum %	n	%	cum %	n	%	cum %
Wealth Index	0	906	15.38	15.38	1,356	10.8	10.8	1,159	7.44	7.44
	1	976	16.56	31.94	2,883	22.97	33.77	1,972	12.66	20.1
	2	2,242	38.05	69.99	3,587	28.58	62.35	3,894	25	45.1
	3	935	15.87	85.86	2,317	18.46	80.81	5,743	36.87	81.98
	4	833	14.14	100	2,409	19.19	100	2,807	18.02	100
	Total	**5,892**	**100**		**12,552**	**100**		**15,575**	**100**	
Predict final level of education	0 a 3	1,787	30.33	30.33	3,052	24.21	24.21	2,076	13.34	13.34
	4	1,963	33.32	63.65	4,473	35.48	59.68	4,237	27.23	40.57
	5 to 8	781	13.26	76.9	2,085	16.54	76.22	3,048	19.59	60.16
	9 to 11	872	14.8	91.7	2,129	16.89	93.11	4,263	27.4	87.56
	12 or more	489	8.3	100	869	6.89	100	1,935	12.44	100
	Total	**5,892**	**100**		**12,608**	**100**		**15,559**	**100**	
Urbanicity	Urban	4,514	76.61	76.61	10,254	81.3	81.3	11,062	71.02	71.02
	Rural	1,378	23.39	100	2,358	18.7	100	4,513	28.98	100
	Total	**5,892**	**100**		**12,612**	**100**		**15,575**	**100**	
Macro Region	North	709	12.03	12.03	1,340	10.62	10.62	2,594	16.65	16.65
	Northeast	1,792	30.41	42.45	4,772	37.84	48.46	3,166	20.33	36.98
	Southeast	2,545	43.19	85.64	3,523	27.93	76.4	3,343	21.46	58.45
	South	846	14.36	100	1,571	12.46	88.85	3,310	21.25	79.7
	Center-West				1,406	11.15	100	3,162	20.3	100
	Total	**5,892**	**100**		**12,612**	**100**		**15,575**	**100**	
Religion	Catholic	4,768	80.92	80.92	9,808	77.77	77.77	10,201	65.58	65.58
	Protestant	521	8.84	89.77	1,832	14.53	92.29	3,478	22.36	87.94
	Other	190	3.22	92.99	380	3.01	95.31	730	4.69	92.63
	None	413	7.01	100	592	4.69	100	1,146	7.37	100
	Total	**5,892**	**100**		**12,612**	**100**		**15,555**	**100**	
Years of education	0 a 3	1,803	30.6	30.6	3,094	24.54	24.54	2,094	13.46	13.46
	4	2,063	35.01	65.61	4,605	36.52	61.06	4,443	28.56	42.01
	5 to 8	915	15.53	81.14	2,264	17.96	79.02	3,726	23.95	65.96
	9 to 11	740	12.56	93.7	1,899	15.06	94.08	3,722	23.92	89.88
	12 or more	371	6.3	100	746	5.92	100	1,574	10.12	100
	Total	**5,892**	**100**		**12,608**	**100**		**15,559**	**100**	
Race	White				4,890	38.82	38.82	5,987	38.8	38.8
	Black				7,674	60.92	99.75	8,638	55.97	94.77
	Other				32	0.25	100	807	5.23	100
	Total				**12,596**	**100**		**15,432**	**100**	

Table 1.2: Values for the parameters of the Bongaarts Proximate Determinants of Fertility calculated for Brazil with the DHS 1986 and 1996 and PNDS 2006.

	TOTAL	Wealth Index					Predicted final education level					Urbanicity		Region					Religion			Years of Education achieved					Race	
		0	1	2	3	4	0 to 3	4	5 to 8	9 to 11	12 or more	Urban	Rural	North	N.East	S.East	South	C.West	Cat.	Prot.	None	0 to 3	4	5 to 8	9 to 11	12 or more	White	Black
TFR																												
1986	3.21	6.39	4.04	2.59	2.19	2.05	5.26	2.81	2.33	1.94	1.64	2.72	4.77	3.18	4.77	2.60	2.63		3.19	2.95	4.22	5.30	2.75	2.23	1.90	1.64		
1996	2.49	4.91	3.31	2.17	1.94	1.69	3.93	2.75	1.85	1.68	1.51	2.30	3.37	2.54	3.03	2.22	2.32	2.27	2.56	2.19	2.88	3.93	2.69	1.80	1.69	1.58	2.23	3.06
2006	1.87	2.84	2.23	2.12	1.73	1.02	3.18	2.52	1.99	1.20	1.01	1.83	2.03	2.34	1.85	1.78	1.71	2.17	1.84	2.00	1.94	3.11	2.35	1.73	1.74	1.54	1.61	2.06
DFS																												
1986	2.79	3.13	3.03	2.64	2.73	2.70	3.13	2.79	2.55	2.48	2.57	2.70	3.09	2.96	2.83	2.69	2.94		2.83	2.82	2.43	3.13	2.77	2.55	2.48	2.58		
1996	2.34	2.59	2.37	2.24	2.32	2.33	2.62	2.31	2.19	2.21	2.20	2.27	2.61	2.36	2.30	2.27	2.40	2.66	2.34	2.41	1.99	2.62	2.30	2.19	2.22	2.23	2.33	2.33
2006	2.10	2.34	2.19	2.03	2.07	2.11	2.60	2.11	2.05	1.92	2.11	2.05	2.35	2.25	2.12	2.02	2.15	2.25	2.12	2.11	1.78	2.60	2.11	2.01	1.93	2.16	2.11	2.10
Unwanted fertility																												
1986	1.34	1.44	1.41	1.31	1.23	1.15	1.44	1.30	1.26	1.22	1.16	1.32	1.39	1.40	1.43	1.30	1.22		1.35	1.28	1.38	1.44	1.29	1.26	1.22	1.16		
1996	1.23	1.30	1.27	1.22	1.17	1.15	1.33	1.21	1.22	1.14	1.15	1.23	1.24	1.16	1.26	1.26	1.17	1.15	1.22	1.26	1.28	1.33	1.21	1.20	1.15	1.15	1.17	1.27
2006	1.19	1.28	1.18	1.20	1.17	1.15	1.28	1.30	1.15	1.10	1.13	1.21	1.18	1.21	1.20	1.20	1.05	1.06	1.19	1.22	1.23	1.26	1.30	1.18	1.12	1.15	1.17	1.22
Child Replacement																												
1986	1.08	1.06	1.06	1.04	1.03	1.02	1.08	1.06	1.04	1.00	1.02	1.06	1.07	1.03	1.09	1.05	1.02		1.09	1.03	1.06	1.08	1.06	1.04	1.00	1.02		
1996	1.04	1.06	1.05	1.03	1.01	1.01	1.05	1.03	1.03	1.01	1.01	1.04	1.06	1.02	1.06	1.04	1.02	1.03	1.05	1.03	1.10	1.05	1.03	1.03	1.01	1.02	1.02	1.06
2006	1.03	1.04	1.02	1.02	1.01	1.01	1.04	1.02	1.01	1.01	1.00	1.02	1.03	1.02	1.05	1.01	1.02	1.02	1.03	1.01	1.01	1.04	1.02	1.01	1.01	1.00	1.02	1.03
Sex Preferences																												
1986	1.05	1.33	1.25	1.12	1.06	1.06	1.08	1.13	1.22	1.03	1.09	1.06	1.10	1.07	1.24	1.07	1.14	.	1.05	1.11	1.29	1.08	1.14	1.28	1.04	1.08	.	.
1996	1.03	1.12	1.04	1.02	1.07	1.05	1.08	1.06	1.06	1.07	1.16	1.03	1.16	1.05	1.18	1.21	1.38	1.38	1.24	1.33	1.17	1.19	1.28	1.28	1.18	1.43	1.30	1.18
2006	1.05	1.07	1.13	1.15	1.11	1.07	1.24	1.10	1.06	1.10	1.09	1.05	1.10	1.06	1.11	1.05	1.11	1.14	1.08	1.10	1.09	1.25	1.11	1.06	1.11	1.09	1.09	1.05
Tempo																												
1986	1.08	1.06	1.17	1.10	1.18	1.18	1.06	1.03	0.84	1.04	1.22	1.07	1.07	1.08	1.18	1.03	0.95		1.06	1.19	1.13	1.05	1.04	0.86	1.14	1.37		
1996	1.00	0.97	0.99	1.03	0.97	1.01	0.95	1.01	0.96	1.12	1.27	0.99	1.01	0.95	1.01	1.02	1.15	0.97	0.99	1.02	1.05	0.95	1.01	0.99	1.11	1.35	1.10	1.02
2006	1.05	0.95	1.01	0.98	1.03	1.12	1.08	1.00	0.96	0.94	0.84	1.09	1.02	1.06	1.05	1.02	1.01	1.07	1.06	1.03	0.99	1.08	0.98	0.95	0.92	0.84	1.06	1.05
Involuntary Infertility																												
1986	0.95	0.97	0.98	0.94	0.92	0.95	0.97	0.97	0.95	0.88	0.83	0.95	0.96	0.99	0.94	0.94	0.97		0.95	0.99	0.93	0.97	0.97	0.95	0.88	0.83		
1996	0.96	0.97	0.97	0.96	0.97	0.96	0.97	0.97	0.97	0.95	0.89	0.96	0.96	0.96	0.96	0.97	0.95	0.99	0.97	0.96	0.94	0.97	0.97	0.97	0.95	0.91	0.96	0.97
2006	0.94	0.91	0.91	0.93	0.93	0.96	0.95	0.96	0.94	0.89	0.92	0.94	0.93	0.96	0.92	0.93	0.95	0.95	0.94	0.95	0.82	0.95	0.96	0.94	0.94	0.92	0.93	0.94
Competing preferences																												
1986	0.74	0.97	0.62	0.62	0.55	0.54	0.97	0.65	0.72	0.68	0.49	0.67	0.91	0.66	0.78	0.68	0.69		0.72	0.61	0.88	1.00	0.64	0.65	0.60	0.44		
1996	0.84	1.31	1.06	0.76	0.70	0.62	1.08	0.92	0.69	0.58	0.45	0.80	0.87	0.94	0.87	0.63	0.54	0.54	0.72	0.53	0.89	0.98	0.75	0.54	0.52	0.34	0.58	0.84
2006	0.70	0.99	0.81	0.81	0.67	0.37	0.72	0.86	0.88	0.61	0.49	0.68	0.68	0.78	0.64	0.73	0.70	0.77	0.66	0.71	0.99	0.72	0.81	0.77	0.83	0.73	0.59	0.75



Fonte: ENDSA, 2008; PNDS, 2006; ENDS, 2005

Figure 1.1: Parity progression ratios by parity. Brazil, 2006. Borrowed from Bonifacio, 2011 p. 18.

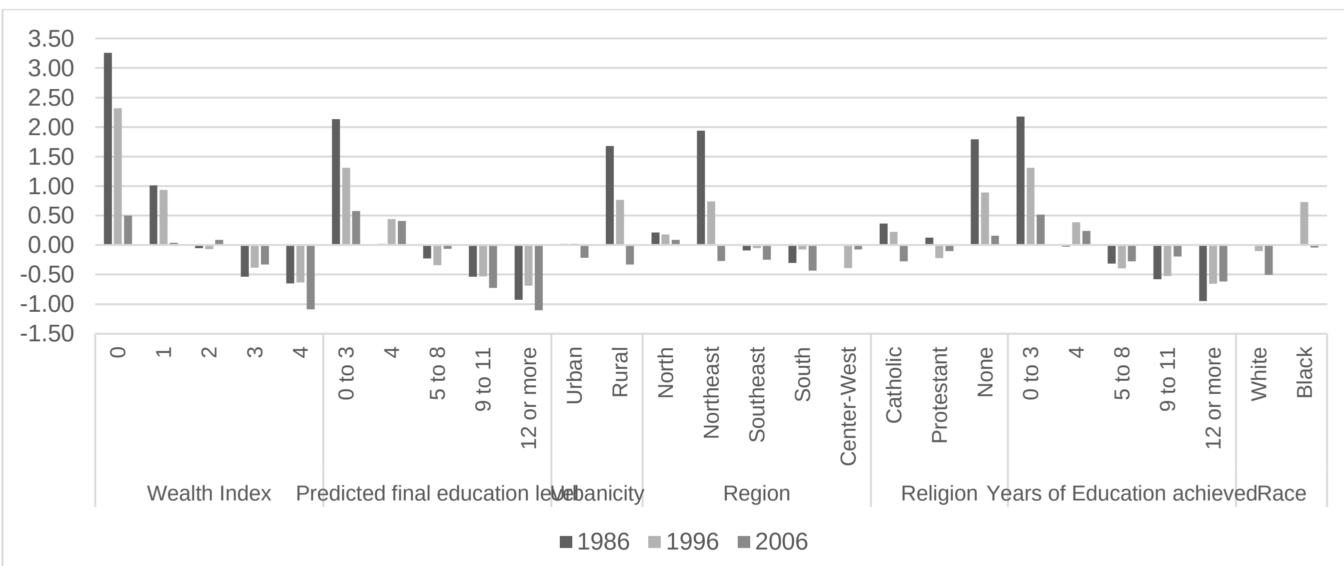


Figure 1.2: Difference between Total Fertility Rates and Desired Family Size in number of children, Brazil (1986, 1996 and 2006)

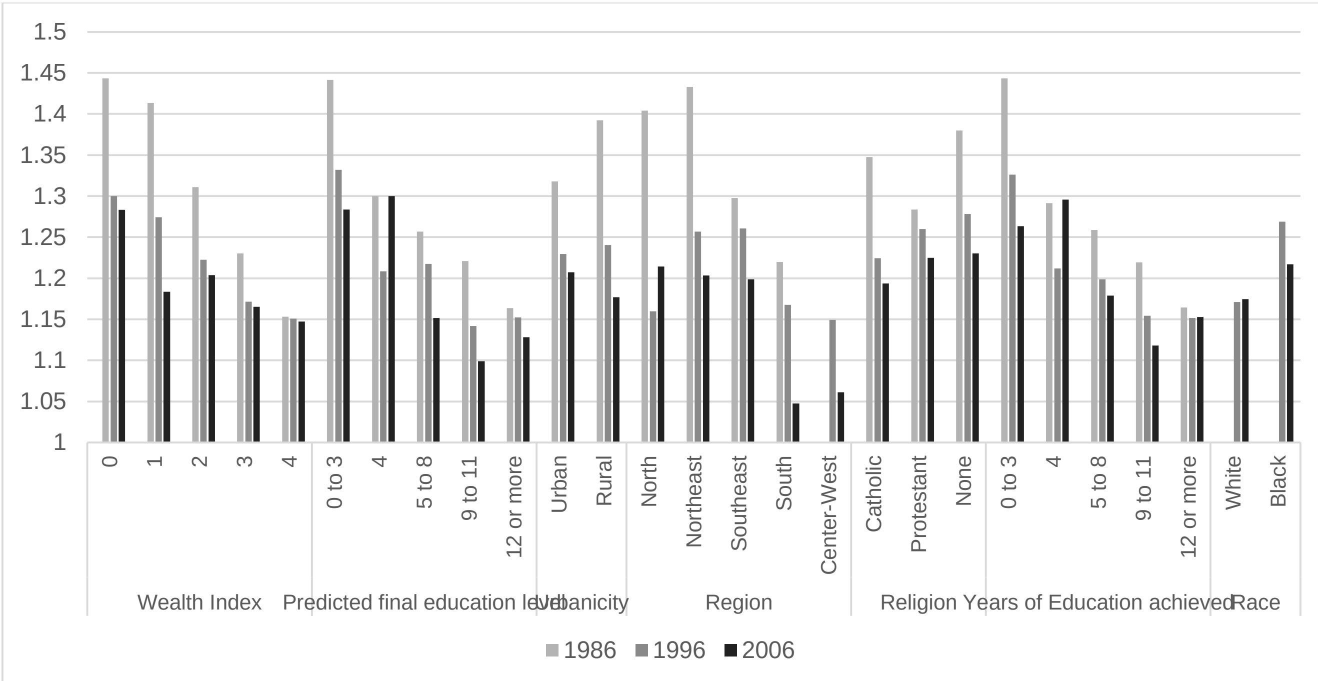


Figure 1.3: Parameter for Unwanted Fertility, Brazil (1986, 1996 and 2006).

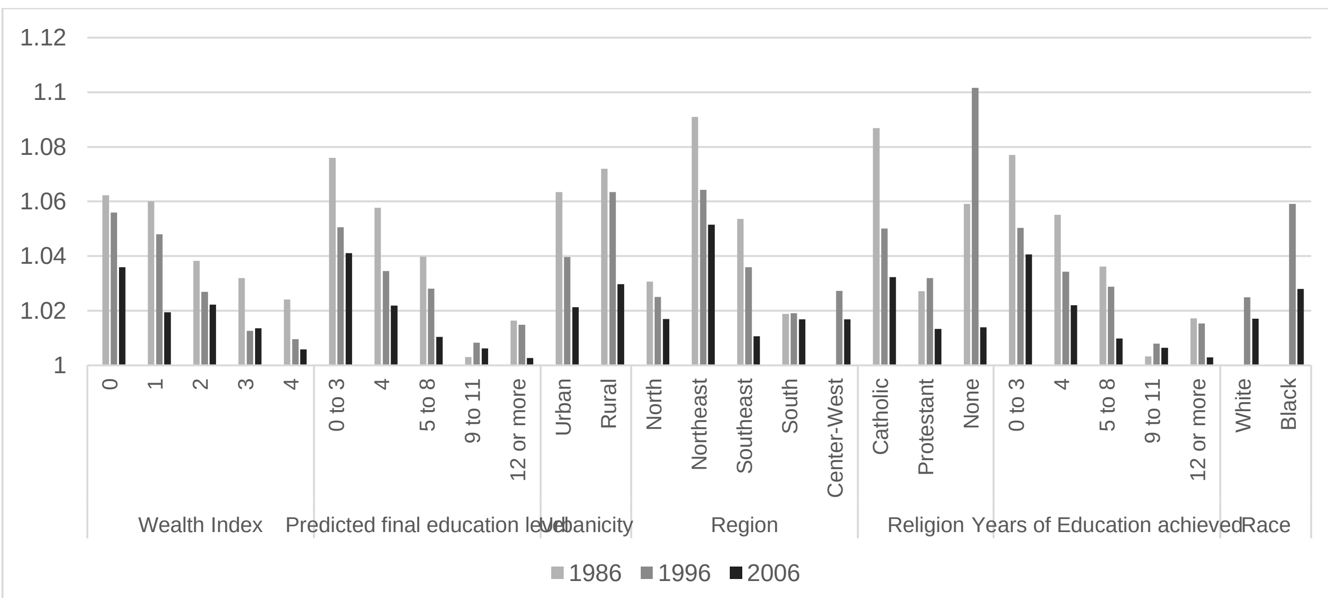


Figure 1.4: Parameter for Child Replacement, Brazil (1986, 1996 and 2006).

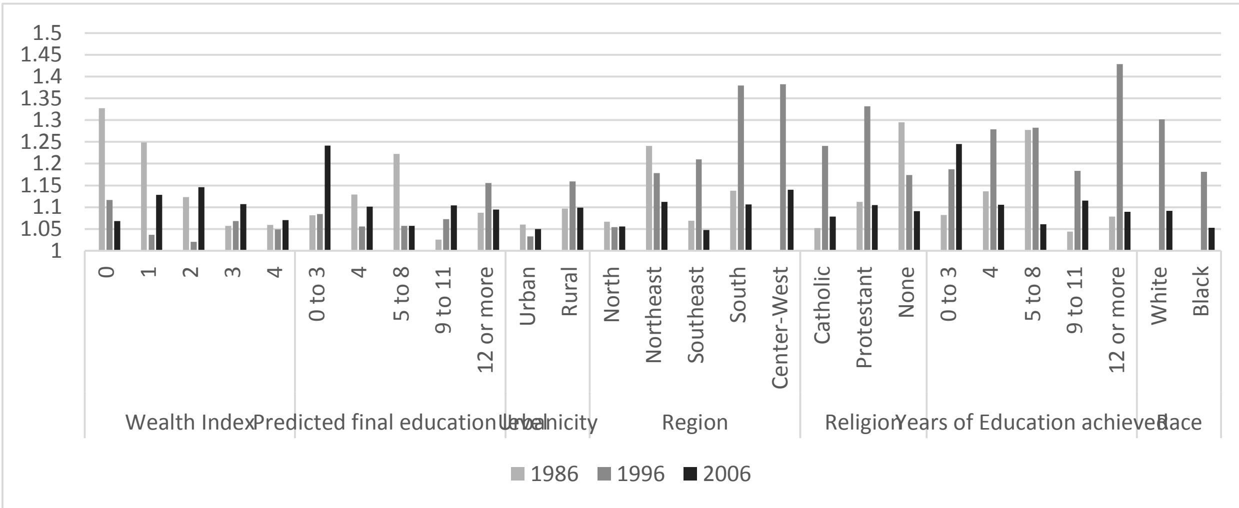


Figure 1.5: Parameter for Sex preferences, Brazil (1986, 1996 and 2006)

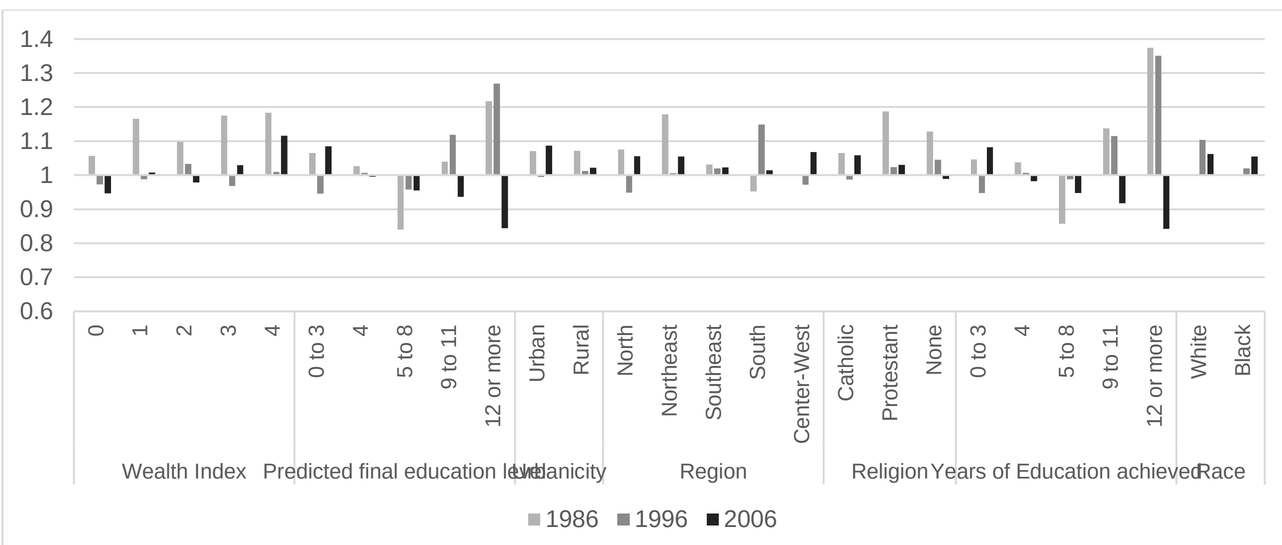


Figure 1.6: Parameter for Tempo, Brazil (1986, 1996 and 2006)

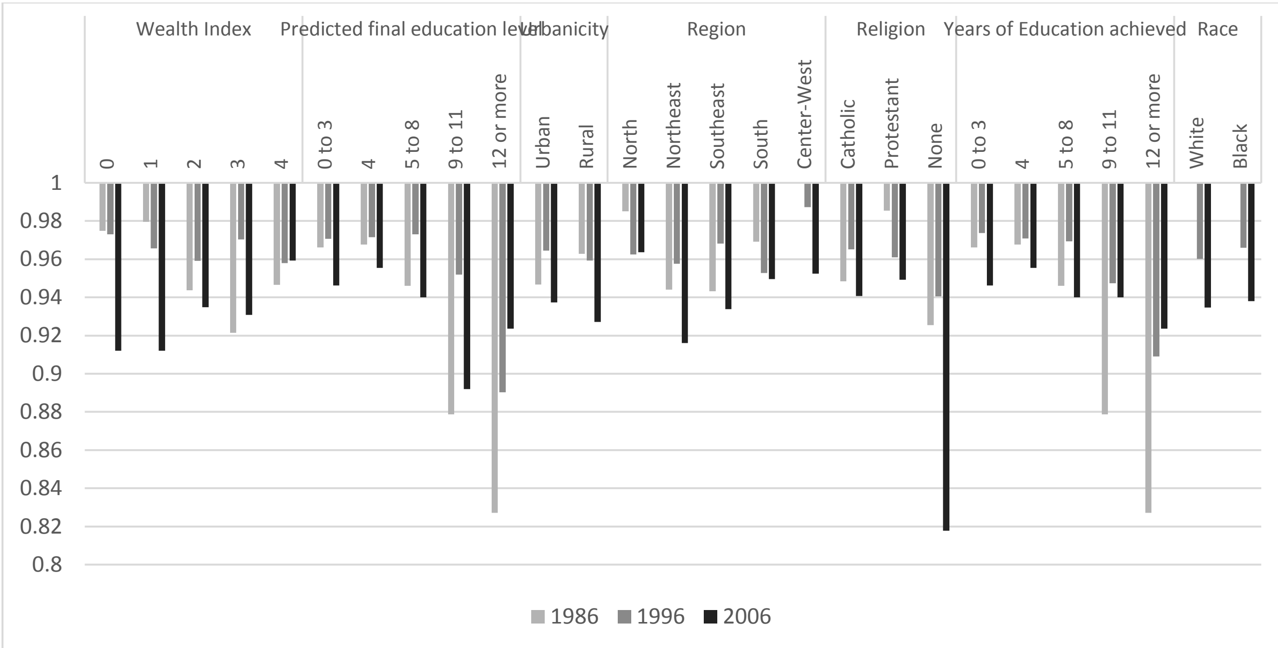


Figure 1.7: Parameter for Involuntary Infertility, Brazil (1986, 1996 and 2006)

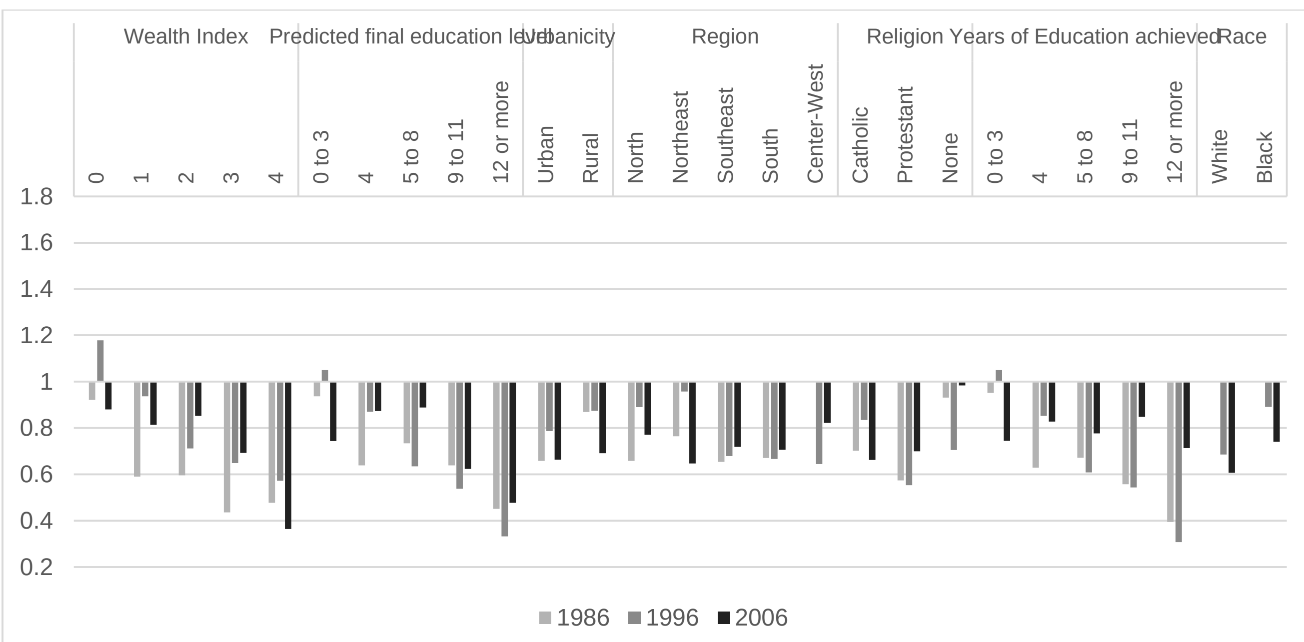


Figure 1.8: Parameter for Competing Preferences, Brazil (1986, 1996 and 2006)

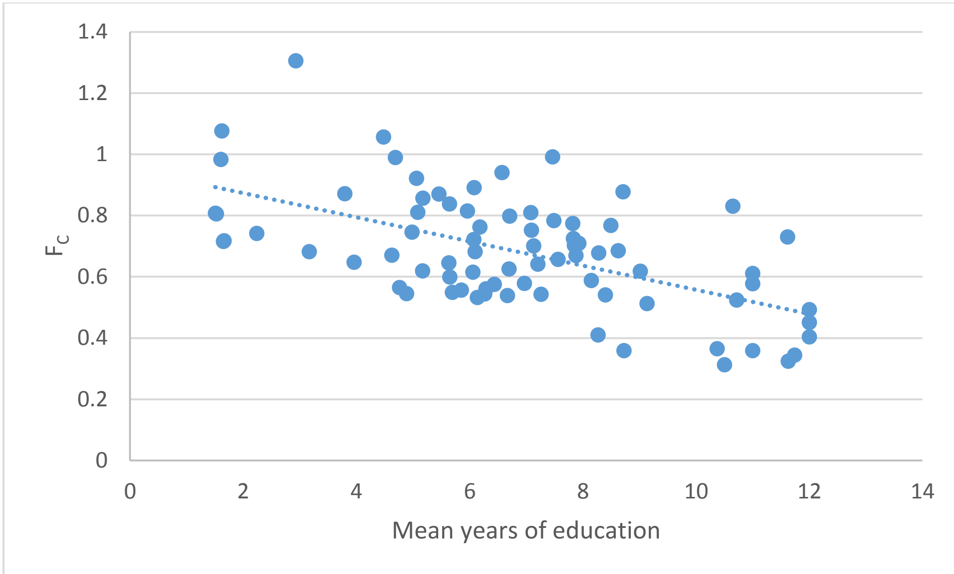


Figure 1.9: Scatterplot of the Competing Preferences values with the population mean values for years of education, all years, all socio-demographic groups, Brazil (1986, 1996 and 2006).

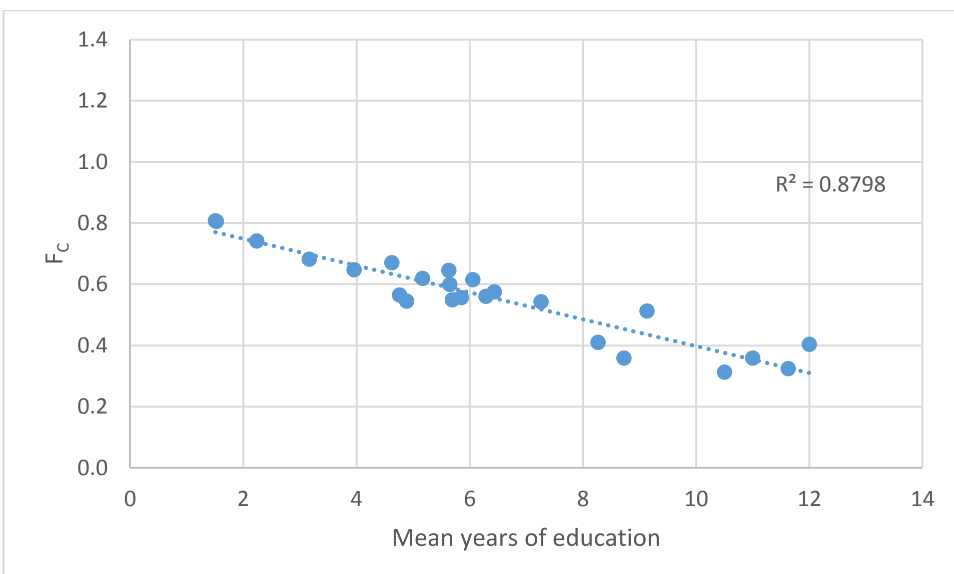


Figure 1.10: Scatterplot of the Competing Preferences values with the population mean values for years of education, 1986, all socio-demographic groups, Brazil.

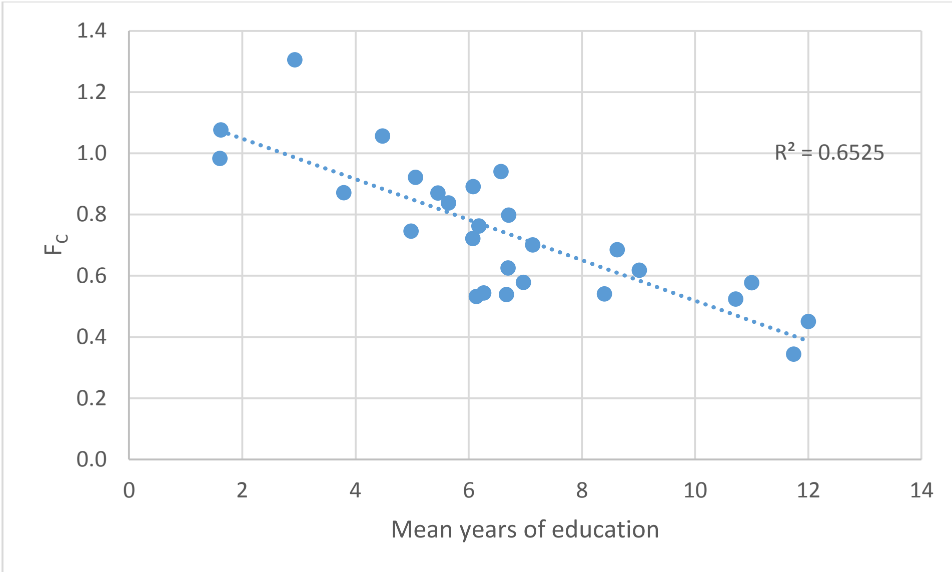


Figure 1.11: Scatterplot of the Competing Preferences values with the population mean values for years of education, 1996, all socio-demographic groups, Brazil.

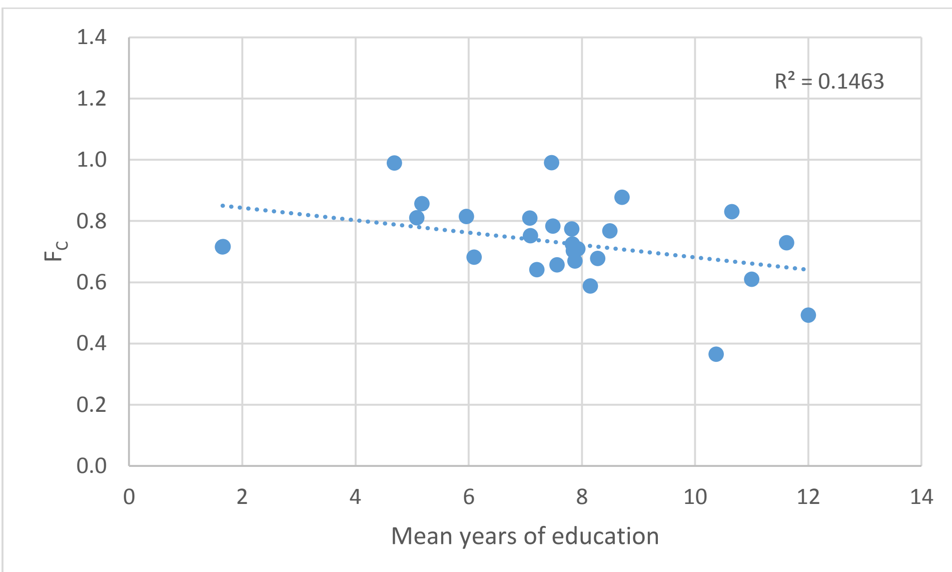


Figure 1.12: Scatterplot of the Competing Preferences values with the population mean values for years of education, 2006, Brazil.

CHAPTER 2: SEX PREFERENCES IN BRAZIL

INTRODUCTION

On a global scale, when one thinks about sex preferences, the first thing that comes to mind is the odd sex ratios that some countries are facing in recent decades due to the wide spread practice of sex selection[20]. In some countries in South Asia, the number of "missing girls" is reported to be close to 10%.

Around the world, preferences for having a child of a certain sex or children with a particular sex composition has always existed due to economic, religious, social and psychological reasons. But because fertility rates were high, achieving common desired compositions was likely. Further, in the absence of sex pre-selection, sex ratios at birth remain at normal levels (around 1.05) even if couples have additional children to achieve a sex preference (Arnold, 1997; Gupta e Bhat, 1997, Park and Cho 1995).

When total fertility rates (TFR) declined, mostly as a result of a smaller desired family size and higher contraception use, many women were unable to achieve their desired sex composition

[20] While in the neonatal period the mortality of boys are usually higher everywhere in the world, in countries with son preference and sex selection, the girls' mortality surpasses the boys' mortality in the post-neonatal period and remain higher during and after the first year of life. This shows that it is not the biological causes, but social causes, that are affecting girls' survival. The mistreatment happens at any time, such as during breastfeeding, food allocation (quality and quantity), proper clothing, parental surveillance, and access to health facilities and immunization (Guilmoto, 2012, pg 24). Discrimination also reflects in smaller school attendance rates for girls, who have to sacrifice their education for their brother's. In the same lines, sonless mothers tend to use less contraceptives and have shorter birth intervals causing their daughters to have more siblings and bigger families, making resources even scarcer (Brockmann, 1999).

of children. In the most notorious example in the literature, Asian women feared being sonless and experienced strong pressures to reduce their number of daughters (Das Gupta et al 2002). Initially, this pressure increased post-natal practices such as female discrimination, neglect and infanticide so that mothers could concentrate efforts and resources on their male offspring (Park and Cho, 1995; Bongaarts, 2013). Later, in some localities, technology became available to act before birth. Prenatal sex selection through selective abortion became widely used, evidenced by high sex ratios even for low birth orders (Park and Cho, 1995; Bongaarts PDR 2013).

In Latin America, the subject has not been studied in depth because it is believed to be irrelevant. In Brazil, any form of disclosed child neglect or violence based on sex would be condemned. Abortion is legally restricted to a few situations, such as rape or risk of death for the mother, otherwise, it brings penal sanctions for women and health care providers.

Although sex selection might not exist in Latin America, sex preferences, which are the underlying sociological explanation for sex selection, remains unnoticed in the literature. Sex preference, is however one of the factors responsible for keeping fertility rates closer to replacement level. This is because in the absence of prenatal or postnatal practices, women who are unsatisfied with the sex composition of their children may progress to future births. So, sex preferences may increase fertility as women and couples pursue a desired sex composition.

In Brazil, the TFR was 1.8 in 2006 and according to estimates presented in Chapter 1, it could be 5% lower in the absence of sex preferences. These results indicate that although women are not selecting their first child based on sex, some might be continuing childbearing in order to achieve a desired sex composition, a strategy that has long been described in international literature.

To my knowledge, for more than 20 years, only three articles (with a demographic focus) touched on this topic in Brazil, and only the first focused on sex preferences (Arnold 1992; Souza, Rios Neto and Queiroz 2011; Carvalho 2014). Based on parity progression rates and in-depth interviews, these studies suggest that there is a national predilection for a mixed-sex composition in Brazil. As a matter of fact, the preference for the dyad boy-girl or girl-boy is so typical that Brazilian demographers might have ignored the importance of that for fertility believing that only a radical preference for a certain sex deserves to be taken into consideration. It is important to keep in mind that even the desire for a balanced composition may substantially increase fertility. In the context of low fertility this factor may prevent fertility rates from falling even more. Therefore, this is a phenomenon that deserves to be further explored, particularly if put in a sociological perspective by stratifying the analyses by social groups.

Most cross sectional studies use parity progression rates to analyze sex preferences. While these studies can show the impact of sex preferences on fertility, the DHS and PNDS offer a unique opportunity to understand sex preferences because the surveys include questions about size and composition of women's ideal family. It is important to characterize the women with different preferences to understand how social structure has been shaping sex preferences and fertility ideals. It is also important to understand which women are pursuing their compositional goals in spite of the low fertility targets.

In this chapter, I will first describe some of the seminal studies regarding sex preferences and then I will formulate hypothesis for the Brazilian case. To avoid the ex post rationalization apparent in the data, I will focus on women who have never had children but who intend to do so. Comparative analysis will explore differences between social groups (wealth, education, race, region, urban/rural, religion, church attendance, marital status and work status).

This chapter presents evidence that a balanced sex preferences exists among most Brazilians; some evidence of a secondary daughter preference is also found. The evidence comes from responses to questions about ideal number of children and their composition available in the Brazilian Demographic Health Survey of 1996 and 2006. Evidence also shows that "gender indifference" has become more pronounced as fertility declines, but Brazilian women, in their majority, still look for balance.

LITERATURE REVIEW

Mechanisms and explanations for sex preferences

A woman or a couple may have desires for a certain sex composition for their offspring. When desires are deliberately enacted, they become sex selection, which is a rational and adaptive behavior to avoid children of the unwanted sex. These desires are linked to schemas that provide women with economic, religious, social and psychological reasons to have a son or a daughter (Guilmoto, 2012; Johnson-Hanks et al. 2011). It happens because society ascribes different roles and expectations to people based on their sex, which is defined as "gender system". When gender roles and costs and benefits of each gender are different, people might have different motivations to have one or another because sons and daughters are not substitutable (Pollard and Morgan 2002). Preference may happen before or after birth and has historically been linked to a preference for males given the predominance of patriarchal societies.

For example, the driver of son preference is the male role in the family and the lower value of women in society (Guilmoto, 2012; Wood and Bean, Das Gupta et al 2002). In traditional societies, men are considered to be more suitable for agricultural work and can acquire better paid labor force positions. Men are necessary to perform religious ceremonies in some ethnic and religious traditions, and provide continuity of the family name in patrilineal households (Das Gupta et al 2002, Park and Cho, 1995). Further, sons are a primitive form of social security responsible for supporting the parents in old age (Wood & Bean, 1977). As a result, women who are born, raised and marry into these societies are embedded in these common norms about social roles that will shape her preferences for offspring.

In the context of India, Dyson and Moore (1983) explain how female and gender differences in treatments can lead to different mortality and sex ratios. In the case of India, indicators of sex discrimination are higher in the northern states compared to the southern states, which also have lower fertility, lower infant and child mortality, and later age at marriage. These differentials are credited to regional sociocultural variation, or schemas, regarding family and kinship structure. In the North, there is a dowry system, women behavior is closely monitored, females leave their homes to join husband's family, and there are weak emotional ties between husbands and wives. In the South, where women have much more freedom and social status, they are allowed to inherit property, marry at later ages and have more freedom picking their husbands and occupations. Besides that, the costs of the wedding are also shared between brides and grooms, women can maintain contact with their kin, daughters can help their old parents, and religious rituals are shared[21][22].

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[21] The description of these two different realities elucidates the necessity of increasing female empowerment and autonomy to promote gender equality (for complete review, see Guilmoto, 2012). Although financial incentives are interesting because they can counterbalance the expected returns in investing in sons[21], literature considers that from all attempts to increase gender equality, the most successful are the aiming at a change of attitudes. Examples of that are allowing women to complete education, to have a valuable income, to exercise political influence, and to have more freedom.

[22] The Family Law of 1989 in South Korea, for example, established that women could be allowed to inherit property, contribute to their parent's household, and get custody of their kids (Chung and Das Gupta, 2007). Government has also encouraged women to work and remain employed after marriage. In India, urbanization also changed women status because it reduced the centrality of sons in their parents' lives. Industrialization also reduced the importance of family because one can live independent of their families based solely on their skills and qualifications. Female education and employment gave women greater ability to function

In places where family sizes are more flexible, having at least one girl is useful for company and household work. In a very psychological piece of work, Teichman, Rabinovitz and Rabinovitz (1992) suggest that women prefer daughters because they could be the caregiver for their parents at old age, but also because they can work out their own identity conflicts. In some societies, however, a daughter is a potential bride with a large cost for parents. Besides having to pay the dowry, they are not supposed to contribute to their parent's house or even see them after marriage; they are expected to leave the home of origin to open space for their daughter-in-law and are also deprived from inheritance and expected to work for the husband's family (Das Gupta et al 2002).

In more developed societies where children are no longer a source of economic security or care during old age, and where the state have taken over some of the son's responsibilities, preference for males is less tangible and important. A report (Arnold, 1997) and an article (Bongaarts, 2013) bring statistics of the status of discrimination in different countries. Girl's prestige seems to be better in Europe and in the Americas, where daughter preference is more common, although it is rare and related to a preference for mixed composition (Arnold, 1997, page 3). Modernization "undermines religious commitment, weakens male privileges, and enhances the status of women, thus eliminating the factors usually invoked to explain the son preference of traditional societies" (Brockmann, 1999, p. 3).

Other studies also find preference for women, which are recent and linked to women's social role and status (Teichman; Rabinovitz and Rabinovitz, 1992). Hank and Kohler (2000) found girl's preference in the United States, Vietnam and Israel, this last one more embedded in

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and contribute to their parental household (Das Gupta et al 2002). Even radio and television have their role in boosting female autonomy and independence (Jensen and Oster, 2008).

military combat. As described in the international literature, boys suffer more threats during their lives, especially in a society that is exposed to wars and hostilities. In those localities, having girls could be a way of preventing the loss of children (Jacobsen, Moller and Engholm, 1999).

As can be seen, gender preferences are “embedded in cultural and religious traditions and community norms shaping individual attitudes and behavior” (Hank and Kohler, 2000, pg.4). In more recent times, however, it is also common to find the rationality surrounding sex preferences to be more socio-psychological, such as the expansion of the self, a sense of affiliation and a feeling of accomplishment.

Besides the large body of research covering reasons for sex preference, there is also growing evidence that a preference for balance has been giving way to a ‘gender indifference” (Pollard and Morgan, 2002). The declining effect of the first two children’s sex composition on the third birth is consistent with a convergence in the roles and gender norms of children and parents. Daughters and sons are increasingly likely to be given the same educational and professional opportunities and also to have access to the same types of activities. Their parents also present more similar rates of college attendance and more similar expectations.

Gender indifference would reflect a major shift in society toward not only gender neutral legal and administrative regulations, but also attitudes that have converged regarding gender neutral roles in work and family spheres (Bianchi, 2000 in Pollard and Morgan, 2002 p. 603). According to the authors, the more rigid a gender system is, the more important the achievement of specific gender compositions will be – thereby represented by having the third birth. In societies, such as France (Marleau and Maheu, 1998), the percentage that do not have a preference is high because of the local context of greater gender equity.

Empirical evidence and hypotheses

When schemas inform what is more advantageous, but life doesn't go as planned, the only way to achieve sex preference is by continuing childbearing[23]. Around the world, evidence from 17 countries suggests that in most European countries a couple is more likely to have three children if the first two are of the same sex (Hank and Kohler, 2000). In general, parents who have two children of the same sex have 1.3 times more chance of continuing (Waller, 2010). In a study for the American population, Wood & Bean (1977) calculate parity progression rates and find that Mexican Americans have a higher probability of progressing to higher birth orders than the Anglo Americans, but they both prefer mixed families and the probability of progressing decreases if you already have a sex mix. At lower parities, however, both populations appear indifferent to the sex. According to Hank and Kohler (2003), the proportion of people who wants a specific sex composition increases as you have your first child, suggesting that people might be actually aiming at a balance.

Brazil seems to be following this pattern, but there are not many published articles on the topic. Preferences for a mixed composition were visible when a study by Arnold (1992) was published with 1986 Demographic and Health Survey (DHS) data. He found that the percentage of currently married, non-pregnant women aged 15-49 in 1986 who wanted another child was larger for the women whose children were of the same sex. While 23% of women who had a boy-girl wanted more children, 31% of the women who had either a girl-girl or boy-boy wanted more children. Data shows how in the case of having two sons, parents are more likely to have another

[23] In the absence of sex selection abortion and infanticide.

child than when they have one of each sex (Arnold, 1997). No other work has extended Arnold's study for the more recent Brazilian data.

Souza, Rios-Neto and Queiroz (2011) found mixed-preference using national household survey data (PNAD, Pesquisa Nacional por Amostra de Domicílios) from 1990 and 2000. While 47% of mothers with a mixed gender of two children would have a third birth, for those with either two girls or two boys, the percentage having a third birth would go up to 51%. Although they have this finding with more recent data, the focus of their research was not on sex preference, so no further exploration and explanation were provided. Given that preferences are embedded in social context, my first hypothesis is that, in general, as in Europe and in the United States, Brazilian preference will be largely for mixed composition, but different social groups will present different sex preferences.

Carvalho's (2014) qualitative study of gender preferences examined the voices of married upper class couples as they revised their reproductive goals and considered having one extra children. She also described the opposite outcome - couples reporting a new composition as ideal as they got used to the joys and challenges of having their non-preferred composition. This work demonstrates how life's conjunctures lead to malleable fertility desires, as the Theory of Conjunctural Action suggests (Johnson-Hanks et al., 2011). But, on average, she found that while females tend to prefer daughters, men tend to prefer sons, which is in accordance with the literature. Although there clearly is a lot of material to be explored, this variable was not fully explored in Carvalho's work given the focus of her research.

Apart from these three studies, gender preferences has not been on the main research agenda in Brazil. Since fertility rates were generally higher than desired family size in 1986, I assume the majority of women were achieving their compositional goals by simply having a lot of children since (in 1986, TFR was of 3.2, DSF was 2.79). In 2006, TFR fell below desired family size (1.87 vs. 2.1), women may still have their desired composition but due to lower fertility intentions, they cannot or are afraid of enacting their preferences. So, I expect that with the decline in fertility rates, women will be more realistic about possibilities of accomplishing a certain desired sex composition. Thus, fewer women in 2006 (compared to 1996) will demonstrate any preference at all, or more women declaring to be indifferent to their offspring composition.

A number of factors may interfere with goals for a certain number of children. An important one is marital status. Teichman, Rabinovitz and Rabinovitz (1992) find that women, in general, prefer daughters for company and complicity, but when men's preferences are considered, sons are preferred. Further, Bongaarts (2013) observed that the desired sex ratio for single females is 105, while for married women is 123, as they are partially influenced by their husbands. Pollard and Morgan (2002) suggest that couples desire at least one of each based on the fact that each sex will have a different "trait, strength, leisure activities and interests (p. 602). For both man and woman, there might be a desire to watch the child grow and interact with that child in those particular activities that are gender driven. Because men and women generally desire more their own sex, especially for a first child (Jacobsen, Moller and Engholm, 1999), it could be the disagreement between the couple that could lead to higher birth orders because they will continue childbearing in order to achieve a mixed composition and satisfy both (Marleau and Maheu, 1998).

While Beckman (1984 in Stein, Willen and Pavetic, 2014) says that each partner negotiate on the basis of individual intentions, von Rosenstiel et al. (1986 in Stein, Willen and Pavetic, 2014) argues that partners have multiple influence upon one another. Power is more symmetrical as women gain more education and increase their labor force participation, which also reflect on more daughter preference among this sub-group. Although male partners have greater relevance in deciding whether to continue childbearing, females have a veto power because they bear the physical costs of pregnancy, birth and child raising (Stein, Willen and Pavetic, 2014).

Women who are single, separated, divorced or without any partnership will be more likely to prefer girls because they will lack the male factor in increasing a desire for a boy. Raising a boy could also be considered harder without a masculine figure around, or it may be psychologically complicated to have a young boy that resembles his father, a man with whom the mother does not have a strong relationship. Currently, in Brazil, the number of young boys put to adoption is 30% higher than the number of girls according to the National Registry for Adoption (CNJ, 2015). If one assumes that single mothers are more likely to put kids up for adoption, it is easier to understand sex preferences as a driving factor for this differential. Younger poor unmarried women might also prefer to have a daughter to keep them company.

In order to test the hypothesis that females tend to prefer daughters and this preference might change only when a man comes into the scene, women who have not had sexual intercourse and those unmarried will show greater preference for daughters. Married couples, on the other hand, will prefer a mixed composition.

Place of residence may also be the source of different sex preferences because rural and urban areas present different social divisions of labor based on gender over time. While rural men were expected to perform more arduous tasks, associated with the agricultural sector, rural women were expected to raise children and complement the income with “lighter” tasks such as handcraft (Paulilo, 1987). Thus, although sons have higher productivity, daughters are necessary for the household, which might have made families opt for bigger families with mixed compositions. In urban areas, both children usually have the same social functions and are thus more substitutable.

Due to the masculinization of the agricultural work, as has been described by Abramovay and Camarano (1998), modernization and urbanization changed the possibilities presented to the children and they started to migrate to the cities. Especially for the daughters, who had lower remuneration compared to man for the same rural work (Paulilo, 1987). While in agricultural and manual labor physical strength was an asset, most current jobs do not require this feature, but others such as patience and dexterity, in which females are not disadvantaged when compared to males (Blau and Kahn, 2000). Thus, in more recent decades, urban areas witnessed an increase in the labor market participation of females, while for men it was at most stable (Juhn and Potter, 2006; Wajman and Rios-Neto, 2000). This indicates that the labor market has been progressively turned into a female locus, with a relative increase in female´s participation as workers and heads of households. Moreover, with an increase in the service sector, women gained access to many better paid types of occupations (Juhn and Potter, 2006). I thus expect that in rural areas, the preferences for mixed sex will be greater when compared to urban areas. In urban areas where the service sector provides equal work opportunities for males and females, there will be less gender preference (more indifference).

There are some regional historical specificities that might also matter. Until the 60's, land distribution among children in the macro-region of the South was called *Minorato*. It was a patriarchal schema that consisted of the last son inheriting the parental property with the responsibility of taking care of the parents at old age (Mello et al, 2003). The remaining sons were expected to acquire agriculture skills and to live in other land bought by the family. This system was possible due to the great availability of land and geographic mobility, the social pressure for young people to move away and become agricultural workers, the existence of a "agricultural dowry" (land and equipment), the exclusion of daughters from this process.

With time, modernization changed the role of the last children to stay in the land, and other possibilities were presented to the children, such as emigration to cities, and for the daughters, who began to receive the agricultural dowry. Nevertheless, daughter are still excluded from inheriting parental land, and they don't seem to participate in the decisions regarding the work (Mello et al, 2003). I then hypothesize that due to the historical existence of the Minorato, the preference for boys will be greater in the macro-region South.

Religious affiliation may also matter (Marleau and Maheu, 1998; Pollard and Morgan, 2002). Patriarchal and conservative religious institutions such as Catholicism and Pentecostalism (Gallagher, 1996) provide couples with schemas of higher family sizes and lower contraceptive prevalence. They also provide them with structural functionalist views on family in which husbands and wives have a complementary role within the ideology of the separate spheres (while men are the breadwinners, women are expected to do the domestic labor, take care of the kids, take care of their social networks and of their husbands). Although women are subordinate to men, their roles are harmonizing and equally important. This could be associated with a desire to have a balance composition or even indifference, if one is to comply with God's plans. Thus, I hypothesize that women affiliated with Catholicism and Pentecostalism will show relative greater preference for balance when compared to people without religious affiliation.

The frequency of attendance to religious services should also be taken into account as many people only nominally identify their religious affiliation, in specific Catholics, as it is the historically dominant religion in Brazil. I hypothesize that the preference of those who more often attend religious service will be even more salient, as in general these individuals hold more conservative views over reproduction.

Other important factors that might influence sex preferences is race. In the case of Brazil, black males aged 15 to 24 present very high homicide rates directly caused by their involvement in drug trafficking, criminality, gang violence, police violence and racial profiling (Waiselfisz, 2013). For instance, their annual mortality rate (145.8 per one hundred thousand) was higher than that of white women as a whole (2.3) and surpasses the mortality rate of many countries under warfare (Waiselfisz, 2013). There is a number of missing boys in the Brazilian society that cannot be ignored, especially among the poor and black. Part of the underlying cause of the problem is lower socio-economic levels and negative ideological and cultural representation of black and poor individuals.

On top of poor males being more victims of violence, women are faring better than men in regards to education completion and university graduation in general and among the disadvantaged stratus (Wajnman and Rios-Neto, 2000; Whinter and Golgher, 2010). That means that having a daughter, more than having a son, might be more advantageous in the near future, when they will be then more effectively able to help support the household, in particular, among the poor. Thus, I also hypothesize that Black women and women of low socio-economic status will have a preference for girls, when compared to other groups in the population.

Moreover, preferences in general might be more salient for poor women, because from all the possibilities that a middle class women have in life, such as career, marriage, children, and personal goals, having kids is many times the only thing a poor woman can have control over (Berquó, Garcia, Lima, 2012). So, their attachment to their offspring' compositional goals might be something they cannot give in. Waller (2010) also shows how there is a higher tendency for lower-class couples to continue childbearing after having two children of the same sex.

The last factor to be tested will be education. Hank and Kohler (2003) find that more educated women have access to other sources of income, so they do not need to rely on their sons or husbands for economic support, which could increase their bargain power. The same reasoning could be behind women who work and thus have their own money. However, more educated women might have fewer preferences whatsoever because education tends to increase egalitarian views over life so their daughters and sons will be highly educated and live in an environment of much more gender equity than their low educated counterparts (Lameirao, 2011), which is not automatically true for all women who work. Finally, achieving a balanced mix composition might disturb the high educated women's economic productivity, making her wish *fewer* children instead of *certain* children and making them be more concerned about the *number* of children than the *gender*. As a result, I expect more educated people to have less gender preferences, but women who work to have more daughter preference.

DATA, LIMITATIONS AND EX POST-RATIONALIZATION

Data comes from the Brazilian DHS of 1996 and the PNDS of 2006. These databases are nationally representative, cross-sectional and focus on women in reproductive age (15-49) and their birth history. Sample sizes were of 12,612 women in 1996 and 15,575 in 2006. Sample procedure for the DHS and the PNDS followed specifications of the *equal probability of selection method* (EPSEM) and the *probability proportion to size* (PPS)[24]. Information about the

[24] More information about sampling procedure for the DHS can be found at http://dhsprogram.com/pubs/pdf/AISM5/DHS_III_Sampling_Manual.pdf.

desired sex composition is present only in these databases. Thus, I could not use the database from 1986 in this chapter, as I did in chapter 1.

The DHS 1996 was coordinated by BEMFAM with the help of the Instituto Brasileiro de Geografia e Estatística (IBGE), Macro International Inc., Agência Norte Americana para o Desenvolvimento, UN Population Fund and UNICEF. The PNDS 2006, Pesquisa Nacional de Demografia e Saúde (PNDS) (Ministério da Saúde, 2008), was coordinated by the Brazilian Center for Analysis and Planning (Cebrap) and the Brazilian Health Ministry and funded by UNESCO. Data were collected in the five Brazilian geographic regions and in urban and rural areas, as well as in urban slums[25].

The DHS and similar surveys such as the PNDS are ideal to perform analysis of sex preference because the reproductive intentions data allow study of ideal family size and composition, and are the only nationally representative database with these information. Giving that these Brazilian surveys are not longitudinal and that some subsample sizes are not large, some limitations need to be addressed before proceeding with the analysis.

The first is that ex-post rationalization, which is captured on retrospective surveys, attenuates the effects of sex preferences because women review their preference after giving birth (Wood & Bean, 1977, p. 130). Research also indicates that when parents fail to achieve the desired sex balance by the time they reach the number of children intended, they tend to revise their family goals upward (Wood and Bean, 1977).[26] I will avoid this limitation by focusing on a sub-sample

[25] Original survey databases have already been published and are available at http://bvsms.saude.gov.br/bvs/pnds, and at http://dhsprogram.com/data/available-datasets.cfm.

[26] Dissertation Paper 3 provides an analysis of ex post rationalization.

of women without any children ever born. I will also only use information from those who wish at least one child.

Tables 2.1, 2.2, and 2.3 suggest that women's desired family composition is heavily influenced by post-rationalization. When compared to the desires of women who did not have any child born alive but who wishes a certain parity, women who already had that parity tended to say they prefer what they already have. The differences are all statistically different at the level of 5% and this is consistent with a narrative of rationalization.

As can be seen in Table 2.1, 71.4% women who had one boy said they wanted one boy 71.4% in 1996. Among women without children, the percentage who desire a single boy is only of 29.5%. In the case of girls, 73.4% of women who had a single girl said that was their desired composition. Among the women without children, this percentage is much lower, of only 41.4% in 1996. Results for 2006 show the same strong pattern that is strongly suggestive of rationalization – respondents claim to want what they have. A second process could also contribute: those who strongly desire a girl, but have a first boy, go on to have a second birth. This process moves the most dissatisfied respondents from Table 2.1.

Even for people who say that they are indifferent to the sex of their baby, post rationalization seems to be occurring. Table 2.1 shows how among the women without children who only want one child, 29% in 1996 and 43.6% in 2006 said they were indifferent. When it comes to women who started childbearing, the percentage who said they were neutral about the sex of the baby declines to 12.7% (had a boy) and 14.7% (had a girl) in 1996 and 31.7 (when women had one boy) and 20.4 (when women had one girl) in 2006. This difference of 11 points in 2006 also indicates that there might exist a latent daughter preference as women tend to post-adjust toward neutrality more often when they have one boy than when they have one girl.

When it comes to women who have two children and those who wish to have two but do not have any yet, the suggestion of rationalization continues. Tables 2.2 shows the desired composition for families of two, for women who have two children or women who wish to have two children.

Note in Table 2.2 how 2.6% (1996) and 2.2% (2006) of the women who did not have any children said they preferred two girls. When it comes to the women who really had two girls, 47.8% (1996) and 49.1% (2006) said they really wanted this preference. While only 2.2% (1996) and 1.5% (2006) of women who did not have any children but wished to have two children say that they wanted two boys, for those who really had two boys 52.4% (1996) and 37.8% (2006) wanted that composition. As for balance composition, a boy and a girl, 91.01% in 1996 and 83.3% in 2006 who had this composition said this was what they wanted. That is even higher than the amount of balance wished by women who did not have children but wished to have a boy and a girl (70.9% in 2006 and 79.8% in 1996). Again these data are highly suggestive of rationalization.

Lastly, Table 2.3 shows the distribution of desired family sizes for a parity of three for women who wish three children. The same trends can be observed. If we were to take the desired composition of women without children as a reference of intention, preferences for three boys or three girls would barely exist (less than 2.3% in all cases and years). But in 2006, 40% and 44% of the ones who had two boys and two girls, respectively, said that was their desired fertility.

In sum, it is very risky to rely on the information about the ideal composition of women who have already started childbearing because as the numbers suggest, ex-post-rationalization is very common. But the lack of women who admit having an unmet composition (these small number can be seen on the Tables 2.1, 2.2 and 2.3 in the proportion of women who admit not having the sex they desired), could also be a sign of a behavior called continuation. It is possible that the women who have an unmet DFC are no longer in those tables because they have already moved forward with their childbearing process in order to achieve their desired sex.

The hypothesis of continuation, unfortunately, cannot be tested with cross-sectional data. One would need longitudinal data in order to resolve this conundrum[27]. Another possible analysis would be to use retrospective data to see if those who wanted a certain sex and had the opposite were more likely to continue childbearing, but this analysis would still contain a great deal of post-rationalization. Thus, throughout this Chapter, I will analyze intentions of women who have no children.

For those who already have stared childbearing, a better indication of sex preferences would be real behavior (less influenced by normative response bias), which can be explored using parity progression rates by composition of previous children. Nevertheless, prenatal ideal sex preferences might not be translated into practice once these women start childbearing and are confronted with real sex ratios and the challenges of pursuing their initially desired sex composition at the risk of increasing too much their family sizes.

Since the DHS and the PNDS also contain data on birth history (sex and parity of children), I have also looked at whether the proportion of women who wishes an additional child dependent on the sex composition of existing children (Table A2.2 and A2.3 in the Appendix 2: Chapter 2). But desires to compose their households might not translate into behavior either. So, I have also analyzed real sex preferences by analyzing parity progression based on sex and number of existing children (Table A2.4 and Table A2.5 in Appendix 2: Chapter 2). I will discuss these further in the Appendix, where it will be possible to see how some of the preferences stated in this Chapter at

[27] Preliminary analysis show that in 2006, at the one child level, having a boy, regardless of the preference does not interfere with the likelihood of wishing to continue childbearing. Having a girl, on the other hand, when one wished a boy, doubles the odds of wishing to continue, but the significance of the statistical test if low (p=0.096) Future work will stratify this analysis by socio-demographic groups and explore this association. In this paper, I won't focus on intentions of women who started childbearing.

the intentions level are different from the trends found in Chapter 1. The use of these three methods enabled me to see the degree to which women are sticking to their sex preferences.

A third limitation of this paper is the timing of covariates. For example, women's marital status may vary throughout her reproductive life. Unfortunately, I cannot avoid this problem totally, but this should not be a concern for women who never had any children since her reproductive intention – her ideal family size and composition – is being captured at the same time as her marital status: the time of the interview.

Other confounding aspects are caused by age and birth cohort effects: due to the declining desired family size and declining fertility rates throughout time, older women and women in 1996 usually had more children than younger ones and women in 2006, so they would be more likely to naturally achieve their preference. Besides, a childless 45 year old women in 1996 is probably not childless for the same reasons as a 45 year old in 2006. Neither is a low educated women who is childless at age 40, childless for the same reasons as a 40 year old college educated[28]. That is, context matters and due to this fact, I perform the analyses separately by year, by desired parity and with controls by age.

Other factors associated with preferences can be found in the literature and are not addressed here such as occupation, full time employment, number of parental siblings, birth cohort, age at first birth, as well as interaction effects. Moreover, as much as I would like to guarantee that ideals of children compositions are stable or that fertility intentions are real, I recognize they are a dynamic sequential decision making process that should be modelled as such to really capture the effect of conjunctures. Unfortunately, the DHS and the PNDS are not longitudinal and dos not allow one to study change over time in actual living conditions, personal goals, and the interactions

[28] Next chapter will shed light on factors that make a woman revise her fertility preferences.

that might happen before conception, or even during pregnancy and after birth, as suggested by Stein, Willen and Pavetic (2014).

VARIABLES, METHODS AND RESULTS

In order to investigate ideal sex preferences, a variable hereby called Desired Family Composition (DFC) was formulated using the women's answer to two different questions. The first question asked women about her ideal family size: "if you could choose the exact number of children to have throughout your whole life, what number would it be?"(*translations are mine*). Women who answer "up to God" were excluded and since they are a small part of the sample, they will not significantly affect the results. I also dropped the women who did not want any child but might have reported an ideal composition by mistake of the interviewer.

The second question asked women about ideal sex composition for their offspring: "How many of the desired number of children, asked in the previous question would you like to be male, how many would you like to be female and for how many you do you not care about the sex?"(*translations are mine*). The answers for both questions were grouped so as to form combinations of ideal number and sex of desired children. Over 30 combinations were found for the surveys, as Box 1 shows.

For those who wanted one child, there are three options, hereby coded as one boy ("b"), one girl ("g") or one and the sex does not matter ("x"). For those who wanted two children, there are six possibilities: bb (two boys), bg (a boy and a girl), gg (two girls), xx (two and the sex doesn't matter), xb (one boy and other whose sex doesn't matter), xg (one girl and one whose sex doesn't matter). In 2006, higher parities were less cited than in 1996, and the variety of compositions were also smaller.

Box 1: Desired family compositions (DFC) that were found in the DHS 1996 and the PNDS 2006, all women, Brazil.

	Family size				
	1	2	3	4	Other
Sex composition	b	bg	bgg	bggg	bbggg
	g	bb	bbg	bbgg	bbbgg
	x	gg	bbb	bbbg	bgggg
		xx	ggg	bbbb	bbgggg
		gx	xxx	gggg	bbbbg
		bx	ggx	xxxx	bgxxxx
			gxx	bgxx	bbbggg
			bbx	gxxx	bbbbgg
			bxx	bgxx	bbbbggg
			bgx		bbbbgggg

Note: b - boy, g - girl, x - indifferent

Three analytical strategies were employed to investigate sex preferences at the intention level, for women who have not had children but intend to do so. In the following section, I will specify the analysis, the methods and I will present the results for each of them separately.

For every analyses, I selected explanatory variables that are used as a controls and also to address the proposed hypotheses. These are mostly women's socio-demographic characteristics available at the surveys. The selected covariates utilized are as follows (reference categories are underlined): Marital status (<u>Married or in Union</u>=1, Separated or Divorced=2, Single and Never married=3); virginity status (no=0, yes=1); place of residence (0=urban, rural=1), macro-region (North=1, Northeast=2, <u>Southeast</u>=3, South,=4, Center-West=5), religious affiliation (Catholic=1, Protestant=2, Other=3, <u>No-Religion</u>=4), church attendance (no=1, yes=1), race (<u>White</u>=1, Black=2, Brown=3), wealth index (5 levels 0 to 4, being 4 the highest)[29], achieved education (5 levels, ranging 0 to 4, being 4 the highest),labor market participation (no=0, yes=1). Because the influence of this variables might change from year to year, I ran each regression

[29] Refer to the Appendix 1: Chapter 1 for explanations on the construction of the Wealth Index.

separately by survey year. Some covariates, like wealth index and education, were treated as continuous in the regressions.

Descriptive analysis

Descriptive analyzes of DFC show the relative distribution of the most preferred compositions according to selected covariates by year. A complete distribution can be found in Appendix 2: Chapter 2 where it can be seen that that the most preferred sex composition in Brazil is the dyad boy-girl for almost every social category (47.39 in 1996 and 40.89% in 2006). But the percentage of women who report this preference has declined in almost every social group. The second most preferred composition continue to be of 2 children indifferent to sex, which grew from 9.1 to 14.3% in ten years and is the second most prevalent in most social categories. One can also see that the third, fourth and fifth most preferred compositions in 2006 are to have one indifferent to sex, one daughter, or not have children at all: preferences for zero children slightly increased from 6 to 7.3%. In Appendix 2: Chapter 2, one can also see that it is also much more common to find compositions of four children in 1996, as well as more diversity in compositions.

In Table 2.4, the two most preferred compositions of each socio-demographic group, are analyzed separately: balance and indifference. With a few exceptions, the proportion of women who mention balance - bg (one boy, one girl) as preferred composition has declined between 1996 to 2006, while the proportion of women who are indifferent to their composition - xx (indifference) has been increasing.

I then performed χ^2 tests to check whether these differences in proportions are significantly different from one year to another. The p values can be found in the last column of Table 2.4. For example, Catholics in 1996 prefer to have a balance 48% of the times in 1996, but that changes to 40% in 2006. They are also indifferent for 9% of the population in 1996 changing to 15% in 2006, and those differences are statistically significant with a $p<0.000$. On the other hand, for people without religious affiliation, those percentages are not statistically different: while 43% want to have a balance in 1996 and 9% are indifferent, 39% wants to have a balance in 1996 and 6% are indifferent in 2006 – which are not statistically different ($p<0.561$).

Desired Sex Ratios

Secondly, sex ratios of the Desired Family Composition were calculated for each socio-demographic group for each separate year and also for each separate groups: women without children and women with children. For each social group, the total number of desired sons were divided by the total numbers of desired daughters using the "collapse" command on Stata. Women who reported "indifferent" were not counted, unless they provided a number for a certain sex, for example, by saying that she desires three children, being 1 female and 2 indifferent. In this case, she would contribute with 1 female for the whole, and nothing else. The sex ratios reported can be seen in Table 2.5[30].

The assumption for Table 2.5 is that in the absence of preferences, most values had to be equal to 1 (same number of sons and daughters) or 1.05 (naturally occurring sex ratios). The

[30] Although sex ratios are usually reported by 100 females, the numbers on Table 5 are still ratios. This is the number of sons for each one female.

second assumption is that in the absences of preferences, values would have to be the same across socio-demographic groups and across time.

Two things can be noticed with Table 2.5.

First, analyzing the two groups of women portrayed in the Table (women without children and women with children), the ratios show how in Brazil, in general, a slightly but pervasive, daughter preference is consistently more prevalent than son preference. Notice how most ratios are below 0, sometimes reaching values as low as 0.89. I performed χ^2 tests of the same groups over time (for example, comparing the ratio for Black women without children in 1996 with the ratio of Black women without children in 2006) and the tests did not point that the proportions are different from one year to another. For example, the ratio for women without children who go to work in 1996 is 0.99 and that is not statistically different from the ratio of women without children who go to work in 2006: 0.95. Likewise, the ratio for women with children who go to work in 1996 is 0.98 and that is not statistically different from the ratio of women with children who go to work in 2006: 0.99. So, whatever has happened to the DFC in the 10 years period, it has not affected the desired sex ratios which have not changed significantly from one year to another for any of the variables (p values not shown).

Second, notice how some exception also exist across the two groups of women without any apparent tendency: Region South, Protestants and High School graduates present a slighter son preference in several moments that can also be interpreted as a search for balance when compared to their counterparts (other regions, other religious groups and other levels of education). In order to tests the significance of these ratios within groups, I performed χ^2 tests of the in-group differences, which can be seen in the column named “p value of in-group differences” on Table 2.5.

The results show that none of the ratios are statistically different within group (for example, by education level) when looking at the women without children in both years. But when it comes to women who have started childbearing, important in-group differences are found in the year 2006: look in Table 2.5 how rural areas compared to urban have more son preference (desired sex ratio for rural area in 2006 is 1.03 compared to 0.96 of urban). Differences are also found for Education Level, where a clear difference between High school graduates (whose desired sex ratio is 1.07) compared to college educated (ratio is of 0.83) emerges. Apparently, education increases son preference, but at the college level, the sign reverses: daughters are preferred.

Multinomial Logit Regressions

Thirdly, in order to investigate the specific hypothesis of this Chapter, further analysis was performed. Using multinomial logistic regression models and logit regressions, I investigated what would explain the different preferences by social groups controlling for important covariates and by parity. In order to do that, I built, for all women without children and for each desired family size, a variable that represents the combinations of ideal composition. These categories, when grouped, became the dependent variables in the models.

The multinomial variables created using sex preferences are:

- *Balance* - preference for balance
- *Indifferent* - no gender preference
- *Daughter preference* - preference for girls
- *Son preference* - preference for boys

The sample distributions into these four categories can be seen in Tables 2.6 for 1996 and 2.7 for 2006. Notice how I classify the sample into different desired family sizes, because I have reasons to believe that a women who wishes to have only one child is different from one who wishes three children even if their sex preference is the same, and that difference is not necessarily correlated with her sex preferences. Also, because the objective for this analysis is to study sex preference and not ideal family size.

In Tables 2.6 and 2.7, women who want only one child as desired family size do not possess the category "balance" for her desired composition, so the dependent variable at the multinomial logit only has three options: indifferent, boy or girl. The categories x, g, b have 4%, 5.7%, and 4.1% of the sample in 1996 and 7.7%, 6.2%, and 3.7% in 2006, respectively.

Also, notice in Tables 2.6 and 2.7 how bgg and bbg were considered a preference for balance, instead of a preference for male and female as some could argue. For family size of 3 children, also notice how the categories for pure daughter and son preference (ggg, gxx, bbb, bxx) have very small sample sizes (24 cases in 1996 and 19 in 2006). So, instead of running a Multinomial Logit, for parity three, I will ignore daughter and son preference and run a Logit Regression of Balance compared to Indifference[31].

Also notice in both Tables 2.6 and 2.7 how "other sizes" represent a multitude of profiles, making it difficult to discern whether there is a preference for mixed or a more indifferent person. Thus, no analysis was conducted separately for women who wish more than 3 children. It is also important to notice that although pure daughter or son preference (gg, ggg, bb, bbb) is only a small part of the sample, compositions that contains more girls than boys, but are still mixed,

[31] I have run the analysis using multiple options of categories and references and the results do not alter significantly. So, for this chapter, the most parsimonious model was chosen.

such as ggb, are a big part of the sample. So, they could be helping keep the sex ratios low on Table 2.5 (because it is contributing with more girls at the denominator of the sex ratio) at the same time that it increases the preference for balance at the multinomial logits because this is where they were classified in Tables 2.6 and 2.7.

On Tables 2.8 through 2.11, I use multivariate analysis to observe how ideal sex preferences behave in the presence of multiple selected covariates. Multivariate models also allow to capture variance that cannot be captured with univariate regression (Hosmer & Lemeshow, 2000). In order to control the fact that older women were under a high fertility schedule most of their reproductive lives, and due to the fact that poor and low educated women without children might be a selected group, age was kept as a control. It has been suggested that the representativeness of the sample would be affected once I selected only women without children, thus I should try to limit my sample to women age 15-25, who are very close to the beginning of her reproductive life. A problem with that approach is that by selecting young women I am losing important variability in education levels and marital status that only happens later in life. Apart from that, I am losing the power of comparing my results of this Chapter with my results from Chapter 1, where all women were used. I am also not solving the problem of bias because among the poor, age at the time of the first child's birth is much lower than 25. Thus, I opted to include all ages, as long as no child was ever born, and keep the appropriate control for age.[32]

The models can be seen in Table 2.8 (all desired family sizes), Table 2.9 (women who want to have one child), Table 2.10 (women who want two children) and Table 2.11 (women who want three children). The results are described in relative risks (RRR), which are a comparison between

[32] I did, however, perform the regressions just for young women. The results are basically the same given the fact that 75% of the women without children are below 25 years old. While the mean age of the sample is 30.8 in 2006 and 29.7 in 1996, for the women without children, this number falls to 22.8 in 2006 and 21.9 in 1996.

the response category and its reference category. Stata releases the risks, but it is calculated by dividing the cumulative incidence in exposed group by the cumulative incidence in the unexposed group. The reference category is *Indifference,* unless otherwise specified at the additional columns to the right.

Below, I will analyze the findings in light of my hypothesis. I will first discuss Table 2.8, which is the Multinomial Logit of all desired family sizes, and then I will discuss the results for the subsequently subsamples in Table 2.9 (one child), Table 2.10 (two children), and Table 2.11 (three children, logit regression).

Marital Status

Analysis of Table 2.8 show how, in general, married women seem to have higher risks of being indifferent because, consistently, other marital status such as singles and divorced show increased risks of preferring balance or any gender over indifference. Take, for example, single women in 1996. They have higher risks (3.18 and 2.7 times more risks) than married women of preferring daughters and sons compared to indifference, respectively. They also have a 68% higher risk of preferring balance over indifference compared to marriage. The same thing happens for divorced/separated women, who had in 1996 more than twice the rate of married women of preferring balance over indifference, and 3.72 and 4.85 times the risks of preferring daughters and sons. In 2006, singles continued to prefer more balance over indifference compared to married and the gender preference continue to be salient for divorced/separated.

For women who only want one child, as can be seen on Table 2.9, marital status becomes less important. Singles have higher risks (2.15 times the risks of married) of preferring a girl over indifference when compared to married.

In Table 2.10, for women who wish two children, the coefficients for marital status mimic those of Table 8 going in the same direction. For women who want even bigger family's sizes, however, the relationship reverses as can be seen in Table 2.11 for women who want 3 children: now, singles and divorced/separated have fewer odds of wishing a balance compared to married women. When I consider a bgg a girl preference and bbg a boy preference instead of balance, the single's preference for daughters becomes evident (not shown).

Age

Women's age consistently contributes to an increase in indifference. That means younger women, in general, have more preferences. Notice in Table 2.8 that with each additional year of age, the relative rate for balance compared to indifference would be expected to decrease by a factor of 0.91 in 2006 and 0.97 in 1996 given the other variables in the model are held constant. More generally, if a women increases her age, they are expected to fall into Indifference instead of Balance.

Same tendency is found for women who wants only child (Table 2.9), two children (Table 2.10), but not for three children (Table 2.11).

Virginity

Analyzing all family sizes in Table 2.8, virginity used to be associated with more indifference in 1996 (the relative risks for virgins relative to non-virgins would be expected to decrease by a factor of 0.48 and 0.60 of preferring daughters or sons over indifference). For women who only want one child, the same trend is observed on Table 2.9. But in 2006, virgins start to demonstrate more daughter preference. In the same table, the coefficient shifts to 1.6 the risks of non-virgins of being in the daughter preference category when compared to son's preference. And in Table 2.8, the coefficient changes to 1.53 in 2006.

Place of residence

In 1996, coefficients for place of residence are non-significant, which means both rural and urban areas behave the same way in relation to sex preferences when controlled by other covariates.

In 2006, however, in both Table 2.8 and Table 2.9, inhabitants of rural areas have lower risks of having a gender preference whatsoever when compared to indifference and urban areas. Take, for example, Table 2.8: for rural relative to urban, the relative risks for daughter and son preference would be expected to decrease by half (0.57 for daughter and 0.50 for sons) compared to the risks of urban areas given the other variables in the model are held constant.

When analyzed together with the Desired Sex Ratios of the Table 2.5, this means that the sex ratio above 1 that is reported for rural women is probably associated with being indifferent, not with a balance.

Geographic Region

One of the greatest surprises of this Chapter is the great importance of geographic region for the findings. Although only the South region was contemplated in the hypothesis, regions North and Northeast consistently appear as having a gender preference when compared to the Southeast, a fact that deserves further exploration in future papers.

In Table 2.8, North and Northeast tend to have more preference for balance than having a preference for indifference when compared to the Southeast Region. The chance of the North and Northeast being in the Balance category is 60% and 70% higher than the chances of the Southeast being in that category in 2006. In 1996, the coefficients are even stronger: the risks of the North reach 3.65 times the risks of the Southeast and the Northeast has 1.68 times more risk. Both regions also have higher risks of preference for girls over indifference, especially in 1996. In that year, changing the reference category to *sons* (as can be seen in the last column of Table 2.8), also reinforced the Northeast strong preference for daughters: they have 47% higher risks of preferring daughters over sons than the Southeast. The region Center-West also shifts from a behavior of being more indifferent (lower chances of having a gender preference whatsoever in 1996) to having a preference for Balance in 2006.

For women who wants to have one child on Table 2.9, the coefficients follow the same trend as the Table 2.8, but the Center West, in 1996, appear to have more daughter preference relative to son preference (4.28) compared to the Southeast. This preference loses strength in 2006. In 1996, northeast have 71% more risks than the Southeast of choosing girls compared to boys.

For women who want to have two children, as can be seen in Table 2.10, the only novelty is the South's and Center-West's strong son's preference. Notice how women in those two states have only 28% and 19%, respectively, the risks of women in the Southeast of preferring daughters over sons in 1996. Those coefficients are not consistent over time, but seem more associated with the patterns in Table 2.8, than for other desired family sizes.

These regional preferences can be related to the patterns found in the sex ratio table (Table 2.5) for 2006. For all women, the South have much higher sex ratio (more balance or male preference) than the Southeast. The Northeast have much lower sex ratio (more daughter preference) than the Center-West.

Religion and frequency of religious service

Religion is much less influential in sex preferences than I previously thought. Because no clear statistically significant tendency is observed, the coefficients won't be commented on in detail.

When it comes to church attendance, however, there is more indication that attendance increases indifference (Table 2.8, 2.9 and 2.10). For family sizes of one child, however, as can be seen on Table 2.9, when compared to people who don't go to church, church goers have 65% more risk than non-church goers of preferring one girl over one boy in 1996.

Race

When looking at all desired family sizes (Tables 2.8, 2.9, 2.10 and 2.11) Blacks compared to Whites, in 2006, demonstrate a strong preference for balance or for each of the sexes individually when compared to indifference. That means whites are more indifferent, in general.

Take Table 2.8, for example. Blacks not only have 30% higher risks than White in being in the Balance category (other than indifference), but they also have 71% and 82% higher risks than whites of being in the category Daughter or Sons.

It seems that for the cases of Black women, gender preferences are extremely salient for their reproductive goals, especially toward balance.

Income, Education and Work

Wealth level, education achievement and work did not seem to matter as much as I previously thought. But in the rare occasions when it was significant, it was in the direction of increasing indifference, which was expected.

In Table 2.8, for each additional year of education, the relative risk for daughter or son preference compared to indifference, respectively, would be expected to decrease by a factor of 0.82 and 0.88 in 2006 and 0.84 and 0.87 in 1996. Wealth level behaves the same way, but with much less significance. Only for women who want three children, wealth slightly increases odds of preferring balance over indifference (as can be seen on Table 2.11).

Also as expected, in 2006, women who work have more daughter preference when considered all family sizes in Table 2.8 (36% higher risks of preferring daughter over sons compared to women who don't work).

DISCUSSION

Several conclusions can be drawn from the empirical results above. The first is that the dominant Brazilian preferences are for a balanced composition, which is in accordance with the findings from Souza, Rios-Neto and Queiroz (2011).

The second conclusion is that fewer women in 2006 than in 1996 demonstrates a clear gender preference or even a balance preference, with increasing preference toward indifference, in accordance with the findings from Pollard and Morgan (2002). This finding suggests that in Brazil, women has been increasingly more likely to base their fertility preferences on size other than quality of their offspring, possibly driven by the decline of fertility. Brazilian women are aware that sticking to a favorite composition might mean they will end up with more children than they planned.

The decline in the search for balance might also mean that in Brazilian society, gender divisions might be getting less rigid and daughters and sons have the same value and fulfill their mothers' expectations the same way. As Pollard and Morgan (2002) state, when benefits of each gender are different, people might have different motivations to have one or another because sons and daughters are not substitutable.

Another sign that women are more likely to value size over quality is the fact that a large number (and bigger in 2006 compared to 1996) makes changes to their reported desired family composition based on the children they already have. The findings that Brazilian women's reports of intentions might be contaminated by their current parity and composition is one of the most important of this paper and raises awareness for the necessity of considering post-rationalization in every work on fertility intentions. This finding is in accordance with what Carvalho (2014) found, that Brazilian couples might change their minds about what is ideal after they start childbearing. In her qualitative study, she could not see the dimension of this factor, but with my analysis, one can have an idea of the amount of post-rationalization. Likewise, the same analysis also alerts us to the fact that women who are unhappy with the composition of their offspring might not even be considered in the analysis above: it is possible that those have moved toward their fertility goals by continuing childbearing in order to achieve them.

I also need to mention that future work should shed light on other factors that might play a role in intentions that were not analyzed in this paper due to data availability, such as partner's preference, siblings relationship, low self-esteem, parenting style, etc. Future work should also investigate whether not having a desired composition influences decisions regarding contraceptive use, sterilization, and remarriage in case of divorce.

As for the specific hypothesis testing the influence of schemas on fertility intentions and compositions, several hypothesis were confirmed, but also rejected:

Being single being separated or divorced are consistently associated with a daughter preference or with balance. Married, on the other hand, contrarily to what I expected, seem to be more indifferent regarding the sex than looking for a balance. The virginity hypothesis is also partially held. Virgins seem to be more indifferent in 1996, but changes to a daughter preference in the recent years.

The hypothesis related to the geographic region is confirmed. The South has consistently more son preference than the Southeast while the North and especially the Northeast, have daughter preference. Future work should investigate the reasons for this consistent daughter preference in the North and Northeast regions. Reasons could be related to higher levels of female migration to urban areas in the decades prior to both survey years possibly caused by the expansion of the demand for domestic labor. This mass migration altered the sex ratio in both urban and rural areas and was responsible for a process named "masculinization of the rural area" in Brazil (Camarano, 1997). So, a preference for daughters could be associated with a women's empowerment in this new environment or her attempt to respond to the societal forces that drove them away from the rural areas. It could also be related to the fact that in those areas where the major proportion of work available consists of strenuous manual work, young women have better educational outcomes than their male counterparts. Although the interaction between geographic region, place of residency and education level has not been explored here, this certainly deserves future study.

Nevertheless, women who live in rural areas are more indifferent when compared to urban, who prefer balance, which is not consistent with the hypothesis. However, when looking at the desired sex ratios, urban areas have lower ratios (more daughter preference) while rural areas have a sex ratio of around 1. The difference seem small but is statistically significant. It is also possible that this social group (rural) do not see a difference between a balance and an indifference.

Contrarily to what I expected, Blacks do not have very high rejection of males. But the opposite: this social group tend to have very strong preferences for both genders – or balance. That means that although the literature gives reasons to believe black boys are rejected by society, they are not being rejected inside of their own household. Future work should try to explore how gender roles in Brazil might vary by race how rigid this gender system is since according to Pollard and Morgan (2002), the more rigid a gender system, the more important the achievement of specific gender compositions.

I did not find that the patriarchal religious affiliations are an important predictor of child preference, but future studies should look into religious traditions that were not considered in this paper, such as the ones with African heritage that respect matriarchal authority.

Last but not least, as predicted, education level and wealth increases indifference while work increases daughter preference. It seems that for the lower class and lower educated, preferences are in fact more salient.

In conclusion, this chapter presents evidence that a balanced sex preferences exists among most Brazilians; evidences of secondary daughter preference are also found and deserve further consideration in future studies. Evidence also shows that “gender indifference” has become more pronounced as fertility declines, but Brazilian women, in their majority, still look for balance and that search is responsible for the effects of gender preferences on fertility.

TABLES

Table 2.1: Actual composition by ideal composition for women who only want one child, Brazil, 2006 and 1996

	1996			2006		
Ideal composition	**Boy**	**Girl**	**No children**	**Boy**	**Girl**	**No children**
Boy	152	26	171	247	27	176
	71.36	11.93	29.53	59.81	6.8	21.15
Girl	34	160	240	35	289	290
	15.96	73.39	41.45	8.47	72.8	34.86
One neutral	27	32	168	131	81	363
	12.68	14.68	29.01	31.72	20.4	43.63
Total	213	218	579	413	397	829
	100	100	100	100	100	100

Note 1: For 2006, Pearson chi2(2) = 387.3934 (p<0.000) for women with children. Ignoring neutral, Pearson chi2(1) = 375.0451 (P = 0.000). Adding boys to girls and comparing with neutral, results in Pearson chi2(1) = 13.4147 (p = 0.000). For 1996, Pearson chi2(2) = 171.4149 (p<0.000) for women with children. Ignoring neutral, Pearson chi2(1) = 171.0261 (P= 0.000). Putting them together to compare with neutral, comes out non significant Pearson chi2(1) = 0.3658 (P= 0.545). Comparing no children between years, Pearson p<0.000.

Note 2: Percentages shown below sample size.

Table 2.2: Actual composition by ideal composition for women who want two children, Brazil, 2006 and 1996.

	1996				2006			
Ideal composition	Two boys	Boy & Girl	Two girls	no children	Two boys	Boy & Girl	Two girls	no children
Boy & Girl	161	597	94	2,001	201	995	129	1,927
	52.44	91.01	34.31	79.82	37.78	83.33	27.8	70.87
Two boys	102	5	3	56	213	6	3	42
	33.22	0.76	1.09	2.23	40.04	0.5	0.65	1.54
Two girls	3	6	131	64	3	9	228	61
	0.98	0.91	47.81	2.55	0.56	0.75	49.14	2.24
Two neutral	41	48	46	385	115	184	104	672
	13.36	7.32	16.79	15.36	21.62	15.41	22.41	24.71
Total	307	656	274	2,506	532	1,194	464	2,702
	100	100	100	100	100	100	100	100

Note 1: In 2006, Pearson chi2(6) = 1600 (p<0.000) for women with children. In 1996, Pearson chi2(6) = 810.3734 (p<0.000) for women with children, (p<0.000). Comparing no children between years, Pearson p<0.000.

Note 2: Percentages shown below sample size.

Table 2.3: Actual composition by ideal composition for women who want three children, Brazil, 2006 and 1996.

	Actual composition									
	1996					2006				
Ideal composition	three boys	Two boys, one girl	One boy, two girls	Three girls	no children	three boys	Two boys, one girl	One boy, two girls	Three girls	no children
One boy, two girls	4	31	192	31	223	7	20	234	31	174
	3.81	10.44	72.18	37.35	37.99	5.38	5.05	66.48	28.44	31.18
Two boys, one girl	39	211	14	1	187	41	251	14	4	125
	37.14	71.04	5.26	1.2	31.86	31.54	63.38	3.98	3.67	22.4
three boys	47	3	5	0	13	52	6	1	0	0
	44.76	1.01	1.88	0	2.21	40	1.52	0.28	0	0
Three girls	3	4	4	37	9	2	5	1	48	8
	2.86	1.35	1.5	44.58	1.53	1.54	1.26	0.28	44.04	1.43
Three neutral	12	48	51	14	146	28	114	102	26	229
	11.43	16.16	19.17	16.87	24.87	21.54	28.79	28.98	23.85	41.04
Total	105	297	266	83	578	130	396	352	109	411
	100	100	100	100	100	100	100	100	100	100

Note 1: In 2006, Pearson chi2(12) = 1100 (p<0.000) for women with children. In 1996, Pearson chi2(12) = 841.8934 (P<0.000). Women without children who wanted to have 3 children also said that they wanted one girl, two neutral (0.17%), one boy, two neutral (0.17%) and one boy, one girl, one neutral (1.19%). Comparing no children between years, Pearson p<0.000.

Note 2: Percentages shown below sample size.

Table 2.4: Decline is the proportion of women who report bg (balance) as ideal composition and increase in the proportion who report xx (indifference) as ideal, all women without children, Brazil, 1996 and 2006 (CONTINUE)

		Women without children				p values for X^2
		n		%		bg vs. xx
		1996	2006	1996	2006	
Total	bg	2,001	1,927	47	41	0.000
	xx	385	672	9	14	
	Others	1,836	2,114	43	45	
	Total	4,222	4,713	100	100	
White	bg	773	734	47	39	0.000
	xx	175	336	11	18	
	Others	696	802	42	43	
	Total	1,644	1,872	100	100	
Black	bg	1,220	1,037	48	42	0.000
	xx	210	284	8	11	
	Others	1,134	1,169	44	47	
	Total	2,564	2,490	100	100	
Wealth (0)	bg	154	91	45	37	0.000
	xx	18	32	5	13	
	Others	168	120	49	49	
	Total	340	243	100	100	
Wealth (1)	bg	441	230	51	45	0.001
	xx	52	54	6	11	
	Others	378	229	43	45	
	Total	871	513	100	100	
Wealth (2)	bg	580	448	46	41	0.000
	xx	115	174	9	16	
	Others	558	464	45	43	
	Total	1,253	1,086	100	100	
Wealth (3)	bg	386	679	46	41	0.048
	xx	100	230	12	14	
	Others	347	767	42	46	
	Total	833	1,676	100	100	
Wealth (4)	bg	428	479	47	40	0.000
	xx	98	182	11	15	
	Others	376	534	42	45	
	Total	902	1,195	100	100	
Urban	bg	1,707	1,453	48	40	0.000
	xx	333	484	9	13	
	Others	1,509	1,670	43	46	
	Total	3,549	3,607	100	100	
Rural	bg	294	474	44	43	0.000
	xx	52	188	8	17	
	Others	327	444	49	40	
	Total	673	1,106	100	100	
Catholic	bg	1,560	1,454	48	40	0.000
	xx	306	535	9	15	
	Others	1,405	1,627	43	45	
	Total	3,271	3,616	100	100	
Protestant	bg	293	375	49	44	0.002
	xx	44	103	7	12	
	Others	255	365	43	43	
	Total	592	843	100	100	
Non-religious	bg	98	43	43	39	0.561
	xx	21	7	9	6	
	Others	111	59	48	54	
	Total	230	109	100	100	
North	bg	247	311	54	43	0.000
	xx	12	89	3	12	
	Others	201	315	44	44	
	Total	460	715	100	100	
Northeast	bg	815	443	49	42	0.000
	xx	123	114	7	11	
	Others	742	496	44	47	
	Total	1,680	1,053	100	100	
Southeast	bg	548	375	45	36	0.000
	xx	129	179	11	17	
	Others	533	498	44	47	
	Total	1,210	1,052	100	100	
South	bg	216	381	45	39	0.002
	xx	60	181	13	19	
	Others	201	413	42	42	
	Total	477	975	100	100	
Center-West	bg	175	417	44	45	0.116
	xx	61	109	15	12	
	Others	159	392	40	43	
	Total	395	918	100	100	

Table 2.4: Decline is the proportion of women who report bg (balance) as ideal composition and increase in the proportion who report xx (indifference) as ideal, all women without children, Brazil, 1996 and 2006 (FINAL).

		Women without children				p values for X^2
		n		%		bg/xx over time
		1996	2006	1996	2006	
Cohabitation	bg	86	262	51	42	0.005
	xx	12	91	7	15	
	Others	69	264	41	43	
	Total	167	617	100	100	
Married	bg	153	204	37	40	0.451
	xx	69	106	17	21	
	Others	195	201	47	39	
	Total	417	511	100	100	
Separated/Divorced	bg	41	67	40	36	0.173
	xx	5	17	5	9	
	Others	57	104	55	55	
	Total	103	188	100	100	
Single	bg	1,721	1,393	49	41	0.000
	xx	299	458	8	13	
	Others	1,515	1,545	43	45	
	Total	3,535	3,396	100	100	
Don't go to church	bg	381	297	46	38	0.000
	xx	66	103	8	13	
	Others	382	385	46	49	
	Total	829	785	100	100	
Goes to church	bg	1,521	1,630	48	41	0.000
	xx	298	569	9	14	
	Others	1,343	1,729	42	44	
	Total	3,162	3,928	100	100	
Virgin (no)	bg	684	1,220	44	41	0.000
	xx	154	442	10	15	
	Others	726	1,285	46	44	
	Total	1,564	2,947	100	100	
Virgin (yes)	bg	1,317	707	50	40	0.000
	xx	231	230	9	13	
	Others	1,110	829	42	47	
	Total	2,658	1,766	100	100	
Work (no)	bg	1,091	1,098	50	42	0.000
	xx	185	359	8	14	
	Others	922	1,175	42	45	
	Total	2,198	2,632	100	100	
Work (yes)	bg	910	829	45	40	0.000
	xx	200	313	10	15	
	Others	914	939	45	45	
	Total	2,024	2,081	100	100	

Note: The P values for the Pearson correlations have the purpose of showing how the decrease in balance and the increase in indifference are statistically important, with a few exceptions.

Table 2.5: Total Desired Sex Ratios for women without children and for women with children, Brazil, 1996 and 2006.

	Women without children				Women with children			
	1996		2006		1996		2006	
	DSR		DSR		DSR		DSR	
TOTAL	**0.98**	p value of in-group differences	**0.94**	p value of in-group differences	**0.98**	p value of in-group differences	**0.98**	p value of in-group differences
Race								
White	0.99		0.95		0.99		0.99	
Blacks and Brown	0.98		0.94		0.98		0.96	
Religion								
Catholic	0.98		0.94		0.98		0.98	
Protestant	1.01		0.96		0.99		1.03	
Non Religious	0.97		0.96		1.01		0.91	
Urbanicity								
Urban	0.98		0.94		0.98		0.96	0.019
Rural	0.99		0.95		1.00		1.03	
Region								
North	0.97		0.99		0.97		0.96	
Northeast	0.97		0.89		0.96		0.93	(3 vs 4) 0.052 (1 vs 4) 0.036 (2 vs 4) 0.006 (2 vs 5) 0.034
Southeast	0.99		0.96		0.98		0.96	
South	1.05		0.94		1.00		1.06	
Center-West	1.00		0.95		1.02		1.02	
Education Level								
None	0.99		0.89		0.99		0.95	(1 vs 4) 0.016
Elementary	0.97		0.93		0.98		0.99	(2 vs 4) 0.064
Some high school or middle	1.01		0.94		0.97		0.97	(3 vs 4) 0.037
High School Graduates	1.00		0.97		0.99		1.07	(2 vs 5) 0.089
College	0.94		0.94		0.95		0.89	(4 vs 5) 0.005
Wealth Index (percentile)								
0	0.98		0.85		0.98		1.01	
1	0.98		0.93		0.99		0.94	
2	1.00		0.98		0.96		0.99	
3	0.97		0.93		1.01		0.98	
4	0.98		0.96		0.97		1.01	
Church attendance								
No	0.96		0.91		0.98		0.94	
Yes	0.99		0.95		0.98		0.99	
Virginity Status								
No	0.98		0.96					
Yes	0.99		0.93					
Work Status								
No	0.98		0.96		1.00		0.99	
Yes	0.99		0.92		0.97		0.98	
Marital Status								
Married	0.99		0.94		0.98		0.99	
Separated/Divorced	0.96		0.90		0.98		0.93	
Single	0.99		0.95		0.97		1.01	
Age								
15-19	0.97		0.95		0.96		0.97	
20-29	1.00		0.94		0.97		0.97	
30-39	0.96		0.99		0.97		1.00	
40-49	1.00		0.85		1.00		0.97	

Note: I performed Pearson Chi2 tests. Pairwise comparisons of categories within social-groups (i.e. White, Black) that are significant are shown in parenthesis, followed by their p value. I also compared if the proportions in 2006 are statiscally different than in 1996. None of the tests were significant, which means that the proportion of daughter and sons (the desired sex ratio) doesn't change from one year to another (not shown).

Table 2.6: Desired composition sample distributions by desired parity, women without children, Brazil, 1996 (n=3935)

Categories in the multinomial logits		n	%		n	%		n	%		n	%
	One child			Two children			Three children			More than three children		
				bg	2,001	47	bgg	223	5.3	Same amount and some indifferent	1	0.0
Balance							bbg	187	4.4	bgxx	1	0.0
							bgx	7	0.2	bbgg	151	3.6
										same amount, no indifferent	23	0.5
Indiference	x	168	4.0	xx	385	9	xxx	146	3.5	xxxx	16	0.4
										Indifferent more than others	14	0.3
Daughter	g	240	5.7	gg	64	2	ggg	9	0.2	women more than men or indifferent	23	0.5
							gxx	1	0.0	bggg	7	0.2
										gggg	2	0.1
										gxxx	1	0.0
Son	b	171	4.1	bb	56	1	bbb	13	0.3	men more than women and indifferent	15	0.4
				bx	1	0	bxx	1	0.0	bbbg	2	0.1
										bbbb	6	0.1
Total		**579**			**2,507**			**587**			**262**	

Note: 251 (5.95%) does not want children, 22 (0.52%) doesn't know and 14 (0.33) had non-numeric responses.

Table 2.7: Desired composition sample distributions by desired parity, women without children, Brazil, 2006 (n=4263)

Categories in the multinomial logits		n	%		n	%		n	%		n	%
	One child			Two children			Three children			More than three children		
Balance				bg	1,927	40.9	bgg	179	3.8	Same amount and some indifferent	1	0.0
							bbg	127	2.7	bgxx	1	0.0
							bgx	7	0.2	bbgg	75	1.6
										same amount, no indifferent	6	0.1
Indiference	x	365	7.7	xx	672	14.3	xxx	229	4.9	xxxx	31	0.7
										Indifferent more than others	14	0.3
Daughter	g	290	6.2	gg	61	1.3	ggg	8	0.2	women more than men or indifferent	16	0.3
				gx	1	0.0	gxx	2	0.0	bggg	1	0.0
Son	b	176	3.7	bb	42	0.9	bbb	7	0.2	men more than women and indifferent	14	0.3
				bx	2	0.0	bxx	2	0.0	bbbg	7	0.2
Total		**831**			**2,705**			**561**			**166**	

Note: 342 (7.26%) does not want children and 100 (2.12%) doesn't know.

Table 2.8: Multinomial logistic regression of desired composition, women without children, Brazil, 1996 and 2006.

	2006								1996			
	Balance (indifference)		Daughter (indifference)		Sons (indifference)		Daughter (sons)		Balance (indifference)	Daughter (indifference)	Sons (indifference)	Daughter (sons)
	RRR		RRR		RRR		RRR		RRR	RRR	RRR	RRR
Region (Southeast)												
North	1.60	***	0.86		1.08		0.80		3.65 ***	3.23 ***	2.02 *	1.60
Northeast	1.71	***	1.41	+	1.19		1.18		1.68 ***	1.52 *	1.04	1.47 +
South	1.14		0.88		0.92		0.96		0.88	0.53 *	0.72	0.74
Center-West	1.67	***	1.00		0.94		1.06		0.76 +	0.50 *	0.42 **	1.21
Religion (Non-Religious)												
Catholic	0.74		0.86		1.24		0.69		1.12	1.87	0.90	2.08
Protestant	1.01		1.44		1.92		0.75		1.45	2.22	1.51	1.46
Race (White)												
Black	1.30	**	1.71	***	1.82	***	0.93		0.93	1.20	1.01	1.19
Rural	0.93		0.57	**	0.51	**	1.12		0.83	0.75	0.80	0.94
Years of Education [1]	1.01		0.82	**	0.88	+	0.94		0.94	0.84 *	0.87 +	0.98
Wealth Index [1]	1.00		1.00		1.03		0.97		0.92 +	0.95	0.87 +	1.08
Attends church	1.02		0.52	***	0.64	*	0.83		1.00	0.82	0.71 +	1.15
Work	0.94		1.17		0.87		1.36	+	1.02	1.00	1.06	0.94
Marital Status												
Separated/Divorced	1.30		2.41	**	2.88	**	0.84		2.62 *	3.72 **	4.85 **	0.77
Single	1.18	+	1.06		1.33		0.80		1.68 **	3.18 ***	2.70 ***	1.18
Age	0.91	***	1.01		0.97		1.04		0.97 ***	1.00	0.99	1.00
Virgin	0.90		1.28		0.84		1.53	*	0.88	0.48 ***	0.60 **	0.81
_cons	2.22	*	0.86		0.42		2.05		6.07 ***	0.31 +	0.76	0.40

Note: reference category in parenthesis.

Table 2.9: Multinomial logistic regression of desired composition, women without children who want one child, Brazil, 1996 and 2006.

	2006					1996				
	One daughter (x)		One son (x)		One Daughter (one son)	One daughter (x)		One son (x)		One Daughter (one son)
	RRR		RRR		RRR	RRR		RRR		RRR
Region (Southeast)										
North	0.99		1.27		1.01	3.28	**	2.16	+	1.52
Northeast	1.44		1.17		1.19	2.35	**	1.38		1.71
South	0.79		0.93		1.33	0.63		0.48	+	1.30
Center-West	1.00		0.79		1.02	0.90		0.21	*	4.28
Religion (Non-Religious)										
Catholic	1.30		2.00		0.77	1.74		0.85		2.05
Protestant	2.06		2.50		0.53	1.60		1.09		1.46
Race (White)										
Black	1.42	+	1.92	**	1.52	1.56	+	1.12		1.39
Rural	0.57	*	0.46	**	0.96	0.95		0.98		0.97
Years of Education [1]	0.94		1.05		1.01	0.88		0.90		0.97
Wealth Index [1]	0.98		0.96		0.83	1.00		0.93		1.08
Attends church	0.70	+	0.83		0.75	1.28		0.78		1.65
Work	1.22		0.82		1.30	1.12		1.04		1.08
Marital Status										
Separated/Divorced	1.37		1.84		1.07	1.83		3.46		0.53
Single	0.79		0.94		0.75	2.15	*	1.83		1.17
Age	0.87	*	0.83	**	1.01	0.88		0.88		1.00
Virgin	1.60	*	0.89		1.06	0.58	+	0.69		0.84
_cons	2.31		1.27		2.62	0.57		2.29		0.25

Note: reference category in parenthesis. X=one child, indifferent to sex.

Table 2.10: Multinomial logistic regression of desired composition, women without children who want two children, Brazil, 1996 and 2006.

	2006						1996					
	Balance (xx)		Two daughters (xx)		Two sons (xx)	Two daughters (Two sons)	Balance (xx)		Two daughters (xx)		Two sons (xx)	Two daughters (Two sons)
	RRR		RRR		RRR	RRR	RRR		RRR		RRR	RRR
Region (Southeast)												
North	1.49	*	1.04		0.62	1.67	4.55	***	1.28		0.00	10.00
Northeast	1.73	***	1.40		1.31	1.07	1.48	*	0.99		1.08	0.91
South	1.10		1.43		0.70	2.04	0.95		0.39		1.39	0.28 +
Center-West	1.74	***	1.41		1.01	1.40	0.67	*	0.26	*	1.34	0.19 *
Religion (Non-Religious)												
Catholic	0.39	*	0.26		0.99	0.00	1.15		0.97		0.84	1.16
Protestant	0.52		0.36		0.99	0.00	1.70		1.51		1.50	1.00
Race (White)												
Black	1.45	***	1.95	*	1.26	1.55	0.92		1.02		1.24	0.83
Rural	0.90		0.63		0.52	1.22	0.92		0.89		1.26	0.70
Years of Education [1]	0.95		0.88		0.97	0.91	0.86	*	0.90		0.86	1.04
Wealth Index [1]	1.05		0.88		1.28	0.68	0.90	+	0.96		0.87	1.11
Attends church	0.99		0.64		0.56	1.14	0.87		0.46	*	0.60	0.76
Work	0.93		1.57		1.01	1.56	0.93		0.93		1.35	0.68
Marital Status												
Separated/Divorced	1.53		6.23	**	2.87	2.17	3.40	*	11.09	*	6.31	1.76
Single	1.23	+	1.77		1.11	1.60	2.04	***	6.49	**	6.63 **	0.98
Age	0.95		0.94		0.96	0.97	0.90	*	1.04		1.01	1.03
Virgin	0.90		0.99		0.98	1.01	0.80		0.71		0.69	1.03
_cons	5.37	**	0.55		0.00	10	7.73	***	0.11		0.05 *	2.14

Note: reference category in parenthesis. xx=two children, indifferent to sex.

Table 2.11: Logistic regression of desired composition, women without children who want three children, Brazil, 1996 and 2006.

		2006		1996	
		Balance (Indifference)		Balance (Indifference)	
		OR		OR	
Region (Southeast)					
North		0.57	+	0.28	***
Northeast		0.59	+	0.60	***
South		0.98		1.14	
Center-West		0.65		1.33	+
Religion (Non-Religious)					
Catholic	+	1.28		0.88	
Protestant		0.99		0.68	
Race (White)					
Black		0.87		1.07	
				0.36	
Rural	+	1.29		1.22	
Years of Education [1]	*	1.15		1.08	
Wealth Index [1]		1.14		1.09	*
Attends church		1.09		0.99	
Work		1.03		0.99	
Marital Status					
Separated/Divorced		0.47		0.37	**
Single		0.53	*	0.59	**
Age		1.01	***	1.03	***
Virgin		1.42		1.14	
_cons		0.26		0.17	***

Note: reference category in parenthesis.
For the logit regressions of women who want three children, ggg, gxx, bbb, bxx weren't considered.

CHAPTER 3: SHEDDING LIGHT ON COMPETING PREFERENCES

INTRODUCTION

The number of children a woman will have during her lifetime is shaped by societal influences, such as her cultural and ethnic background, her place of residency and her socio-economic status. These factors shape not only what is on her mind about ideal family size, but also her opportunities for achieving those goals. For instance, chapter 1 has shown how a woman living in an urban area is not only more likely to report smaller family sizes as ideal, but is also less likely to have unwanted children.

In the path to motherhood, unanticipated circumstances, such as not having found a suitable partner or attending school, might turn a woman who dreamed about having two children into a childless one. On the other hand, other situations such as an unwanted pregnancy might cause a woman to bear a child in spite of her plans[33]. As a result, some women end up with fewer than desired while others end up with more children than were planned.

Due to the persistent gender roles for women in Latin American (LA) countries, often those unmarried and without children are seen as abnormal. Nevertheless, childlessness is not a new

33 Unwanted pregnancies accounted for 30% of births in Brazil in 2006. Curtis (2012) suggests that fertility intentions vary throughout the life time and respond to circumstances. Although 45% of births in Brazil were unwanted or mistimed, 80% of women were using contraception, a pattern which is consistent with an ambivalence about using contraception and waiting another child.

phenomenon in the world (Morgan, 1991), and even less in Brazil where the quote *ficar pra titia*, which literary means "to become an aunt", has historically referred to unmarried old women without children. Little is known about the trends, distribution and motivation for *titias* in the Brazilian population although everyone has one in the family. No one knows, for example, if have the *titias* been married, they would be much more likely to have a big family size.

Based on the assumption that the desire for children is universal, for the women who have married, childlessness has been attributed to involuntary infecundity. Nowadays, given that it has become more common, married women without children are sometimes labeled as "post-modern", "living the Second Demographic Transition (SDT)"[34] when in fact, these women might have fertility ideals that are higher, but due to circumstances of life that compete with motherhood, they are unable to realize it.

Although high educational attainment is the most influential factor predicting childlessness, postponement, and low fertility among women in LA, the inability to have the children one planned is not consistent with the SDT. It is possible that many women with zero or few children are facing situations that constrain or compete with motherhood plans, regardless of marital status. Having fewer children, or none at all, does not automatically allow the inclusion of these women in a "post-materialistic" category in terms of values and preferences[35]. It is important

34 Having a child disturbs autonomy and the framework of the SDT understand postponement of childbearing and smaller family size as part of an ideational change in which emphasis is given to individual self-realization and autonomy, recognition, expressive work, educational values, the rejection of institutional control, the rise of values associated with the satisfaction of individuals' 'higher-order needs', and gender equality (Surkyn and Lesthaeghe 2004; Van de Kaa 2001 in Billari, Liefbroer, Philipov, 2006; Lesthaeghe, 2014).

35 It is not part of the second demographic transition to wish kids and not have them (Lesthaeghe, 2014). The SDT is a complex framework but it does not postulate that women wish a replacement family size (around 2 children) but cannot accomplish them due to life conjunctures. It is part of the STD to wish and achieve smaller families or even zero but they do so voluntarily, not because of constrains.

to understand the desired fertility of women with no or few children and unveil the possible factors competing with motherhood and making her revise her goals.

In 2001, Bongaarts[36] described a theoretical model aimed at explaining fertility rates at the aggregate level (TFR), as a result of the multiplication of six parameters by the Desired Family Size (DFS). The first group of parameters is composed of factors that increase fertility related to desired family size: *unwanted fertility* (F_U), *replacements for child mortality* (F_R), and *sex preference* (F_{SP}). The second group is composed of factors that decrease fertility related to desired family size: *rising age at childbearing* (tempo effect which would be the number of children that a women would have had if they had not waited, or the F_T), *involuntary infertility* (which includes the inability to have a child and also an inability to find a suitable partner, the F_I), and *competing preferences* for child (set to 1 when childbearing is universal, the F_C). Thus, following this author:

$$TFR = DFS * (F_U * F_R * F_{SP}) * (F_T * F_I * F_C)$$

Notice that if woman realizes her fertility intention, TFR=DFS.

With the exception of the last parameter, all others have been proved to be well measured and reliable[37]. The Competing Preferences parameter (F_C), however, was calculated indirectly in the Bongaarts' Framework, by first estimating all the parameters in the equation, then getting the residual from what could not be explained of the TFR[38] by the equation above assuming that all factors have been measured correctly. In the first chapter of this dissertation, I estimated the values

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36 Bongaarts, J. (2001). Fertility and reproductive preferences in post-transitional societies. Population and Development Review, 27(Suppl), 260–281

37 Dharmalingam, A. Rajan, S. Morgan, S.P. (2014). The Determinants of Low Fertility in India. Demography. August 2014, Volume 51, Issue 4, pp 1451-1475

38 In the case study of Dharmalingan et al (2014), childbearing was nearly universal, so the Competing Preference parameter was set to 1. The authors suggested, however, that new reliable ways to measure Competing Preference had to become available to be used in countries where motherhood has competition.

of F_C to range between 0.34 and 1[39], and I found that they vary by social groups consistently with what the literature has pointed as having more barriers to fertility, for example, high education level or living in more urban areas.

But such an important factor as the F_C deserves to be better explored because it is responsible for substantially lowering the TFR, net of the influence of Desired Family Size.

As explained in Chapter 1, the Theory of Conjuncture Action (Johnson-Hanks et al, 2011) postulates that the desired family size and the number of children a woman will have during her lifetime is shaped by societal influences or resources named respectively, schemas or materials. They interact with a woman's agency to produce an Identity, a woman's distinctive and consistent behavior, ideas, meanings, inclinations, and aspirations--such as the dream of becoming a mother, or the dream of being a successful professional. People form life goals and follow long term plans accordingly to their identity. However, work from Gerson (2011) shows that it is possible that women have a family, career or a mix of the two profiles, following different schemas.

A life's course is embedded in a social context which brings about conjunctures that might affect existing plans and make, for example, women take different decisions than *a priori* expected, or make her priorities clash within one's identity (Johnson-Hanks et al. 2011). This is because the TCA also allows the life course to be dynamic, absorbing the impact that conjunctures and new experiences will make on the individual. While long term goals can be predictive, people constantly reassess their goals making choices that are distinct from their long term intentions.

By using this framework to interpret competing preferences, I am arguing that desired family sizes are influenced by different schemas that value smaller family sizes and are unique to

39 A F_C of 1 means that no competing preference can be detected as a residual. Estimation errors on the part of the other factors caused F_C to be higher than 1 in few cases.

socio-demographic characteristics. These major influences, when happen in regularity, can be conceptualized and measured at the aggregate level in order to understand what social components motivate behavior. By understanding and conceptualizing a series of conjunctures that women cannot anticipate when reporting their ideal family size, the model explains variability among social groups, by explaining what "constrains" behavior, fertility trends, and differentials. This sheds light on the fertility transition and explains the mismatch between observed fertility and desired family size (Dharmalingan et al. 2014).

The TCA and the Bongaarts frameworks are also useful because a women's identity can fit more than one schema or life goal that are apparently contradictory, such as being career oriented and an excellent mother. While some women are able to make adjustments to fit both, some have to make choices about what to pursue first or what dream to give up on. How exactly women decide by different schemas when faced with life conjunctures might tell what schemas seem more salient or strong and which schemas will define the relationship between a women's DFS and her CEB.

Given its dynamic nature, fertility intentions have only been explored in literature thus far using longitudinal data, which allows visualization of fertility accommodations. The expectations and revisions of fertility intentions are then better analyzed at individual level data. Unfortunately, no such data is available for Brazil. Besides, the focus of this analysis is on the Bongaarts framework, which was written as a decomposition procedure for fertility at the aggregate level. At the aggregate level, the investigation of the imbalance between DFS and CEB has been explored in the literature, in relation to the percentage of women in a certain population who are missing their target fertility[40].

Because of the variety of profiles and social groups in Brazil, it is important to understand the motivations surrounding fertility outcomes and the complexities of growing old as a woman. I will make use of different methods of analysis to shed light on factors that compete with fertility using two consecutive Demographic and Health Survey data from Brazil (DHS 1986 and 1996) and one Pesquisa Nacional de Demografia e Saude (PNDS 2006). I analyze the impact of career attainment, extended education and lack of partnership[41] on fertility, ideal family size, and fertility postponement and forego. I also analyze socio-demographic groups who were more likely to have a deficit in fertility (fewer children than they believe is ideal) and who are more likely to revise their goals at the mid-end of their reproductive life. Finally, I propose a different and robust way to estimate Competing Preference Scores at the aggregate level that fits the original Bongaarts equation. At the limitations section, I finalize with a brief discussion about the stable nature of the DFS component.

What competes with motherhood?

Literature shows that prolonged education, career and work, and extended singlehood can compete with motherhood, although the desire for personal goal achievements co-exist with a desire for children. The reasons are many, but basically, because the pursuit of life goals put into

40 In the past, it was more common to find women having more children than wished because rates of unwanted pregnancies were high. Women have, however, increasingly having fewer children than they wished.

41 According to the parameters, “lack of partner” would be better suited inside “Involuntary Infertility” instead of “Competing Preference”. But because it needs to be accounted for and because it is not being accounted in the Infertility parameter, I decided to include “lack of partner” as a competing preference factor.

practice by women with preferences other than motherhood consequently increase one's mean age at childbearing and delaying childbearing may reduce the quantum. More importantly, those competing factors also may cause women to revise their goals, translating into a fertility foregone. On top of that, those women usually have smaller desired family sizes to start with. In the paragraphs below, I will discuss these variables further.

Education

Countless studies have explored education's importance for fertility and its mechanisms (Brand and Davis, 2011). Kreider (2009) finds that countries facing declining fertility have increasing trends in women's educational attainment (Kreider, 2009). In the work of Rosero-Bixby, Castro-Martín, and Martín-Garcia (2009), the higher odds of being childless are found among those with college degree and working women (for more recent cohorts). Differently, Cohen, Kravdal and Keilman (2011) tested for reverse causality and found that having a child at an early age caused very detrimental effects on a women's education attainment.

Three main explanations associating education with fertility stand out. First, as a source of social norms, education provides women with ideal family sizes. Second, it increases the resources women have to stick to their plan and implement their preference. And three, it provides women with life course roadmaps that make education compete with childbearing, thus society reserves the place for education prior to marriage. More details are found in the paragraphs below.

First, education attainment models ideal family size because it provide literacy skills, information and cognitive changes that broaden a women's knowledge about her own body and reproductive potential reducing her fatalistic approach to life and increasing her trust in science and technology. Information gained at school or throughout mass media also changes attitudes by exposing women to nontraditional life styles and making her questions traditional beliefs and values held by their family of origin, their religious affiliation, and other social structure (Martin and Juarez, 1995; Heaton, Forste, Otterstrom, 2002).

Secondly, education foster a women's achievement of her ideals by leading to higher socioeconomic advantage which increases her access to contraceptive means and reduces her reliance on the existence of public family planning programs, decreasing her proportion of unwanted births. Around the world, the difference between wanted and unwanted is bigger for women with poor education (Bongaarts 2003). Brazil is not different, and 20 years ago, a gap in contraceptive use was responsible for different TFR among social groups. Unwanted fertility reach 30% of pregnancies although desired family sized was much more similar among groups denouncing a very low level of preference implementation, especially among the low educated (Ibisomi et al. 2005; Bongaarts 1993; Martin and Juarez, 1995).

Testa and Toulemon (2006) call preference implementation "planning capacities", and also find that highly educated have better odds to stick to their 5 year reproductive plans. Other authors have also found that development and positive changes in socio-economic conditions increases implementation and decreases unwanted fertility (Potter, Schmertmann and Cavenaghi, 2002).

Lastly, education competes with motherhood because it increases social and economic mobility, "raising the opportunity costs of children by enhancing women's opportunities to pursue wage-earning activities, which are likely to compete with domestic and childrearing responsibilities" (Martin and Juarez, 1995; Heaton, Forste, Otterstrom, 2002). Put in a life course perspective, education attainment is reserved to the first decades of life. Females who pursue higher levels of education and for which the levels of return of education are higher, are encouraged to postpone marriage and family formation, which affects the quantum and tempo of fertility (Kohler and Ortega, 2011). Although educational improvements in Latin American at the primary and secondary level affected fertility in the past, the differences are now more pronounced among women with or without college education (Rosero-Bixby, Castro-Martín, and Martín-Garcia, 2009).

Education also provides women with alternative plans to marriage and a family life that ultimately may not include children, for example, leading a career oriented life that may be equally satisfying. Rosero-Bixby, Castro-Martín, and Martín-Garcia (2009) discuss the role of tertiary education in the retreat of childbearing in Latin America. They find that an increasing proportion of women are childless by age 50.

Women with different levels of education show not only very different levels of fertility but also different timing. Women with only one child ever born at the end of their reproductive life tended to be the last ones to become a mother, last ones to marry and to have the longest intervals between marriage and first child. It is important to notice that women having their first child at older age also have fewer odds of having high parity births due to an age effect – it is simply more difficult to get pregnant at older ages, so there is a decline in fertility caused by women who cannot catch up on childbearing (Bonifacio, 2011; Ortega and Kohler, 2002). It is unknown whether this behavior has been increasing over time.

Although fertility in Brazil has a young pattern, with mean age at childbearing around 26.5 in 2007 (Alves and Cavenaghi, 2009), the differentials by education and income are important to be considered. For women with lower income and low education the mean age at childbearing is 25.6, while for the upper income with high education the same number is 30. A teenage with fewer than eight years of study is twice more likely to have a child than an adolescent with at least a secondary education level (Gupta and Leite, 1999). In the work of Rios-Neto and Guimaraes

(2013), women with tertiary education present lower fertility level and older mean age at childbearing. Bonifacio (2011) also finds that the proportion of highly educated becoming a mother was already smaller in 1996 for the highly educated compared to the low educated. Moreover, while only 30% of the highly educated progressed for the 4th birth, 70% of the low educated did so.

In Brazil, access to higher education is largely determined by social origin and race, thus in order to analyze the potential effects of education on fertility, it is necessary to control for income or other SES, and also for race, because education is selective and might have different gain for different women. “The observed disparity in reproductive behavior among educational strata, thus, may be partly a reflection of this polarized social structure (Martin and Juarez, 1995)”. Alves and Cavenaghi (2009) finds that for the more educated women, income does not matter, but for the less educated, income does. Interestingly, Brand and Davis (2011) find evidence that the effect of college attainment in decreasing fertility is stronger for initially disadvantage women than for those whose biography were predictable to attend college showing that low educated have higher gains from college completion.

In conclusion, among the competing preferences for motherhood, education stands out as one of the most important. I do not expect primary education to be much relevant nowadays, as it is close to universal in Brazil, but higher levels of education, such as having a college or BA education, might affect at a great extent fertility levels and fertility plans. More remarkably, women who attend college or graduate courses tend to postpone childbearing and further focus on work/career, also influencing fertility. Next subsection discuss the role of work and career on fertility.

Work/Career

The influences of career and work for fertility rates are less straight forward than those of education. In fact, Martin and Juarez (1995) found that the impact of education is often reduced when economic controls are applied. That means there is a substantial difference between women according to their income or work status regardless of her education. On top of that, both educated and low educated women tend to work in Brazil and women of low SES have historically worked (Leme e Wajnman, 2000). Work status are also historically contingent on race, with 50% more chance of a Black women being a worker than a White (Itaborai, 2013).

Brewster and Rindfuss (2000) shows how the relationship between work and fertility can be either positive or negative depending on the context and on the women's ability to combine work and family. Her ability to combine, on the other hand, is subjected to the family policies available, her necessity for income, and the salience of her career for her Identity.

The importance of family policies to determine fertility rates in Brazil has not been studied extensively. Most research so far has been concerned with public policies for fertility control (Wong and Perpetuo, 2006). Although mothers are granted a 4-6 months of paid maternity leave and free childcare are available only in selected cities, middle class have been outsourcing their infant care to nannies, family members, or private daycare, while their poorer counterparts have been primarily counting on family and friend's network, especially grandmothers, to be able to conciliate work and family (Marteleto and Noonan, 1998).

A women's necessity of income also correlates with her ability to conciliate work and fertility. That is because women might work for different reasons. Poor and low educated many times work to improve their economic conditions and get out of poverty. These women are the ones most likely to have higher fertility rates and higher unwanted fertility, promoting a vicious cycle of poverty and fertility. Richer and highly educated, on the other hand, have higher odds of keeping their wages for themselves (Martin and Juarez, 1995).

Work and careers are also associated with childlessness. Smock and Greenland (2010) show how voluntarily childless women have higher incomes, a higher percentage in managerial and professional occupations, and most extensive past work experience in comparison to the temporarily and involuntarily childless. The authors also show that childlessness is much more common among women with high human capital, managerial positions, highly compensated and time-intensive careers reaching 50% in some subgroups (Crittenden, 2001 in Smock and Greenland, 2010). Because of that, evaluating occupation dynamics might give better insights in how fertility is being negatively affected by work and vice versa. The higher the "degree of skill depreciation" coming from a time away of the labor market, the less likely this women will be to have children. Because the skills of highly educated are usually difficult to obtain and are easily lost if not practiced compared, for example to a domestic worker or a secretary, the first may be more tempted not to leave the labor market when having children or not to be absent from it for too long. They also might be more likely to not have children at all, focusing on their career.

Data for Brazil shows that the type of occupation could definitely interfere with her reproductive behavior. Dias Junior (2010) finds that the mean number of children ever born for administrative workers is two children. Manual workers have at least 1 more child if they are urban and domestic workers, or 2 more children in case of rural workers.

In an analysis considering separate effects for each new parity, Souza, Rios-Neto and Queiroz (2011) find that the children, in general, reduce the probability of labor market participation of women, especially children of high parity, such as the third.

Working outside the home reduces by 12% a woman's chance of wishing to have children, even controlling for important socio-demographic variables (Itaborai, 2013). It is not clear whether this influence comes from a feeling of competition with motherhood or simple because working outside the home has similar effects as education, of exposing women to different ideas and smaller family sizes.

Lastly, harsh economic conditions has been linked to delayed marriage and childbearing (Morgan, 1991). As for unemployment, it might have different effects on fertility according to the literature. Temporary unemployment might reduce women's opportunity cost of time without affecting long-term income so it makes it a good time for childbearing. On the other hand, permanent unemployment decreases future income and increases uncertainty, impacting the marriage market and consequently, fertility (Becker 1972; Becker 1981, Adsera 2005, Leone and Hinde, 2007).

Adsera and Menedez (2011) also find that fertility rates are reduced when urban and more educated women face economic uncertainty. It is important to say that both income and work status are time varying variables, so it is difficult to investigate the reverse causality that could possibly exist. For example, women might be unemployed because they got pregnant, or they might have got pregnant because they were unemployed. It is also impossible to know whether a women had a child because she is working in a blue collar job or she is working a blue collar job because she need to support a child she had.

Apart from that, women might work from home, making it more challenging to observe the impacts of career on motherhood, increasing the possibility of combining the demand of labor market participation and child bearing.

The pursuit of a higher level of education associated with career/work demands are two factors that may have an impact on fertility levels and plans. Another one that may be linked to these factors is the women's acknowledgment that she has not found a suitable partner, which is the next topic addressed.

Lack of partner

The lack of a partner and late marriage reduce fertility by limiting the opportunities and the amount of time women have to bear children.

Data from the 90's reveal that by age 50, 13% of women in Latin America have not married (Heaton, Forste, Otterstrom, 2002). Because childhood is not tied to marriage in Brazil, this does not mean they do not have any children or they do not want any children. Limited data is available on the percentage of women who arrives in mature life single and without children in Brazil. Bonifacio (2011) suggests the main reasons are involuntary, such as infertility or involuntary celibacy.

Another complicating factor of studying the influences of marriage on childbearing is that among 25 to 29 years old, 50% were in cohabitation in 2010 and this number has been increasing (Esteve et al. 2012; Covre-Sussai et al. 2015). That is why in the case of Brazil, one has to use data on sexual activity rather than marriage to indicate exposure to pregnancy (Stover, 1998). Some unions follow the birth of a child or immediately precedes it. In some cases, the interval between the marriage and the first child is 0.7 years, proving that it has become more common to get marriage pregnant (Alves and Cavenaghi, 2009). Brazilian cohabitants also have bigger fertility and is associated with more social disadvantaged people who cannot pay for the costs of marriage, and persons with African and Native Indian heritage (Merrick, 1986; Rosero-Bixby 1996).

More recently, cohabitation has been used by more educated counterparts (Castro Martin 2002; Esteve, Lesthaeghe, and Lopez-Gay, 2012) which made authors suggest that this could be a sign of the Second Demographic Transition in Brazil (Verona et al, 2015). As Castro-Martin (2002) points, the high prevalence of cohabitation could be a sign of modernity or tradition, depending on the social group (Castro-Martín 2002).

In addition, Brazilian unions have become more dissolvable (Leone and Hinde, 2007). If divorce and separation reach females before the onset or the end of childbearing, these could decrease their cohort fertility because they would not have a partner with whom have children. Leone and Hinde (2001), however, indicate that union instability has a positive effect on the overall level of fertility because women might have more children with the new partner or because women with more unions have more exposition to sex and more liberal behavior which also make them more prone to having children.

Late transitions

The traditional path into adulthood in Latin America was composed of starting to have sex during teen years, enter a union a year later and have a child a year later, but Latin America women with higher levels of education are less likely to follow this rule. "Normative patterns or cultural expectations about the appropriate timing of life events and transition contains and shape the life course of individuals. Within the life course framework, age expectations mark appropriate times for major life events and transitions such as initiating sexual activity, getting married and having children" (Hogan 1981, Elder 1985 in Heaton, Forste, Otterstrom, 2002).

The delay in transitions probably reflects societal changes (Smock and Greenland, 2010, 579). In Italy and Portugal, where young adults don't have economic or emotional conditions to leave their parents' house and establish their own, they continue to live with their parents prolonging young adulthood and delaying childbearing until they achieve higher educational degree, establish themselves in the labor market and increase economic security. They also wait until they find a suitable husband, marry them, move from their parents' house and enjoy married life before having children (Billari, Liefbroer, and Philipov 2006).

According to Blossfeld and Huinink (1991) being dependent on one's parents economically has negative effects on fertility. In fact, in the United States, 36% of young adults aged 18 to 31 live in their parents' home, a number that is much higher than before (Fry, 2013). Rising college enrollment, delayed marriage and declining employment could be the reasons (Fry, 2013).

In Brazil, research has pointed to the existence of the same phenomenon. It is possible that men and women age 30 are not ready to leave their parental home and establish their own. But as seen earlier, for the low educated counterparts, continuing to live in the parental household does not seem to prevent the transition to parenthood because they can establish their parental home as their own.

RESEARCH QUESTIONS AND METHODS

Women having fewer children than they want are a source of concern due to the direct demographic consequences of low fertility, such as population aging, and also because the degree to which they are able to implement their preferences characterizes the sexual and reproductive rights of women.

Extensive literature has covered the conjunctures of life leading to unwanted fertility (Bongaarts, 1997; Adetunji, 1998; Hakkert, 2001; Chackiel, 2004). Alternatively, some women planned to be mothers, but the conjunctures of life made them childless or with fewer children compared to their ideal family size. Because reasons to postpone or to forego fertility might be different, women with fewer children than desired or women with zero children form a heterogeneous group who deserve to be studied and explored in order to understand their motivations and the level of competition that impacted their motherhood plans.

What competing factors seem to be more important in defining a women's fertility related to her ideal family size? For which reasons are women having fewer children than they wish over the years? Do I have evidence to suggest that some women are foregoing fertility while others are just hoping to delay? How different are the two groups? How well does the residual of the Bongaarts' equation calculated at Chapter 1 represent the competing factors that make a women revise their fertility goals or simply having fewer children than they wish?

Unfortunately, longitudinal data on fertility intentions and outcomes is not always available, as in the case of Brazil. On top of that, as already mentioned, the Bongaarts equation decomposes fertility rates into parameters that uses aggregate level data to model fertility parameters that drive disparities between what is desired and what is achieved. So, I will use the Brazilian Demographic Health Surveys of 1986, 1996 and 2006, the most recent at the time of this research, to answer the four specific objectives of this chapter:

1 - Evaluate the impact of career attainment, extended education and lack of partner on actual and desired fertility.

2 - Understand the characteristics of women who have fewer children than they wish and who have more children than they wish. Understand what explains a women intentions of postponement or foregoing of their fertility.

3 - Evaluate the applicability of the Competing Preference factor estimated at the Chapter 1 as a residual of the Bongaarts equation.

4 – Evaluate how well the parameter of Competing Preference (F_C) represent a fertility depletion/revision downwards.

In the following paragraphs, while introducing the four objectives of this chapter, I will also present the methodology I chose to address them and their results. Data cleaning, variable recoding, and data analysis were done using Stata 12. The specific statistical commands and filters utilized will be detailed further individually.

First objective

First, at the individual level, I am interested in evaluating the impact of career attainment, extended education and lack of partner on actual and desired fertility. In order to do that, I Performed Poisson regressions of number of Children Ever Born (CEB) and Desired Family Size (DSF) to clarify which of those covariates are associated with lower values for both fertility measures at the individual level. The categories for those variables of interest are: Marital status (Cohabiting =0, Married =1, Separated or Divorced=2, Single and Never married=3); Years of education continuous), labor market participation (no=0, yes=1), BA level (no=0, yes=1).

Covariates will be used to control for the fact that socio-demographic groups are more likely to have or wish fewer children over time: place of residence (0=urban, rural=1), macro-region (North=1, Northeast=2, Southeast=3, South,=4, Center-West=5), religious affiliation (Catholic=1, Protestant=2, Other=3, No-Religion=4), church attendance (no=1, yes=1), race (White=1, Black=2, Brown=3), and wealth index (5 levels 0 to 4, being 4 the highest)[42].

For CEB, as usual in demographic research, only women age 40 and plus were considered, as they are close to the end of their reproductive life. Age is kept as a control in the DFS regression.

The dependent variable are both count data at the individual level represented by a distribution of non-negative integers that resemble a Poisson distribution. The logarithm of the expected value of both independent variables (DFS and of the CEB) conditioned on the exogenous variable is linked to a linear function on their predictor variables, which are the characteristics investigated in this study:

$$\log(E[Y|X]) = \alpha + \beta' X$$

where: α is a parameter, β is a vector of parameters and X is a matrix with the explanatory variables.

The coefficients and p values for the Poisson Regression of the CEB can be found on Table 3.1, while the Poisson Regression of the DFS can be found on Table 3.2. The results displayed are showed in Incidence Rate Ratios. It is obtained by exponentiating the Poisson regression coefficient.

42 Refer to the Appendix 1: Chapter 1 for explanations on the construction of the Wealth Index and the Predicted Level of Education.

Poisson Regression of Children ever Born

After controlling for important covariates such as race, religion, church attendance, urbanicity and geographic region, the coefficients on Table 3.1 show that the number of children born is dependent on one's wealth index, level of education, work status and marital status as predicted by the literature review. Notice how for each additional wealth level, the risks of having a child decreases. In 1986, for example, the RRI of 0.89 means that each additional wealth level decreases the risks of having an extra child by 11% (1-0.89). The proportions are consistent across survey years.

Having a BA decreases fertility much more in 1986 than 1996 and much more in 1996 than 2006. Notice that having a BA in 1986 decreases the risks of having a child by 38% (RRI is 0.62) and in 2006, by 19% (RRI is 0.81).

Women who work behave the same way, but the relative risks are slightly more consistent over time: 0.88, 0.95 and 0.95.

By far, the most important predictor of fertility is marital status. Being married, cohabiting or being separated/divorced are associated with much higher risks of having additional children than being single, varying from 25.86 times the risks of singles in the case of married in 1986 to 4.56 in the case of cohabitants in 2006. One can also notice that throughout time, marital status has been losing importance, as can be seen in the decline of magnitude in those risks.

In sum, consistently, at the multivariate level, women who work, have a Bachelor degree, and have higher socio-economic status (measured using Wealth) have fewer children. Singles also have fewer children than married, cohabitants and separated/divorced and marital status.

Poisson Regression of Desired Family Size

When it comes to desired family sizes, which is not supposed to be contingent on competing preferences, the roles of wealth, work and education are unaltered as can be seen in Table 3.2, although their effects are very small yet significant.

Notice, for example, that each additional wealth level contributes for a decrease in DFS by 1.5% (in 1996, RRI is 0.99) to 3% (in 2006, RRI is 0.97).

Women who work follow the same tendency, but the only significant coefficient is in 2006 when working gives women a 4% decreased risk of wishing additional child as can be seen in Table 3.2.

BA, however, changes from being associated with smaller desired family sizes in 1986 and 1996 (coefficients are smaller than 1 on Table 3.2), to be related to larger family sizes in 2006 (larger than 1), but this last is not statistically significant. So, this basically means that BA no longer matters for DFS in 2006 probably because of the expansion of the tertiary education, suggesting that the deterrence effect of holding a BA is diminishing.

Since this regression was performed for women of all ages, the coefficients of age also indicates that the older a women, the higher her DFS. In fact, each additional year of age contributes for an increase in 1% of her risks of having more children.

Another important thing to notice on Table 3.2 is that both married and cohabiting have higher DFS than singles (higher DFS represented as a higher risk), but not separated/divorced.

That means that if divorce is not selective of women with smaller family sizes, it could contribute for a decline in DFS. With this database, however, it is difficult to evaluate the causality and selectivity of that.

It is also important to notice from Tables 3.1 and 3.2 together that women who cohabited or were separated/divorced desired less children that their married counterparts, but had similar CEBs (*changes in reference category not shown*). These results indicated that being separated/divorced is not a competing preference for fertility. Altering the reference category it is also possible to see that even controlling for all covariates, all marital status wish fewer children than married women. Again, it is impossible to suggest a causality here implying that women change their minds once they get married because this is a cross sectional database.

In order to see whether having had a child changes the desires, I also included "had a child" in my controls (not shown) and the biggest finding is that having a child increases the desire for bigger family sizes, as expected for a population with higher levels of rationalization.

Second objective

The second objective is twofold. First, I want to understand what the characteristics of women who have fewer children than they wish are compared to women who have more children than they wish (*Multinomial regression of fertility status*). Second, I want to understand who the women who are revising their fertility goals are, trying to understand the association with postponing or foregoing motherhood for women age 30 and plus (*Odds of wishing to stop or continue for women who have fewer children than desired family size*).

Multinomial logit regression of fertility status

Using women's response to their CEB and DFS utilized in the previous question, I built a 3 category variable called Fertility Status. Using the following calculation, I determined which category a women age 30 and plus belong:

1 - If her DFS=CEB, women were categorized as Neutral because they currently have the same number of children as their ideal[43].

2 - If her DFS<CEB, women were categorized as Surplus because they already had more children than she was desired.

3 - If her DFS>CEB, women were categorized as Deficit, because women had fewer children than she considered ideal.

Thus, the three category variable of Fertility Status stands as follows (0=neutral, 1=surplus, 2=deficit). I performed a multinomial logit regression of Fertility Status because Multinomial logit are used to model discrete variables with more than two possible outcomes given a set of independent variables. The coefficients for the Multinomial logit regressions, showed in Log Odds and having Surplus (1) as the reference category, can be seen in Table 3.3.

The independent variables are the same applied in Objective 1 - Marital status (Cohabiting =0, Married =1, Separated or Divorced=2, Single and Never married=3); Years of education continuous), labor market participation (no=0, yes=1), BA level (no=0, yes=1). The controls are also the same.

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[43] It is impossible to know whether they could be just rationalizing.

For this analysis, women who did not have a DFS were classified as neutral and those who were pregnant were dropped.

Who are the women who have fewer children than they wished at age 30? Who are the ones who have more children than desired?

As can be seen on Table 3.3, controlling for all covariates, the women who have higher chances of having a Deficit fertility compared to a Surplus are the women of higher Wealth Level, those who work, those with a bachelor degree and the singles. Notice in Table 3.3, for example, that the odds of being in the Deficit category (having Surplus as a reference) tend to be more positive the wealthier the women is and in case or has a BA degree. In 2006, women with college education have more 1.41 log odds of being in the deficit group as compared to the surplus. Exponentiating the coefficient would result in 4 times higher chances of being in that group. In the same year, each additional wealth level would increase a women's odds of being in the Deficit group by 23% (Exp 0.215). Because this is a multinomial logit, those variables also present higher chances of being in the neutral category when compared to Surplus, but these coefficients won't be commented.

In 2006, those who work have higher chances of being neutral, but not higher chances of being in the Deficit group. In fact, in both 1986 and 1996, women who work have higher chances of being in the surplus (log odds are -0.02 and -0.03, respectively), but these numbers are non-significant.

The strength of marital status compared to the other variables seem to be decreasing over time, which suggest that either childbearing has become equal across marital status or that single-motherhood has become more acceptable and people are no longer getting married after an unwanted pregnancy. Take the odds of married people over time, for example: on Table 3.3, their log odds vary from -3.68 in 1986, to -2.70 in 1996, and -1.86 in 2006. Since this is an analysis of fertility deficit, it is also possible that both groups are either having fewer children or wishing more.

Odds of wishing to stop or continue for women who have fewer children than desired family size

As a second step for this Objective 2, I selected only the women for whom their number of children ever born (CEB) is smaller than her desired family size (DFS) for women age 30 and plus. Within this group of women with deficit fertility, I look at what percentage of women answered "no" and "yes" to the following question: "would you like to have an additional child/any child? (*Translations are mine*)". Women who answered "**yes**" are women who are possibly postponing their fertility and they were coded as 0 (zero). Women who answered "**no**" are women who are foregoing fertility; in other words, these women have revised their fertility intentions downwards, possibly due to competing preferences, and they were coded as 1 (one).

DFS>TFR → would you like to have an additional child/any child?

Yes (0), she is postponing.

No (1), she is foregoing.

A logistic regression on selected covariates clarifies the factors associated with answering **no (0)** compared to answering **yes (1).** The coefficients in this case are the log odds that a person with a certain characteristic will have marked the option **no**, or foregoing one's fertility (Hosmer & Lemeshow, 2000). Thus, a positive coefficient means that this social group has higher odds of wishing to stop fertility by not having more children. This is the group making a downward revision of their fertility intentions. A negative coefficient means the social group is more likely to delay fertility (by saying that wish to have children at a later time).

Although competition depletes fertility rates related to ideal family size, postponing fertility might temporarily decrease period fertility rates or even cause a tempo effect that ultimately leads to a quantum effect. The coefficients can be seen in Table 3.4.

The independent variables are the same applied in Objective 1 - Marital status (Cohabiting =0, Married =1, Separated or Divorced=2, Single and Never married=3); Years of education continuous), labor market participation (no=0, yes=1), BA level (no=0, yes=1). The controls are also the same. In 1986, women who were not married or cohabiting did not get asked the question about intention for additional births.

For the two years, women who were pregnant, sterilized or infecund at the time of the interview or who said they didn't know their intention for additional births, were dropped from the analysis. The coefficients for the Logit Regression, in log odds, can be found on Table 3.4.

Within the women who have fewer than desired, who are the ones who are postponing their fertility (with an additional child later) and who are the ones who are revising (do not want more children)?

Notice, on Table 3.4, that positive and significant coefficients are associated with foregoing fertility, while negative and significant are associated with fertility postponement.

Additional wealth levels are associated with increasing odds of revising fertility. That means, when richer people are facing a deficit fertility, they are more likely to say that they do not want more children (revise their fertility downwards), but only in 1986 that coefficient is significant (log odds are 0.34 which translates into a 40% increase in the odds of revising fertility compared to postpone).

In that same year, women who are working or who have Bachelor degrees are more likely to say that their deficit is temporary (or that they are postponing their fertility). This is because their odds of being in the foregoing group is negative (-0.35 for Work in 1986 which translates into being 70% the odds of people who don't work of being in that same category and -0.81 for BA in 1986, which translates into 44% the odds of people without BA in being in that category).

The results are consistent over survey years, but work is only significant in 1986.

As expected, singles have much higher odds of just being delaying fertility.

In this bivariate models, I did not control for the number of children ever had, but they all have fewer than wished. It is possible, though, that the married women are much more likely to stop because they already have <u>some</u> children, while the single might have none. In both cases, they could have fewer than wished.

The results presented in this subsection suggest that wealthier, the more educated individuals, those who work and the singles had a greater propensity to belong to the group with deficit fertility. It also shows that, with the exception of the wealthy, they suggest their fertility is a matter of postponement.

Third objective

After understanding the determinants of the number of CEB and DFS, and of the differences between both variables, I intend to relate the findings of this chapter with those of chapter 1. More specifically, I will relate the Competing Preference factor estimated at the Chapter 1 as a residual of the Bongaarts equation with the deficit in fertility examined here. It is important to mention that under the Bongaarts (2001) assumption, the residual can only be accounted for Competing Preferences if all factors are measured perfectly, something I know is unattainable.

My third objective is to evaluate the applicability of the Competing Preference factor estimated at the Chapter 1 as a residual of the Bongaarts equation. How well does that represent women's revised intentions?

As seen in the last pages of Chapter 1, plotting the coefficients for Competing Preferences (F_C) calculated as a residual against the population mean values of level of education produces a consistent straight line showing that education is highly associated with Competing Preference. The finding is consistent across years. Would that still hold true for other indicators of Competing Preferences? In order to test that, I plot the Competing Preference factor estimated at the Chapter 1 against population values of mean age at first union and proportion of women in the labor force to investigate if those factors are indeed associated with higher values of competing preferences. I do it separately by each survey year, using the same socio-demographic groups of Chapter 1. The rationale driving this analysis is that if people are making decisions and revising their fertility based on concrete situations such as not finding a mate or having to work, populations with higher age at first union and major proportions of women in the labor force are expected to have more competition (or lower values for F_C) than those population with low age at marriage and low proportion of women in the labor force (remembering that lower values for this parameter means higher levels of competing preferences). That is, I expect a negative slope.

The crude values for the population means can be found on Table A3.1 in the Appendix 3: Chapter 3. The plots can be visualized in Figures 3.1 through 3.6. It is important to keep in mind that the F_C is a multiplicative model, which makes values depart from 1. Thus, the stronger the Competing Preferences, the more it negatively departs from 1.

As a result, plotting the residual (F_c) with their correspondent population mean value of mean age at marriage (Figures 3.1 through 3.3) and proportion of women in the labor force (Figures 3.4, 3.5 and 3.6) also produce a negative linear correlation. The respectively coefficient of determination (R^2) are 0.6207 for 1986, 0.5468 for 1996 and 0.3621 for 2006 in regards to mean age at marriage and 0.4052 for 1986, 0.4959 for 1996 and 0.4316 for 2006 for proportion of women working.

Contrarily to education (Figures 1.10, 1.11 and 1.12 in Chapter 1), the relationship hasn't become flatter over the years, neither has it become stronger, but they seem to be more correlated in 1996, with higher values of R^2.

Although these statistics are not very high, they certainly show how those socio-demographic indicators have some value in explaining the variability in F_C. Besides, I did not try to improve the model fit but it could be that the relationship between the variables are not linear, but follow other relationships, such as exponential or logarithmic.

In conclusion, this socio-demographic indications of competing preferences seem to be working well, and it is possible to say that the higher the proportion of women in the labor force, and the higher the mean age at first union of a certain socio-demographic group, the lower their F_c value (the higher the competing preference).

This finding suggests that the residual of the Bongaarts equation does reflect competing preference (it would be a perfect measure if all other factors could have been measured perfectly), but the residual likely contains other unexplained variance in regards to fertility. It is necessary, however, that this residual, if it is to be called Competing Preference, represents a revision of fertility intention downwards.

Fourth objective

In the analysis above, I learned that F_C is correlated with social indicators of competition, but how well does the parameter of Competing Preference (F_C) represent a fertility depletion? In order to check this fact, I decided to plot the residual (F_C) against another measure of fertility depletion: the number of children who were not born in calculated by the difference between the women's CEB and their desired family size. I calculated this deficit fertility for each social demographic group in each survey year.

Using People without religious affiliation in 2006 as example, the calculation was as follows:

First, I tabulated the difference between the women's DFS and her CEB to see how many women shared the same number of missing or surplus children:

DFS-CEB	**Frequency**	**(DFS-CEB)* frequency**
-11	1	-11
-7	1	-7
-5	1	-5
-4	3	-12
-3	12	-36
-2	24	-48
-1	18	-18
0	82	0
1	54	54
2	62	124
3	17	51
4	4	16
5	1	5
Total	280	

As can be seen above, 82 women are Neutral, or DFS-CEB=0.

Then, I multiply the difference by the frequency in each row to see how many children, in each line were born in excess or were not born at all. Then, at the last column, summing the negative numbers will result in the total number of children who were born in excess (Surplus: 137) while summing the positive numbers will result in the total number of children who were not born (Deficit: 250). Table 3.5 brings the total count of children who were born in excess (Surplus), who were not born (Deficit) and born according to their mother's CEB (Neutral), for each socio-demographic characteristic and survey analyzed on Chapter 1.

With these numbers of Table 3.5 at hand, I calculated a new parameter of competing preference, called Adjusted Deficit, which is the proportion of the CEB given the number of children who were not born: CEB/CEB+Deficit.

In the case of non-religious in 2006, the CEB was of 445. So, the Adjusted Deficit was of: 445/445+250=0.64. Table 3.6 brings the Adjusted Deficit for each of the socio-demographic groups and survey year.

Likewise, I also produced a new parameter (Adjusted Surplus) to account for the children who were born in excess. In the same example, 445/445-137=1.44. The only difference in this case is, obviously, the mathematical sign. Here I need the Adjusted Surplus to reflect the CEB born in relations to what the CEB would be in the absences of surplus. The estimation of Adjusted Surplus can be seen on Table 3.7 for each of the socio-demographic variables and survey year.

On Table 3.6 I also present the estimates of the original value for F_C as a residual of Chapter 1 and also the result of the multiplication of the Competing Preferences, Involuntary Infertility and

Tempo (F_C*F_I*F_T) estimated at Chapter 1. These three factors are responsible for depleting the TFR in relation to the DFS.

To be consistent, I also present the estimates of F_U calculated at Chapter 1 and also the coefficients of Unwanted Fertility, Sex Preference and Replacement Rate altogether (F_u*F_{SP}* F_R) on Table 3.7. These three factors are responsible for increasing fertility in relations to DFS.

The Pearson correlations and the values of the Coefficient of Determination (R^2) between the coefficients in the columns can be seen on the bottom of Tables 3.6 and 3.7. Correlations higher than 0.6 will be considered strong. R^2 higher than 0.5 will be considered a good fit.

To illustrate the relationships, the same coefficients were plotted against one another. The corresponding plots of the relationships can be observed in Figures 3.7 through 3.18 as indicated on the bottom row of the Tables 3.6 and 3.7.

In sum, expect that my new measure of Adjusted Deficit will be positively correlated both with the F_C as a residual of the Bongaarts in Chapter 1 and with the multiplication of F_C *F_I*$F_{T.}$ I also expect that the new measure of Adjusted Surplus will be positively correlated with F_U and the F_C*F_I*F_T of Chapter 1.

Adjusted Deficit

At Table 3.6, Adjusted Deficit Fertility is found to be positively correlated with the estimates of F_C*F_I*F_T of Chapter 1. The Pearson correlations of both columns at the bottom of table shows how the correlations is slightly lower in 2006 (0.71) compared to 1996 (0.75) and 1986 (0.79). The estimates of Adjusted Deficit Fertility are also correlated with the estimates of F_C but at a lower rate (0.44 in 2006, 0.78 in 1996 and 0.73 in 1986), except for 1996. Notice how the curves for 2006 (Figures 3.7 and 3.8) tend to be much flatter than the other years, especially on Figure 3.7.

There are two explanations for the values of the correlation not to sum in 100%. The first explanation is that the factors of the Bongaarts equation might not have been measured perfectly on Chapter 1 due to measurement errors or simply due to the limitations of the techniques, which disturbs the residual. On Chapter 1, those limitations have been extensively discussed.

The second is that even if it was possible of perfectly measurement all the factors stated on Bongaarts (2001), there would still be a lot of unexplained factors surrounding what is considered Competing Preferences. As has been suggested in Chapter 1 and as I cannot highlight enough, other techniques should be created and utilized in order to explain bigger portions of what is driving women to revise their fertility goals. Nevertheless, the correlations are clear and in the directions expected. The fact that the relationships have becomes more flat over the years probably means that in 2006 there more things playing a role in regards to competition than in previous years.

Adjusted Surplus

The correlations for Adjusted Surplus fertility available on Table 3.7 are also positive and strong as can also be seen in the Figures 3.13 through 3.18. The Pearson correlations of both columns at the bottom of table shows the correlations to be 0.73, 0.89 and 0.94, for 1986, 1996 and 2006, respectively when correlating Adjusted Surplus with F_U. When correlating Adjusted Surplus with $F_U*F_{SP}*F_R$, correlations are slightly smaller for 1996 and 2006, of 0.74 for 1986, 0.64 for 1996, and 0.85 for 2006. The fact that the correlations are smaller for the aggregated measure ($F_U*F_{SP}*F_R$) when one would expect the opposite is because although this factors have been estimated directly, they might still contain errors or technique limitations (and I have reasons to believe that the sex preference measurements might be causing this[44]). By multiplying a very robust indicator (such as F_U) by others that contain measurement errors of limited techniques, such as the F_{SP}, one is adding error and disturbing the correlations, just like competing preferences in the previous example. I have no doubts that unwanted fertility (F_U) is a very good indicator of surplus fertility, especially after seeing them correlated at the level of 94% in 1986 as can be seen on Table 3.7 and observed on Figure 3.17. Unwanted fertility alone explain 88% of the variation in Surplus fertility.

Nevertheless, comparing the correlations on Table 3.7 with Table 3.6, the Adjusted Surplus, in general, have higher correlations than Adjusted Deficit. This serves to strengthen the point stated in the previous paragraphs that when one is not correlating residual (as the case of unwanted fertility, sex preferences and replacement for mortality which are all estimated directly) the measurement errors are much smaller and this produces more reliable estimates. This fact urges for the necessity of creating an indicator of F_C that is reliable and that can be estimated directly.

[44] On Chapter 1, the coefficients of Sex Preferences are shown to be highly sensitive to small sample sizes in certain sex compositions, disturbing the overall estimate of this factor when it comes to more sensitive analysis.

DISCUSSION

The results of this chapter indicates that at age 30, women who are single, work, have a Bachelor degree, and have higher socio-economic status (measured using Wealth) have fewer children than their counterparts: the married, cohabiting or separated/divorced, the women without a bachelor degree, the women who don't work and women of low socio-economic strata. These finding are in accordance with the literature as previously explored (Kreider, 2009; Rosero-Bixby, Castro-Martin, and Martin-Garcia, 2009; Martin and Juarez, 1995; Heaton, Forste, Otterstrom, 2002; Smock and Greenland, 2010; Dias Junior, 2011; Itaborai, 2013; Souza, Rios-Neto and Queiroz, 2011).

At the intention level, these women also wish fewer children, especially younger women. College degree, however, changes from being associated with smaller desired family sizes in 1986 and 1996 and loses its effects in 2006. This could be related to the less selectivity of education over time.

Even though it is no longer significant in 2006, the difference between what highly educated desire and what they end up having represent a negative number, meaning that they have a deficit fertility. This finding suggests that schemas that prioritize college education might not be easy to combine with schemas for marriage.

Deficit fertility is also found for women who work and the higher one's wealth level. Nevertheless, being single is the most important predictor of having fewer than desired at age 30. The signs of the relationships found above are consistent. The only difference found in the associations is for women who work, who move from having surplus children in 1986 and 1996 (more than they wish) to being neutral in 2006. This possible means that women who worked in

1986 and 1996 were already wishing to have fewer even thought they could not completely achieve it (which inflates the proportions of surplus).

Within the group with deficit fertility, when asked if they have the desire for an additional child, both people with Bachelor degree, singles and people who work mention they are willing to do so. So, with the exception of the wealthy (who revise their fertility down saying that they do not wish to have more), low fertility is, at least theoretically, a matter of postponement. It is impossible to know, however, if these women who are already 30 years old, will be able to catch up on the fertility they are missing.

My analysis also showed that being single is highly associated with having fewer children, but this was more important in the past, where women might have been more likely to get married following an unwanted pregnancy, remaining single only the ones who did not get pregnant. Nowadays, singleness after age 30 have become more alike compared to marriage when it comes to childbearing behavior (odds of CEB are more alike), which is probably caused by a decline in stigma surrounding single motherhood or decline in marital fertility. In terms of intentions, however, singles do not differ much from other marital status (even though they do have smaller intentions).

At the aggregate level, I also find that the Competing Preference factors calculated as a residual from Chapter 1 (F_C) is highly associated with education, age at marriage and proportion of women in the labor force. That is, the higher the proportion of women in the labor force, the mean years of education and the higher the mean age at first union of a certain socio-demographic group, the lower their F_c value (the higher the competing preference). This finding, together with the regressions in objectives 1 and 2 are enough evidence to suggest that competing preferences are indeed correlated with factors that set women into two different paths: maternity and career.

In sum, these findings are consistent with claims that schemas of low fertility are more present for highly educated, women who work, and of higher wealth, but they co-exist with a desire for motherhood as those are exactly the same groups that present a deficit fertility. However, when it comes to decide whether to revise one's goal, the first two groups (high educated and women who work) do not see the necessity of revising their plans downwards, but they hope they can make accommodations to fulfill first their human capital investments and then their role as mothers. But these women are already 30 and have fewer years ahead of them – with declining chances of conceiving.

Given that postponement is being driven by women with BA and who work, policies such as affordable childcare and paid maternity leave which have been successfully implemented in some European countries could make a difference for the fertility recuperation in Brazil. It is important to learn what is necessary, in terms of public policy and institutional arrangements, to allow them have the children they wish because it might be easier to help a women have the children she is missing than fostering policies to increase incentives for childbearing in women who do not want to have any children.

Further, the higher the wealth, the more odds a women have of revising her fertility down. This suggests that revising fertility is not a matter of not having enough money. That is possible, unless the costs associated with having children grows in different magnitude than the wealth of the women. Research for the United States has shown how the costs of raising children gets more expensive the richer the parents are. This happens because wealthy parents might have the desire to spend on their children whatever it takes to stay ahead in "this world of uncertainty" (Cohen, 2015). So, the costs of children escalate. If this is also true for Brazil, this could explain why wealthy women revise their fertility down: it could be their strategy of maximizing their investments. Future studies should investigate the levels of wellbeing of women and if they are somehow disturbed for having to revise their fertility downwards.

As Alves and Cavenaghi (2009) find that income does not seem to affect fertility for highly educated, but do so for low educated, future work should also look more attentively to interactions, such as this effect of low socio-economic status when interacted with college education, and also interacted with work and marital status.

It is also important to notice that Competing Preference might not be the best way to call a factor that embraces both things that depends on women's will – such as career and college education – and things that might reflect women's lack of choices, such as not having a partner with whom she would like to have children with. Although childbearing happens outside of marriage for many Brazilian women, those are usually of low socio-economic strata and at very early ages. When women are more empowered and are able to make choices that expands their life opportunities, such as the college attainment, both marriage and childbearing are postponed. So, remaining single while marriage is a condition *sine qua non* for childbearing cannot be simply be defined as a choice, but as constraint. The new parameter, if any, should be named Competing Preferences and Constraints. Future studies should explore how different socio-demographically are the groups who have deficit fertility due to the pursuit of life opportunities and those who have it because simply did not find a suitable partner. It would also be interesting to see the differences in wellbeing for both groups.

Although this analysis suggests that the residual of the Bongaarts equation reflects competing preference (it would be a perfect measure if all other factors could have been measured perfectly), the residual might contain other unexplained variance in regards to fertility. In that case, after observing high correlations in the previous analysis and that the F_C is indeed a good approach to estimating deficit fertility but not a perfect one, I conclude that there are room for improvements in the empirical estimation of competing preferences. Current work is being done on a new and robust way to calculate this factor directly using simple aggregate population level data that could produce estimates of Competing Preference score that fits the original Bongaarts equation and that represents a revision of fertility intention downwards.

The objective of this on-going work is not to fully explain the residual of the equation, given that there will always be unexplained and latent variables defining one's fertility, but to minimize the residual by addressing into that equation some of the factors that are proved to be associated with competing preferences, estimating the counterfactuals. For example, what would the fertility deficit be if all never married women were to get married controlling for all socio-demographic characteristics? What if all women with a bachelor's degree suddenly had the same fertility as the ones without again controlling for other observable variables? This analysis needs to be done separately for each socio-demographic group (as the Bongaarts equation was at Chapter 1) and for each survey year (because different years will have different variables that matter for Competition and Constraints). The strategy here is similar to a population standardization, but using Propensity Score Matching (PSM) (Austin, 2011, Caliendo and Kopeinig, 2005). The PSM has been used with DHS data in other studies (Vyas and Heise, 2005; Babalola and Vonrasek, 2005).

Back to the results of this chapter, the main limitation of this study is the fact that most of its analysis are constructed based on the report women give, at the time of the interview, of values for their DFS at the moment they did not have any children, sometimes referring to decades ago. But I have showed here and also at Chapter 2, that women might revise their goals when faced with competition, with unwanted pregnancies or when faced with unexpected sex ratios. So, when the variables utilized in the Bongaarts equation are calculated, although they are asking women “back at the time when you did not have children”, women are reporting a DFS that might have already suffered transformation throughout the time.

In that case, the competing preference parameter might be biased because what a women may have had reported in the far past might have been higher or lower than what she is reporting at the time of the interview. Unfortunately, DHS and PNDS are not the state of the art database to evaluate changes in desired fertility because they are cross-section, so they do not capture these changes as they happen. However, in the case of Brazil, this is the most appropriate database for this kind of study that was available at the time of this research and it is extremely rich in regards to fertility information.

In order to further explore this limitation, in Table 3.8 I reconstruct reports of DFS using three different survey years, capturing samples of the same “cohort” of women 10 years later. Although they are not the same people given that the data is cross-sectional, women who were 40-49 in 2006, were 30-39 in 1996 and 20-29 in 1986 assuming that mortality and international migration are not biasing my results. So, I am capturing a sample of a true population group.

Notice in Table 3.8 how the values for the DFS according to age varies a lot over time, decreasing with the year and being always smaller for the younger women. For example, in 2006, women age 20-29 have a DFS of 1.9 while women age 30-39 have a DFS of 2.15 and women age 40-49 have a DFS of 2.46. Looking across years for the same age group, women age 20-29 in 1986 had a DFS of 2.60 in 1986, 2.09 in 1996 and 1.90 in 2006.

It is impossible to know, however, whether these are effects of age, period or cohort.

However, the values for the cohorts on Table 3.8 do not seem to follow a big trend. They all decline in 1996 compared to 1986, and then return to higher values in 2006, when they reach 40-49 year old. Thus, variations may be caused by small sample size differences.

I observed two increasing trends, for Protestants (2.41, 2.43 and 2.50 for 1986, 1996 and 2006 respectively) and region North (2.56 in 1986, 2.62 in 1996 and 2.77 in 2006), and two decreasing tendencies, for Education 2 and 4, which refer to Middle School (2.62 for 198, 2.42 for 1996 and 2.39 for 2006) and High School (2.43 for 1986, 2.30 for 1996 and 2.10 for 2006).

In sum, the overall result indicate that women do revise their DFS, but not very much. So, in the end of the day, I am stuck with a measure of competing preference (F_C) that evaluated the revisions of a women's ideal family size of an ideal family size that might already been revised. It is possible that some of these of women on Table 3.8 might have revised their DFS because they had children. Others, revised down due to Competing Preference. In the end, they might cancel one another out.

So, in my last analysis of the paper, I will do a humble attempt to investigate whether women's preferences for DFS have altered over time controlling for their parity. Stratifying by selected socio-demographic characteristics, women aged 40-49 in 2006 are the same women aged 30-39 in 1996 and 20-29 in 1986. Using birth calendar data (age of mother at each birth), I also know where in time her children were born. So, for example, I am able to track samples of cohorts of women who had zero children in 1986 when they were 20-19, but who had one in 1996 when they were 30-39 and then had 2 in 2006, when they were 40-49. I am also able to see their report of DFS at each of these moments and list down the reported DFS for each cohort of women who had each combination of parity at each year: 0, 1, 2 or 3 or more children in 1986, 0, 1, 2 or 3 or more children in 1996, 0, 1, 2 or 3 or more children in 2006. I also calculated measures of dispersion for DFS (mean, standard deviation, coefficient of variation) to understand if controlling for the timing of each parity, women at the aggregate level and as a cohort revised their intention.

On Table 3.9, the reports of DFS and the measures of dispersion can be seen for each of those combinations as they represent different lines on the table.

For example, I know that the group of women who had 0 children in 2006 also had 0 in 1996 and had 0 in 1986. Their mean DFS as a group changed from 2.49 when they were 20-29 in 1986 to 1.79 when they were 30-39 in 1996 to 1.80 when they were 40-49 in 2006.

A group of women who started with 1 children in 1986, and moved to having 2 children in 1996 and finished with 3 in 2006, moved from having a mean DFS of 2.32 in 1986 to 2.32 in 1996 to 2.82 in 2006 as a group.

It is important to notice that given that the ones with zero are a larger pool of women, one cannot say that the DFS declined and then increased, but it certainly increased after women had the first children.

The DFS and the measures of dispersion on Table 3.9 consistently increases for every group at every 10 years. For instance, for women who had 0 children in all years, the coefficient of variation moves from 0.52 in 1986 to 0.63 in 1996 and 0.95 in 2006. The higher the coefficient of variation, the more diversity within sample.

The fact that the DFS changes and gets more diverse either means that women adapted their DFS to their current composition or that women who were selected of low fertility continued with zero as the other ones moved forward. It is interesting to see, however, that even when a women has zero children at age 40-49, she still mentions close to 2 (1.80) as a DFS.

Table 3.9 also shows that the major qualitative change is between the first two DHS (1986 and 1996), with not a lot of movement happening after women turned 40.

In sum, women's reports has become more diverse as they follow different life paths with the first child birth being a great turning point in defining their mom's DFC.

This finding results suggest that the DFS, by the time are reported by women in the interview, have already been revised. However, it does not invalidate the Bongaarts parameters, but emphasizes that the competing preference parameter is estimated with limitations and can only be estimated properly when new measures of DFS make themselves available, and after all other factors are measured perfectly.

Back to the results of this chapter, as Brazil is already 10 years older than its last PNDS survey, it will be interesting to see if these patterns of Competing Preferences continued and even gained more momentum as public policies that fostered education achievement and college enrollment among Blacks and people with low socio-economic status were implemented in the last decade.

Last but not least, although competing preferences depletes fertility related to DFS, no other parameter in the Bongaarts equation (2001) exist to represent revisions upwards. For example, it is possible that re-marriage, love, peer pressure or even new social trends can cause a women to revise her goals upward.

Future studies should investigate other turning points in a women's life course. How frequent and in what circumstances women re-assess their fertility goals? In what measure and for which women an important job offer make women revise their goals? Likewise, for what women and how promising a loving partner would need to be in order for a 30 year old single woman revise their goals upwards or anticipate their fertility? How far do women go in order to accomplish their dreams? Are the gains of motherhood compensating the losses in terms of professional achievements and personal life? In other words, what is the limit of one's adherence to their own identity and how does it change to accommodate conflicting schemas? As Brazil heads to lowest low, will one see the participation of Competing Preferences and Constraints increase? What will be the new competing preferences and constrains in the near future?

FIGURES

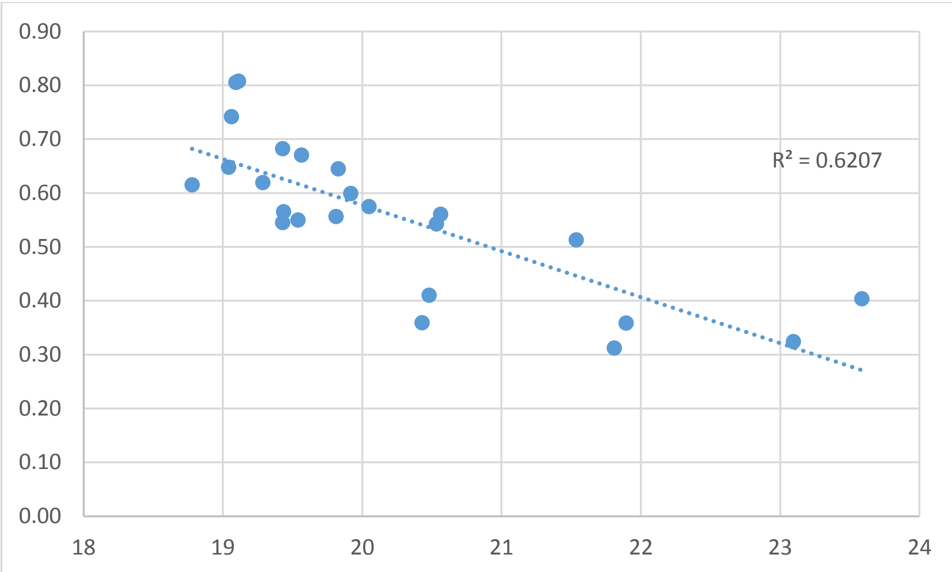


Figure 3.1: F_C by mean age at first union, Brazil, 1986

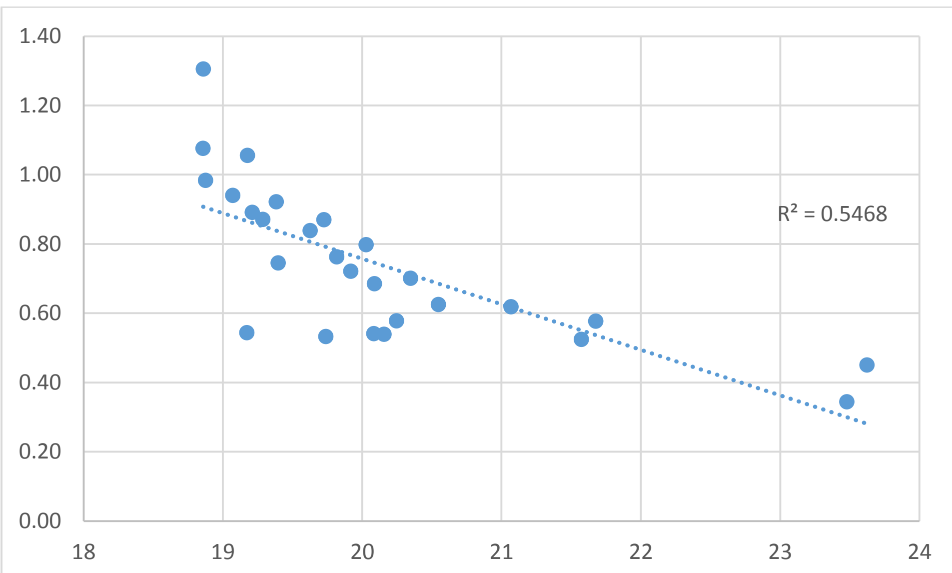


Figure 3.2: F_C by mean age at first union, Brazil, 1996

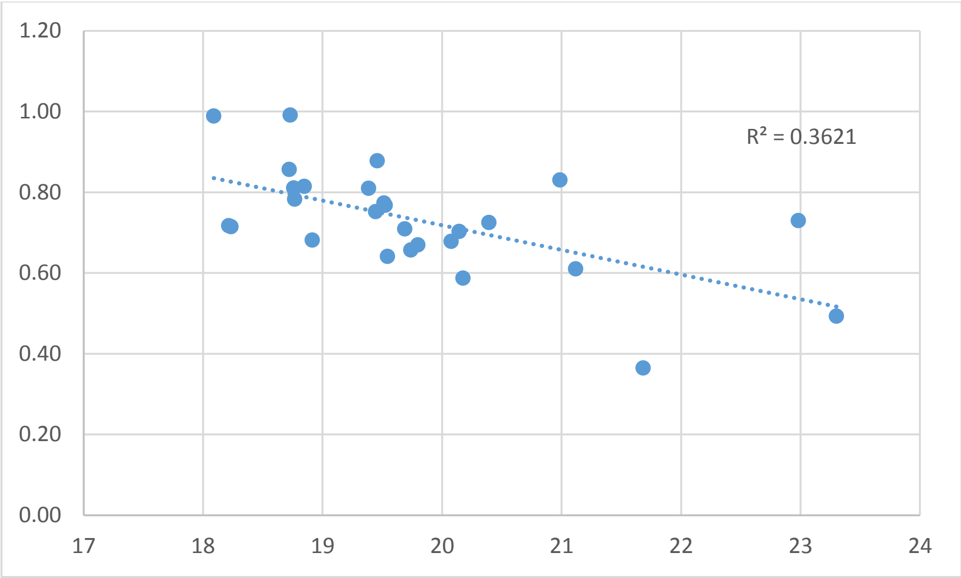


Figure 3.3: F_C by Mean age at first union, Brazil, 2006

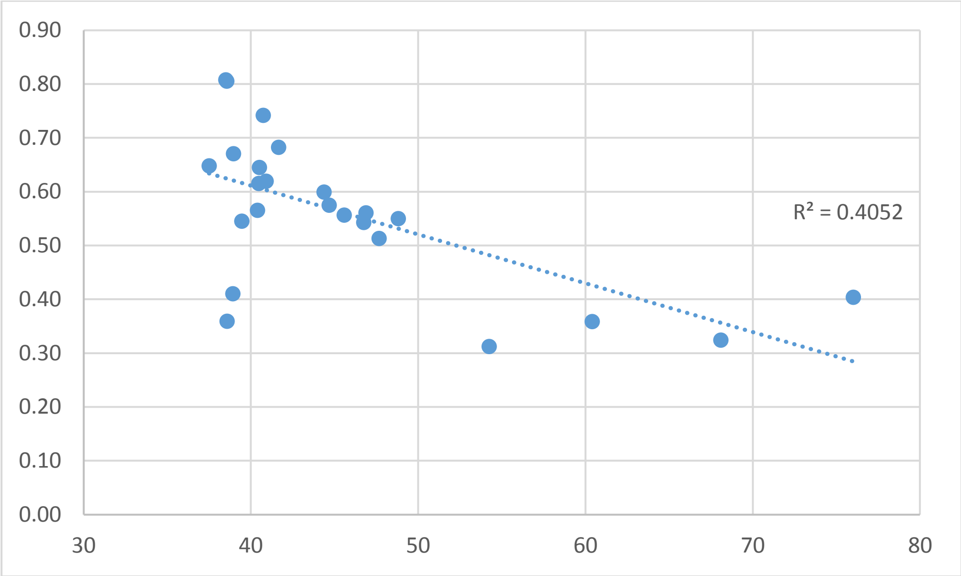


Figure 3.4: F_C by proportion of women working, Brazil, 1986

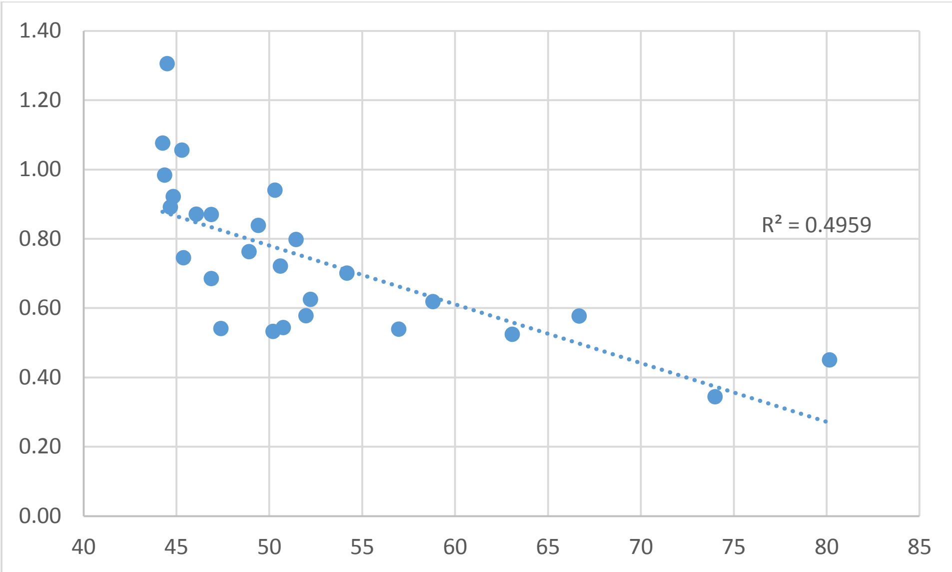


Figure 3.5: Fc by proportion of women working, Brazil, 1996

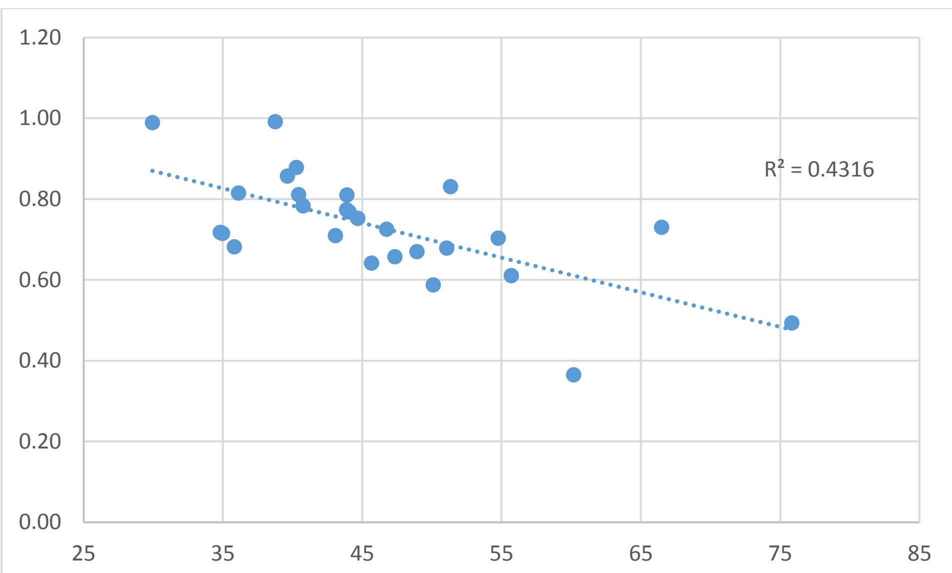


Figure 3.6: Fc by proportion women working, Brazil, 2006

Figure 3.7: Correlation between Deficit and (F_C), Brazil, 2006.

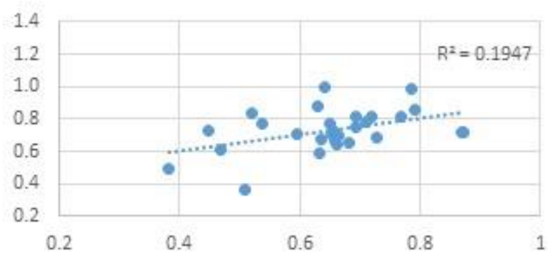


Figure 3.8: Correlation between Deficit and (F_C)*(F_t)*(F_i), Brazil, 2006.

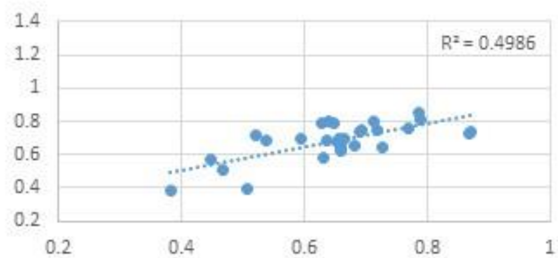


Figure 3.9: Correlation between Deficit and (F_C), Brazil, 1996.

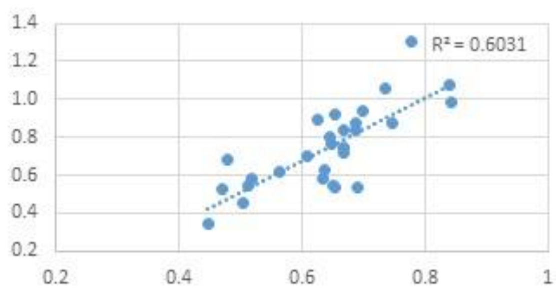


Figure 3.10: Correlation between Deficit and (F_C)*(F_t)*(F_i), Brazil, 1996.

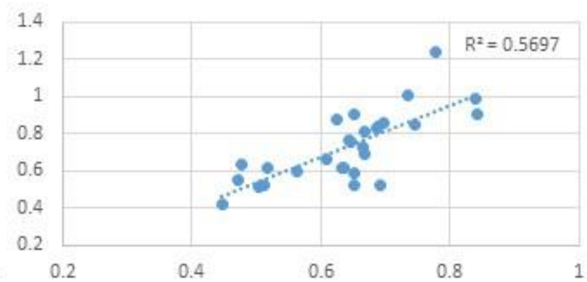


Figure 3.11: Correlation between Deficit and (F_C), Brazil, 1986.

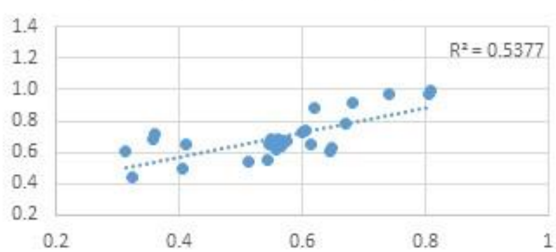


Figure 3.12: Correlation between Deficit and (F_C)*(F_t)*(F_i), Brazil, 1986.

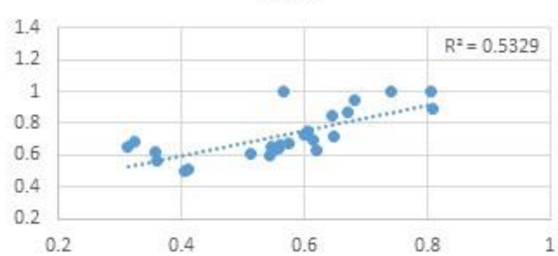


Figure 3.13: Correlation between Surplus and (F_u), Brazil, 2006.

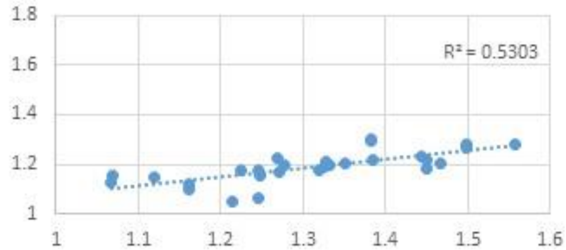


Figure 3.14: Correlation between Surplus $(Fu)*(F_{sp})*(F_R)$, Brazil, 2006.

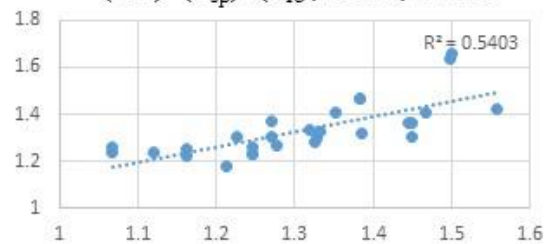


Figure 3.15: Correlation between Surplus and (F_u), Brazil, 1996

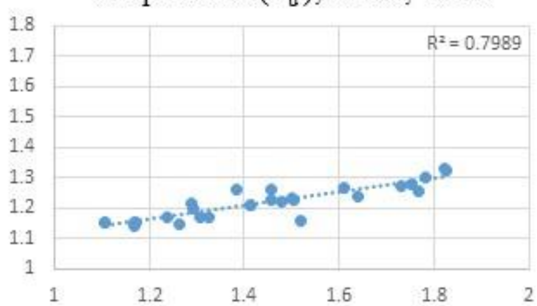


Figure 3.16: Correlation between Surplus and $(F_u)*(F_{SP})*(F_R)$, Brazil, 1996.

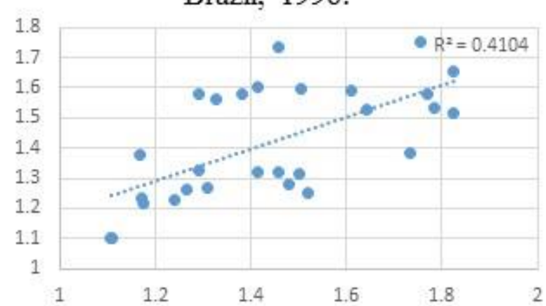


Figure 3.17: Correlation between Surplus and (F_u), Brazil, 1986

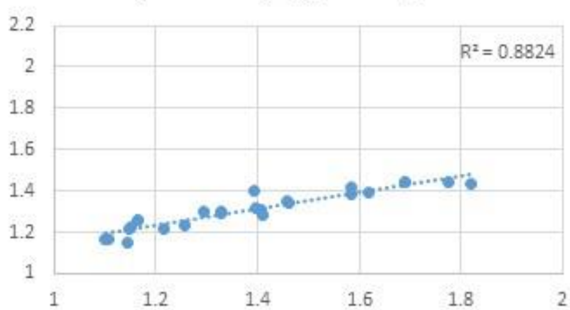
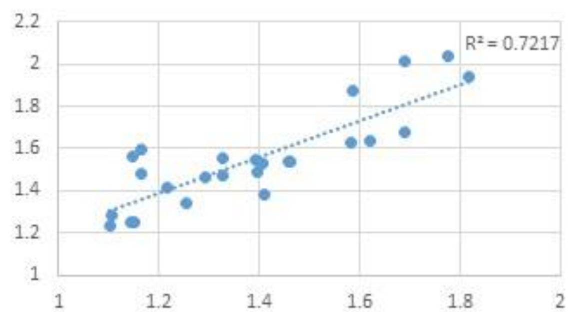


Figure 3.18: Correlation between Surplus and $(F_u)*(F_{SP})*(F_R)$, Brazil, 1986



TABLES

Table 3.1: Bivariate and Multivariate Poisson regressions of Children Ever Born, women age 40 and plus, Brazil, 1986, 1996 and 2006.

		Incidence Rate Ratios					
		1986		1996		2006	
	Models:	Bivariate	Multivariate	Bivariate	Multivariate	Bivariate	Multivariate
Wealth Index (continuous)		0.80***	0.89***	0.80***	0.88***	0.81***	0.88***
Work		0.81***	0.88***	0.88***	0.95**	0.83***	0.95***
BA_level		0.41***	0.62***	0.52***	0.73***	0.58***	0.81***
Marital status (ref:Single)	*Cohabiting*	32.69***	24.58***	11.36***	9.38***	5.22***	4.56***
	Married	31.54***	25.87***	10***	9.28***	4.65***	4.49***
	Separated/Divorced	26.51***	23.15***	9.84***	8.69***	4.56***	4.29***
Constant for multivariate model			0.19***		0.46***		0.77**
Observations		647	647	2,547	2,529	3,743	3,726

Note: All multivariate models controlled by Race (except 1986), Region, Urbanicity, Religion and Church attendance (except 1986).
*** p<0.01, ** p<0.05, * p<0.1

Table 3.2: Bivariate and Multivariate Poisson regression of Desired Family Size, all women, Brazil, 1986, 1996 and 2006.

	Incidence Rate Ratios					
	1986		1996		2006	
	Bivariate	Multivariate	Bivariate	Multivariate	Bivariate	Multivariate
Wealth Index (continuous)	0.96***	0.98***	0.98**	0.99**	0.97***	0.97***
Work	0.98	1.00	1.01	0.98	0.99	0.96***
BA_level	0.86***	0.93***	0.93***	0.98	0.96**	1.03
Marital status (ref:single)						
Cohabiting	1.15***	1.02	1.13***	1.00	1.19***	1.03*
Married	1.23***	1.08***	1.30***	1.10***	1.35***	1.11***
Separated/Divorced	1.05	0.93**	1.10***	0.94***	1.16***	0.97
Age	1.01***	1.01***	1.01***	1.01***	1.01***	1.01***
Constant for multivariate model		1.75***		1.29***		1.13**
Observations	5,818	5,818	12,492	12,399	15,348	15,287

Note: All multivariate models controlled by Race (except 1986), Region, Urbanicity, Religion and Church attendance (except 1986).
*** p<0.01, ** p<0.05, * p<0.1

Table 3.3: Multinomial logit of Fertility Status, all women aged 30 and plus, Brazil, 1986, 1996 and 2006. Reference category is Surplus.

	2006		1996		1986	
	Neutral	**Deficit**	**Neutral**	**Deficit**	**Neutral**	**Deficit**
Wealth Index (continuous)	0.29***	0.24***	0.27***	0.25***	0.35***	0.22***
Work	0.10*	0.10	-0.02	0.08	-0.03	0.21*
BA_level	1.02***	1.41***	0.86***	0.99***	0.52***	1.07***
Marital status (ref:single)						
Cohabiting	-1.03***	-2.26***	-1.56***	-2.57***	-2.10***	-3.70***
Married	-0.49**	-1.86***	-1.05***	-2.70***	-1.84***	-3.68***
Separated/Divorced	-1.08***	-2.39***	-1.38***	-2.83***	-1.85***	-3.69***
Constant for multivariate model	0.33	0.66*	0.13	1.17***	0.92	2.47***
Observations	7,991	7,991	6,004	6,004	2,341	2,341

Note: All multivariate models controlled by Race (except 1986), Region, Urbanicity, Religion and Church attendance (except 1986).

*** p<0.01, ** p<0.05, * p<0.1

Results are in log odds

Table 3.4: Logit regressions of Not wishing to have more children (reference=1) compared to people who wish to have it later (0), women who have CEB<DFS, Brazil, women age 30 and plus, 1986, 1996 and 2006.

	1986		1996		2006	
Models:	**Bivariate**	**Multivariate**	**Bivariate**	**Multivariate**	**Bivariate**	**Multivariate**
Wealth Index (continuous)	1.20**	0.34***	1.10	0.11	1.06	0.08
Work	0.62***	-0.35*	0.91	-0.08	0.85	-0.13
BA_level	0.70*	-0.81***	0.76*	-0.37**	0.58***	-0.53***
Marital status						
cohabiting (ref: married)	1.16	0.12				
cohabiting (ref: single)			1.30	0.18	1.65***	0.33*
Married (ref. single)			1.91 ***	0.51**	2.27***	0.70***
Divorced (ref: single)			3.92***	1.33***	4.47***	1.41***
			0	-0.27	0	-0.20
Constant for multivariate model		2.05		0.12		-1.44
Observations	527	527	828	825	1467	1,455

Note: All multivariate models controlled by Race (except 1986), Region, Urbanicity, Religion and Church attendance (except 1986).

In 1986, women who were not married or cohabiting did not get asked the question about intention for additional births.

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Results in log odds.

Table 3.5: Total count of children who were born in excess (if DFS-CEB <0, Surplus), who were not born (if DFS-CEB>0, Deficit) and born according to their mother's CFS (DFS-CEB=0, Neutral), all women, Brazil, 1986, 1996 and 2006 (CONTINUE).

		1986	**1996**	**2006**
Total	Total Neutral	1052	3153	4863
	Total Surplus	3900	8513	6739
	Total Deficit	8067	12690	13814
	CEB	12357	25513	41292
Education Level 0	Total Neutral	328	685	690
	Total Surplus	2752	4982	2416
	Total Deficit	1632	2120	1098
	CEB	6748	11032	7257
Education Level 1	Total Neutral	380	1163	1512
	Total Surplus	896	2497	2714
	Total Deficit	3036	4548	2954
	CEB	3637	8542	9807
Education Level 2	Total Neutral	153	509	1060
	Total Surplus	123	597	904
	Total Deficit	1567	2912	3941
	CEB	878	2655	4587
Education Level 3	Total Neutral	117	560	1127
	Total Surplus	91	345	589
	Total Deficit	1242	2228	3885
	CEB	694	2383	4226
Education Level 4	Total Neutral	74	236	472
	Total Surplus	38	86	99
	Total Deficit	590	877	1921
	CEB	400	889	1564
Catholic	Total Neutral	830	2427	4065
	Total Surplus	3150	6673	5817
	Total Deficit	6694	9858	10950
	CEB	10015	19880	23350
Protestant			500	630
	Total Neutral	94	1246	694
	Total Surplus	343	1778	2219
	Total Deficit	647	3978	3271
	CEB	1176	5756	5490
No religion	Total Neutral	84	120	82
	Total Surplus	302	442	137
	Total Deficit	503	616	250
	CEB	819	1028	445
Urban	Total Neutral	838	2650	3420
	Total Surplus	2402	5960	4380
	Total Deficit	6243	10457	10150
	CEB	8442	18977	17749

Table 3.5: Total count of children who were born in excess (if DFS-CEB <0, Surplus), who were not born (if DFS-CEB>0, Deficit) and born according to their mother's CFS (DFS-CEB=0, Neutral), all women, Brazil, 1986, 1996 and 2006 (CONTINUE).

Rural	Total Neutral	214	503	1443
	Total Surplus	1498	2553	2359
	Total Deficit	1824	2233	3664
	CEB	3915	6536	9729
Wealth Level 0	Total Neutral	120	249	301
	Total Surplus	1371	1870	1194
	Total Deficit	1091	1215	908
	CEB	3136	4256	3334
Wealth Level 1	Total Neutral	135	591	521
	Total Surplus	926	3080	1302
	Total Deficit	1364	2641	1644
	CEB	2507	7288	4193
Wealth Level 2	Total Neutral	400	901	1178
	Total Surplus	1131	2131	1865
	Total Deficit	3121	3603	3194
	CEB	3916	6591	7167
Wealth Level 3	Total Neutral	201	628	1948
	Total Surplus	317	903	2037
	Total Deficit	1314	2480	4962
	CEB	1558	3839	9580
Wealth Level 4	Total Neutral	196	768	915
	Total Surplus	155	509	341
	Total Deficit	1177	2684	3106
	CEB	1240	3449	3204
North	Total Neutral	114	366	733
	Total Surplus	440	982	1725
	Total Deficit	975	1240	2251
	CEB	1558	2873	5555
Northeast	Total Neutral	249	939	820
	Total Surplus	2191	4667	1829
	Total Deficit	2392	4858	2951
	CEB	4867	10742	5747
Southeast	Total Neutral	531	976	1110
	Total Surplus	997	1723	1177
	Total Deficit	3448	3560	2851
	CEB	4404	6229	5433
South	Total Neutral	158	512	1158
	Total Surplus	272	543	928
	Total Deficit	1252	1497	2796
	CEB	1528	2811	5272
Center-West	Total Neutral		360	1042
	Total Surplus		598	1080
	Total Deficit		1535	2965
	CEB		2858	5471

Table 3.5: Total count of children who were born in excess (if DFS-CEB <0, Surplus), who were not born (if DFS-CEB>0, Deficit) and born according to their mother's CFS (DFS-CEB=0, Neutral), all women, Brazil, 1986, 1996 and 2006 (FINAL).

Predicted education 0	Total Neutral	327	681	686
	Total Surplus	2750	4977	2412
	Total Deficit	1603	2052	1077
	CEB	6733	11012	7238
Predicted education 1	Total Neutral	376	1162	1495
	Total Surplus	898	2500	2712
	Total Deficit	2796	4279	2590
	CEB	3635	8537	9780
Predicted education 2	Total Neutral	150	499	1018
	Total Surplus	123	598	904
	Total Deficit	1245	2526	2689
	CEB	867	2643	4567
Predicted education 3	Total Neutral	122	570	1158
	Total Surplus	91	344	594
	Total Deficit	1555	2707	4864
	CEB	706	2405	4261
Predicted education 4	Total Neutral	77	241	504
	Total Surplus	38	88	100
	Total Deficit	868	1121	2579
	CEB	416	904	1595
White	Total Neutral		1409	2003
	Total Surplus		2132	1701
	Total Deficit		5019	5408
	CEB		8648	9259
Black	Total Neutral		1733	2625
	Total Surplus		6360	4631
	Total Deficit		7613	7411
	CEB		16781	16644

Note: In 1986, Center-West is included in Southeast.

Table 3.6: Estimates of Deficit Fertility based on women's report for Ideal Family Size compared to estimates of Competing Preferences (F_C) measured as a residual of the Bongaarts equation and compared to the multiplication of the Competing Preference residual (F_C) by Tempo effect (FT)and involuntary infertility (FI), Brazil, values for 1986, 1996 and 2006.

		2006				1996				1986			
		Adjusted Deficit	**F_C**	**$F_C*F_I*F_T$**	**% pop**	**Adjusted Deficit**	**F_C**	**$F_C*F_I*F_T$**	**% pop**	**Adjusted Deficit**	**F_C**	**$F_C*F_I*F_T$**	**% pop**
	Total	0.67	0.70	0.69	0.49	0.67	0.84	0.81	0.52	0.61	0.74	0.75	0.62
Wealth Index	*0*	0.79	0.99	0.85	0.40	0.78	1.31	1.24	0.44	0.74	0.97	1.00	0.51
	1	0.72	0.81	0.75	0.46	0.73	1.06	1.01	0.48	0.65	0.62	0.71	0.60
	2	0.69	0.81	0.74	0.48	0.65	0.76	0.76	0.52	0.56	0.62	0.64	0.64
	3	0.66	0.67	0.64	0.49	0.61	0.70	0.66	0.56	0.54	0.55	0.60	0.64
	4	0.51	0.37	0.39	0.59	0.56	0.62	0.60	0.56	0.51	0.54	0.61	0.66
Years of achieved education	*0 to 3*	0.87	0.72	0.74	0.27	0.84	1.08	0.99	0.34	0.81	0.97	1.00	0.42
	4	0.79	0.86	0.81	0.39	0.65	0.92	0.90	0.53	0.55	0.65	0.65	0.64
	5 to 8	0.63	0.88	0.79	0.58	0.48	0.69	0.64	0.65	0.36	0.72	0.57	0.76
	9 to 11	0.47	0.61	0.51	0.59	0.52	0.58	0.61	0.60	0.36	0.68	0.62	0.77
	12 or more	0.38	0.49	0.38	0.64	0.50	0.45	0.51	0.60	0.40	0.49	0.50	0.73
Urbanicity	*Urban*	0.64	0.68	0.69	0.51	0.64	0.80	0.77	0.53	0.57	0.67	0.68	0.63
	Rural	0.73	0.68	0.65	0.45	0.75	0.87	0.85	0.48	0.68	0.91	0.94	0.56
Region	*North*	0.71	0.78	0.80	0.47	0.70	0.94	0.86	0.49	0.62	0.66	0.69	0.64
	Northeast	0.66	0.64	0.62	0.51	0.69	0.87	0.84	0.51	0.67	0.78	0.87	0.56
	Southeast	0.66	0.73	0.69	0.49	0.64	0.63	0.62	0.53	0.56	0.68	0.66	0.63
	South	0.65	0.70	0.68	0.49	0.65	0.54	0.59	0.52	0.55	0.69	0.63	0.68
	Center-West	0.65	0.77	0.79	0.50	0.65	0.54	0.52	0.56				
Religion	*Catholic*	0.68	0.66	0.65	0.48	0.67	0.72	0.69	0.52	0.60	0.72	0.85	0.63
	Protestant	0.60	0.71	0.69	0.55	0.69	0.53	0.52	0.49	0.65	0.61	0.64	0.60
	None	0.64	0.99	0.80	0.48	0.63	0.89	0.88	0.54	0.62	0.88	0.89	0.57
Predicted education level	*0 to 3*	0.87	0.72	0.73	0.27	0.84	0.98	0.91	0.33	0.81	1.00	1.00	0.42
	4	0.77	0.81	0.76	0.36	0.67	0.75	0.73	0.51	0.57	0.64	0.52	0.62
	5 to 8	0.54	0.77	0.68	0.51	0.51	0.54	0.52	0.62	0.41	0.65	0.65	0.73
	9 to 11	0.52	0.83	0.72	0.64	0.47	0.52	0.55	0.64	0.31	0.60	0.68	0.80
	12 or more	0.45	0.73	0.57	0.69	0.45	0.34	0.42	0.65	0.32	0.44	0.45	0.79
Race	*White*	0.63	0.59	0.58	0.52	0.63	0.58	0.61	0.53				
	Black	0.69	0.75	0.74	0.47	0.69	0.84	0.83	0.51				
	Pearson correlation:		0.44	0.71			0.78	0.75			0.73	0.79	
	R^2:		0.19	0.50			0.60	0.57			0.54	0.62	
	Figure #:		7	8			9	10			11	12	

Note: No information for race was recorded for 1986. In that year, Center-West was included in Southeast.

Table 3.7: Estimates of Surplus fertility based on women's report for Ideal Family Size compared to estimates of Unwanted fertility (Fu) measured as the Bongaarts equation and compared to the Unwanted (Fu) multiplied by sex preferences (FSP)and child replacement (F_R), values and Pearson correlations for Brazil, 1986, 1996 and 2006.

		2006				1996					1986			
		Adjusted Surplus	F_u	F_u*F_{SP}*F_R	% pop	Adjusted Surplus	F_u	F_u*F_{SP}*F_R		% pop	Adjusted Surplus	F_u	F_u*F_{SP}*F_R	% pop
	Total	1.32	1.19	1.28	0.18	1.50	1.23	1.32		0.23	1.46	1.34	1.54	0.20
Wealth Index	*0*	1.56	1.28	1.42	0.31	1.78	1.30	1.53		0.37	1.78	1.44	2.04	0.36
	1	1.45	1.18	1.36	0.26	1.73	1.27	1.38		0.32	1.59	1.41	1.87	0.26
	2	1.35	1.20	1.41	0.21	1.48	1.22	1.28		0.22	1.41	1.31	1.53	0.18
	3	1.27	1.17	1.31	0.16	1.31	1.17	1.27		0.17	1.26	1.23	1.34	0.14
	4	1.12	1.15	1.23	0.07	1.17	1.15	1.22		0.12	1.14	1.15	1.25	0.10
Years of achieved education	*0 to 3*	1.50	1.28	1.66	0.37	1.82	1.33	1.52		0.43	1.69	1.44	1.68	0.39
	4	1.38	1.30	1.46	0.26	1.41	1.21	1.32		0.22	1.33	1.30	1.55	0.17
	5 to 8	1.25	1.15	1.23	0.12	1.29	1.22	1.32		0.13	1.16	1.26	1.60	0.07
	9 to 11	1.16	1.10	1.22	0.09	1.17	1.14	1.23		0.10	1.15	1.22	1.26	0.07
	12 or more	1.07	1.13	1.24	0.04	1.11	1.15	1.10	*	0.08	1.10	1.16	1.29	0.07
Urbanicity	*Urban*	1.33	1.21	1.29	0.17	1.46	1.23	1.32		0.21	1.40	1.32	1.49	0.18
	Rural	1.32	1.18	1.33	0.20	1.64	1.24	1.53		0.30	1.62	1.39	1.64	0.28
Region	*North*	1.45	1.21	1.30	0.24	1.52	1.16	1.25		0.24	1.39	1.40	1.54	0.20
	Northeast	1.47	1.20	1.41	0.22	1.77	1.26	1.58		0.29	1.82	1.43	1.94	0.30
	Southeast	1.28	1.20	1.27	0.16	1.38	1.26	1.58		0.20	1.29	1.30	1.46	0.16
	South	1.21	1.05	1.18	0.13	1.24	1.17	1.23	*	0.15	1.22	1.22	1.41	0.13
	Center-West	1.25	1.06	1.23	0.15	1.26	1.15	1.26	*	0.18				
Religion	*Catholic*	1.33	1.19	1.33	0.19	1.51	1.22	1.59		0.23	1.46	1.35	1.54	0.20
	Protestant	1.27	1.22	1.37	0.15	1.46	1.26	1.73		0.23	1.41	1.28	1.39	0.22
	None	1.44	1.23	1.36	0.21	1.75	1.28	1.75		0.26	1.58	1.38	1.63	0.22
Predicted education level	*0 to 3*	1.50	1.26	1.64	0.37	1.82	1.33	1.65	*	0.44	1.69	1.44	2.01	0.39
	4	1.38	1.30	1.46	0.27	1.41	1.21	1.60		0.23	1.33	1.29	1.47	0.18
	5 to 8	1.25	1.18	1.26	0.15	1.29	1.20	1.58		0.14	1.17	1.26	1.48	0.08
	9 to 11	1.16	1.12	1.25	0.08	1.17	1.15	1.38		0.09	1.15	1.22	1.56	0.06
	12 or more	1.07	1.15	1.26	0.03	1.11	1.15	1.10	*	0.07	1.10	1.16	1.24	0.05
Race	*White*	1.23	1.17	1.30	0.13	1.33	1.17	1.56		0.17				
	Black	1.39	1.22	1.32	0.21	1.61	1.27	1.59		0.26				
Pearson correlation:			0.73	0.74			0.89	0.64				0.94	0.85	
R^2:			0.53	0.54			0.80	0.41				0.88	0.72	
Figure #:			13	14			15	16				17	18	

Note: No information for race was recorded for 1986. In that year, Center-West was included in Southeast.

* Values replaced due to possible calculation errors or technique limitation in the original Bongaarts equation. On Chapter 1, the coefficients of Sex Preferences are shown to be highly sensitive to small sample sizes in certain sex compositions, disturbing the overall estimate of this factor when it comes to more sensitive analysis. If original values are kept, outliers highly disturb the correlation. After removing the outliers (*), the new correlation was changed to 0.64.

Table 3.8: Desired Family Size by survey year, age groups and selected covariates, Brazil (1986, 1996 and 2006).

All women

Total	1986	1996	2006
40-49	3.44	2.88	*2.46*
30-39	3.00	*2.38*	2.15
20-29	*2.60*	2.09	1.90

Wealth Level 0	1986	1996	2006
40-49	3.54	3.24	*2.89*
30-39	3.45	*2.80*	2.52
20-29	*2.99*	2.30	2.10

Wealth Level 1	1986	1996	2006
40-49	3.84	3.04	*2.84*
30-39	3.44	*2.53*	2.35
20-29	*2.82*	2.10	1.88

Wealth Level 2	1986	1996	2006
40-49	3.34	2.76	*2.44*
30-39	2.85	*2.27*	2.01
20-29	*2.44*	2.02	1.88

Wealth Level 3	1986	1996	2006
40-49	3.38	2.87	*2.38*
30-39	2.87	*2.35*	2.08
20-29	*2.48*	2.09	1.86

Wealth Level 4	1986	1996	2006
40-49	3.33	2.80	*2.34*
30-39	2.76	*2.30*	2.20
20-29	*2.52*	2.08	1.93

Urban	1986	1996	2006
40-49	3.31	2.78	*2.37*
30-39	2.89	*2.32*	2.09
20-29	*2.50*	2.04	1.87

Rural	1986	1996	2006
40-49	3.84	3.34	*2.93*
30-39	3.36	*2.68*	2.47
20-29	*2.93*	2.32	2.04

Catholics	1986	1996	2006
40-49	3.47	2.89	*2.45*
30-39	3.02	*2.39*	2.13
20-29	*2.67*	2.09	1.94

Protestants	1986	1996	2006
40-49	3.97	2.96	*2.50*
30-39	3.00	*2.43*	2.15
20-29	*2.41*	2.14	1.94

No Religion	1986	1996	2006
40-49	2.28	2.29	*2.32*
30-39	2.70	*2.16*	1.91
20-29	*2.25*	1.86	1.61

Education 0	1986	1996	2006
40-49	3.62	3.08	*2.95*
30-39	3.34	*2.56*	2.53
20-29	*2.88*	2.26	2.19

Education 1	1986	1996	2006
40-49	3.53	2.85	*2.39*
30-39	2.88	*2.42*	2.16
20-29	*2.62*	2.07	1.87

Education 2	1986	1996	2006
40-49	3.30	2.64	*2.51*
30-39	2.80	*2.27*	2.04
20-29	*2.35*	2.03	1.84

Education 3	1986	1996	2006
40-49	2.89	2.71	*2.10*
30-39	2.55	*2.30*	1.99
20-29	*2.43*	2.03	1.85

Education 4	1986	1996	2006
40-49	2.56	2.55	*2.33*
30-39	2.65	*2.09*	2.23
20-29	*2.53*	2.14	1.98

North	1986	1996	2006
40-49	4.28	2.94	*2.77*
30-39	3.29	*2.62*	2.40
20-29	*2.56*	2.11	2.02

Northeast	1986	1996	2006
40-49	2.93	2.77	*2.54*
30-39	3.07	*2.37*	2.17
20-29	*2.75*	2.09	1.90

Southeast	1986	1996	2006
40-49	3.37	2.82	*2.31*
30-39	2.88	*2.24*	2.08
20-29	*2.48*	2.05	1.84

South	1986	1996	2006
40-49	4.06	2.94	*2.51*
30-39	3.11	*2.47*	2.11
20-29	*2.67*	2.07	1.94

Center-West	1986	1996	2006
40-49		3.39	*2.72*
30-39		*2.91*	2.26
20-29		2.27	2.05

White	1996	2006
40-49	2.85	*2.39*
30-39	*2.32*	2.17
20-29	2.12	1.88

Black	1996	2006
40-49	2.90	*2.51*
30-39	*2.43*	2.15
20-29	2.06	1.91

Race 3	1996	2006
40-49	2.88	*2.65*
30-39	*2.18*	1.91
20-29	2.33	1.86

Key
- Decrease and Increase
- Decreasing
- Increasing

Note: No information for race was recorded for 1986. In that year, Center-West was included in Southeast.

Table 3.9: Measures of dispersion for Desired Family Size by survey year, age groups, birth cohort and children ever born in 1986, Brazil.

Desired family size (DFS)											
1986				1996				2006			
(Age: 20-29)	Mean	Standard Deviation	CV	(Age: 30-39)	Mean	Standard Deviation	CV	(Age: 40-49)	Mean	Standard Deviation	CV
CEB				CEB				CEB			
0	2.49	1.29	0.52	0	1.79	1.13	0.63	0	1.80	1.70	0.95
				1	1.99	1.00	0.50	1	2.00	1.06	0.53
				2	2.32	1.25	0.54	2	2.48	1.39	0.56
				3	2.89	2.01	0.69	3	3.44	3.73	1.08
total (all parities)	**2.49**	**1.29**	**0.52**		**2.45**	**1.69**	**0.69**		**2.64**	**1.76**	**0.67**
1	2.32	1.14	0.49	1	1.81	1.16	0.64	1	1.95	1.84	0.94
				2	2.63	2.35	0.90	2	2.35	0.85	0.36
				3	2.43	1.22	0.50	3	2.82	1.47	0.52
total (all parities)	**2.32**	**1.14**	**0.49**		**1.97**	**1.44**	**0.73**		**2.70**	**2.18**	**0.81**
2	2.61	1.26	0.48	2	2.47	1.70	0.69	2	2.46	1.54	0.63
				3	2.78	2.01	0.72	3	3.13	1.83	0.58
total (all parities)	**2.61**	**1.26**	**0.48**		**2.29**	**1.34**	**0.59**		**2.67**	**1.67**	**0.62**

Note: CV=coefficient of variation

APPENDIX 1: CHAPTER 1

a) Construction of the Wealth Index

The Wealth Index was built following the guidelines of Rutstein and Johnson (2004). This is supposed to be a pure economic variable, without taking into account education level or occupation type. According to the authors, the wealth index has many advantages over other economic variables. It represents a more permanent status when compared to income or consumption, especially due to fluctuation of income in Brazil during the 80's and early nineties, in particular during the period of hyper-inflation. It also solves a problem of missing data about income. For my Brazilian samples, 21.1% in 1986 and 14% in 2006 do not know the household income.

Wealth is also more easily measured and requires fewer questions than either consumption expenditures or income (Rutstein and Johnson, 2004. p. 4). Plus, the assets taken into account in the measurements are easily observable by all residents. For instance, it is common to be unaware of your parental income, but it is very uncommon to not know whether one owns a fridge.

As suggested by the authors, the variables chosen to compose the index have to be appropriate for the Brazilian reality, so they might differ from the ones utilized in this dissertation. Likewise, assets and utilities that are able to differentiate households in terms of economic prosperity might vary from one period to another. For example, when television was an expensive household item, having a TV was an important component of the index. When TV became popular and nearly universal, present even in the poorest households, it had to be left out of the index because it no longer separated people of different economic classes. Thus, I not only adapted the index to the Brazilian reality, but I created one index for each different DHS year and the PNDS. To make it comparable among the 3 survey years, I divided the index into 5 groups, ranging from 0 to 4, being 4 the wealthiest.

The configuration of the index was as follow:

I started by selecting some variables among household assets and utility services available at the DHS questionnaires and at the PNDS survey. I then conducted a Principal Component Analysis by factoring the variables for each year separately. PCA is a commonly used procedure to group strongly correlated variables. I performed the PCA for many different combination of variables in all three years, until I found a combination that fit the data well according to the PCA. For a matter of importance and space, I am only showing here the final combinations. For example, “source of drinking water” and “main material of the roof” did not prove to be relevant enough to be included in this index. The final selection after the PCA was as follow:

For the year 1986, I used possession of television, radio system, bathroom, car, vacuum cleaner, washing machine and if the household had a housekeeper, or domestic servant.

For the year 1996, I used possession of radio system, bathroom, car, vacuum cleaner, washing machine, housekeeper and VCR.

For the year 2006, I used possession of vacuum cleaner, washing machine, housekeeper, fridge, telephone line, computer and internet access at home.

The three PCA resulted in 2 different observable factors, or groups, for each year.

For 1986, the first factor included the possessions of TV and bathroom, and the second factor included the possession of car, housekeeper, vacuum and washing machine. I assigned the same weight for each of the possessions, therefore, Factor 1 has three categories: 2= possession of television and bathroom, 1=possession of television or bathroom and 0=household does not possess any of them. Similarly, factor 2, has 5 categories: 4= car, housekeeper, vacuum cleaner and washing machine, 3=a combination of 3 out of the 4 already cited, 2=a combination of 2 out of the 4, 1=only one out of the 4, 0=household does not possess any of them.

Then, I ran a crosstab between the two distinct groups, resulting in 12sub- categories. I re-grouped them according to the number of the possessions: the higher the number of possessions, especially the possessions which would differentiate higher classes from lower, the higher the Wealth Index of the person. I chose to re-group them so that I could keep comparability with the other DHS by creating a 5-level continuous scale ranging from 0 to 4, being 4 the wealthiest category.

The same procedure was used for 1996 and 2006, however, the variables utilized to differentiate poorer and richer were different – as it is supposed to be with the PCA method. For 1996, the factor with the possession of bathroom differentiated the poorest from the rest; while car, housekeeper, vacuum and VCR differentiate the richest.

For 2006, the possession of housekeeper, computer and internet differentiated the richer from the others, while the absence of fridge, washing machine and telephone differentiated the poor from the rest.

Tables with the group distribution can be made available upon request.

b) Construction of the Predicted Final Education Level

Studies involving young subjects or school-age subjects are exposed to a common problem: their incomplete level of education. In the case of this dissertation analyzes, 22% of the respondents in 2006 (goes up to 64% among women age 15-19) and 21% in 1996 (65.3% for women age 15-19) are still in school and their achieved years of education might not correspond to their final level of education. Statistical modelling can overcome differences in education level by controlling for age. Because this is a descriptive analysis where no control for age can be done, I opted for predicting the final level of education of women age 15 to 24 based on her age grade distortion and the probability that a women her age and with her current level of education would finish subsequent education levels.

In order to calculate the grade progression probabilities, I used a different database that contained the age groups and education levels in 1986, 1987, 1996, 1997, 2006 and 2007 in order to build a distribution of women and school grade. The PNAD (Pesquisa Nacional por Amostra Domiciliar) is nationally representative of the Brazilian population.

I used two successive years (i.e.:1986 and 1987) because it was possible to derive the proportion of women who would successfully pass to the next school grade. For example, the proportion of 15 years-old who were in the 9th grade in 1986 and the proportion of 16 years-old who were in the 10th grade in the 1987 have been successful. Any 16 years old in the 9th grade in 1987 would be considered to have failed one year in school.

By doing that, I created a probability matrix for annual transitions. Assuming that these probabilities were roughly constant for a few years to come, I got the probability of transition to the next school level for each age and grade. For example, I found that the probability of having an Incomplete High School Degree (having 8 to 10 years of education) of a White[45] women age 17 years-old who were in the 9th grade in 2006 was 0.17. I also found that her probability of finishing High School was 0.68. Her probability of going to college was 0.15.

[45] I calculated different probabilities for Whites and Blacks. I could have calculated for other social strata, but the refinement of this measurement is out of the scope of this dissertation given the complexity of the calculations.

After obtaining these probabilities using PNAD, I went back to the DHS and PNDS data to create, in every single year, for every women, a random variable ranging from 0 to 1 named "u". A random White women age 17, for example, had the value of u= 0.25 while other had the value of u=0.83. I then assigned (or better, I predicted) one education level for each women based on her age, her current level and her value for u:

In the previous example, the White women aged 17 with a value of u=0.25 would be assigned Incomplete High School (because her probability is lower than the 0.68 that is necessary to continue to finish High School). The women with the u=0.83 would be assigned Graduated High School because she would need to be at least 0.85 (0.68 + 0.17) to be considered "College".

This procedure was done for all three combinations (1986 and 1987; 1996 and 1997; and 2006 and 2007). The strongest assumption I am making is that the grade progressions remains the same from year to year after 1987, 1997 and 2007, even though I know education outcomes have been improving in Brazil and, ideally, I would have to track women in 1987, 1988, 1989 and so on.

A quick analysis of the results (that deserves further investigation or even a future paper) show how the probability of finishing high school and proceeding to college has increased enormously over the decades. It has also showed how these probabilities are much higher for Whites.

My predicted education levels which are used in the Bongaarts equation are: Elementary School or less (0 to 3 years of education), Elementary School (4), Middle School (5 to 8), High School (9 to 11) and college or some college (12 or more).

Tables with the group distribution can be made available upon request

APPENDIX 1.2: CHAPTER 1

The estimation of Sex Preferences as stated in the methods section lead some of the results to be inflated. That happens because the technique requires the division of the population in parity and composition, as can be seen in the example below:

Parity	Composition	number of women (P_i)	Number who doesn't want anymore	Proportion doesn't want (C_i)	Proportion Min (C_i*)	Number of women/kids in the absence of preferences (Ci*Pi)
1	b	5,519,480	2,735,999	0.50	0.50	2735999
1	g	5,136,525	2,731,087	0.53	0.50	2546169
2	bb	1,915,823	1,386,610	0.72	0.72	1386610
2	bg	1,558,071	1,244,829	0.80	0.72	1127681
2	gb	1,539,519	1,301,803	0.85	0.72	1114253
2	gg	1,274,700	969,165	0.76	0.72	922586
	∑Pi=	16,944,118			(∑(Ci*Pi) =	9,833,298
	Arnold (∑(Ci*Pi/∑Pi):	1.7231				

If higher the amount of variation in the proportion who doesn't want (C_i), more inflated the rate will be (see below how the result of the division changes drastically from 1.72 to 2.45). The high variability might be caused by having too many parities with different compositions, to small sample sizes, or to both.

Parity	Composition	number of women (P_i)	Number who doesn't want anymore	Proportion doesn't want (C_i)	Proportion Min (C_i*)	Number of women/kids in the absence of preferences (Ci*Pi)
1	b	5,519,480	2,759,740	0.50	0.50	2759740
1	g	5,136,525	2,619,628	0.51	0.50	2568263
2	bb	1,915,823	1,436,867	0.75	0.25	478956
2	bg	1,558,071	623,228	0.40	0.25	389518
2	gb	1,539,519	1,170,034	0.76	0.25	384880
2	gg	1,274,700	318,675	0.25	0.25	318675
	∑Pi=	16,944,118			(∑(Ci*Pi) =	6,900,031
	Arnold (∑(Ci*Pi/∑Pi):	2.4557				

APPENDIX 2: CHAPTER 2

Table A2.1: Top 5 preferred composition, women without children, Brazil, 1996 and 2006 (CONTINUE).

	1996			**2006**	
	n	**%**		**n**	**%**
			TOTAL		
bg	2,001	47.39	bg	1,927	40.89
xx	385	9.12	xx	672	14.26
No child	251	5.95	x	365	7.74
g	240	5.68	No child	342	7.26
bgg	223	5.28	g	290	6.15
bbg	187	4.43	xxx	229	4.86
b	171	4.05	bgg	179	3.8
x	168	3.98	b	176	3.73
bbgg	151	3.58	bbg	127	2.69
			Whites		
bg	773	47.02	bg	734	39.21
xx	175	10.64	xx	336	17.95
No child	101	6.14	x	158	8.44
bgg	81	4.93	No child	132	7.05
x	76	4.62	xxx	99	5.29
			Black		
bg	1,220	47.58	bg	1,037	41.65
xx	210	8.19	xx	284	11.41
g	175	6.83	No child	196	7.87
No child	150	5.85	x	175	7.03
bgg	141	5.5	g	174	6.99
			Wealth Level 0		
bg	154	45.29	bg	91	37.45
bgg	25	7.35	xx	32	13.17
bbgg	22	6.47	No child	24	9.88
g	19	5.59	x	17	7
bbg	19	5.59	g	13	5.35
			Wealth Level 1		
bg	441	50.63	bg	230	44.83
g	58	6.66	xx	54	10.53
xx	52	5.97	g	35	6.82
No child	52	5.97	No child	31	6.04
bgg	41	4.71	x	27	5.26

Table A2.1: Top 5 preferred composition, women without children, Brazil, 1996 and 2006 (CONTINUE).

		Wealth Level 2			
bg	580	46.29	bg	448	41.25
xx	115	9.18	xx	174	16.02
No child	89	7.1	No child	86	7.92
g	71	5.67	x	82	7.55
bgg	68	5.43	g	74	6.81
		Wealth Level 3			
bg	386	46.34	bg	679	40.51
xx	100	12	xx	230	13.72
g	51	6.12	x	159	9.49
bgg	50	6	No child	123	7.34
No child	42	5.04	g	101	6.03
		Wealth Level 4			
bg	428	47.45	bg	479	40.08
xx	98	10.86	xx	182	15.23
No child	53	5.88	x	80	6.69
g	40	4.43	No child	78	6.53
xxx	39	4.32	xxx	69	5.77
		Urban			
bg	1,707	48.1	bg	1,453	40.28
xx	333	9.38	xx	484	13.42
No child	215	6.06	No child	282	7.82
g	206	5.8	x	274	7.6
bgg	184	5.18	g	241	6.68
		Rural			
bg	294	43.68	bg	474	42.86
xx	52	7.73	xx	188	17
bbgg	41	6.09	x	91	8.23
bgg	39	5.79	No child	60	5.42
No child	36	5.35	xxx	54	4.88
	1996			**2006**	
	n	**%**		**n**	**%**
		Catholics			
bg	1,560	47.69	bg	1,454	40.21
xx	306	9.35	xx	535	14.8
g	193	5.9	x	292	8.08
No child	183	5.59	No child	251	6.94
bgg	177	5.41	g	207	5.72
		Protestant			
bg	293	49.49	bg	375	44.48
xx	44	7.43	xx	103	12.22
No child	32	5.41	No child	70	8.3
bbg	31	5.24	g	63	7.47
g	30	5.07	x	53	6.29

Table A2.1: Top 5 preferred composition, women without children, Brazil, 1996 and 2006 (CONTINUE).

No religious affiliation					
bg	98	42.61	bg	43	39.45
xx	21	9.13	x	12	11.01
No child	21	9.13	No child	11	10.09
g	14	6.09	xx	7	6.42
x	13	5.65	g	6	5.5
North					
bg	247	53.7	bg	311	43.5
g	37	8.04	xx	89	12.45
No child	33	7.17	No child	54	7.55
bgg	28	6.09	x	41	5.73
bbg	27	5.87	bgg	35	4.9
Northeast					
bg	815	48.51	bg	443	42.07
xx	123	7.32	xx	114	10.83
g	110	6.55	No child	86	8.17
bgg	105	6.25	g	84	7.98
No child	98	5.83	x	71	6.74
Southeast					
bg	548	45.29	bg	375	35.65
xx	129	10.66	xx	179	17.02
No child	75	6.2	x	107	10.17
b	68	5.62	g	76	7.22
x	63	5.21	No child	74	7.03
South					
bg	216	45.28	bg	381	39.08
xx	60	12.58	xx	181	18.56
No child	32	6.71	x	87	8.92
x	30	6.29	No child	62	6.36
bbg	27	5.66	g	49	5.03
Center-West					
bg	175	44.3	bg	417	45.42
xx	61	15.44	xx	109	11.87
xxx	23	5.82	No child	66	7.19
bgg	21	5.32	x	59	6.43
bbg	18	4.56	xxx	50	5.45

Table A2.1: Top 5 preferred composition, women without children, Brazil, 1996 and 2006 (CONTINUE).

		Cohabitation			
bg	86	51.5	bg	262	42.46
g	13	7.78	xx	91	14.75
xx	12	7.19	x	53	8.59
x	11	6.59	g	42	6.81
b	8	4.79	xxx	33	5.35
		Married			
bg	153	36.69	bg	204	39.92
xx	69	16.55	xx	106	20.74
xxx	29	6.95	x	44	8.61
x	28	6.71	xxx	30	5.87
bgg	24	5.76	g	27	5.28
		Separated/Divorced			
bg	41	39.81	bg	67	35.64
No child	13	12.62	x	20	10.64
b	9	8.74	No child	20	10.64
g	7	6.8	g	18	9.57
bgg	7	6.8	xx	17	9.04
		Single			
bg	1,721	48.68	bg	1,393	41.02
xx	299	8.46	xx	458	13.49
No child	219	6.2	No child	272	8.01
g	200	5.66	x	248	7.3
bgg	186	5.26	g	203	5.98
		No Church attendance			
bg	381	45.96	bg	297	37.83
xx	66	7.96	xx	103	13.12
No child	58	7	g	72	9.17
g	46	5.55	No child	69	8.79
bgg	44	5.31	x	68	8.66
		Church attendance			
bg	1,521	48.1	bg	1,630	41.5
xx	298	9.42	xx	569	14.49
g	180	5.69	x	297	7.56
No child	172	5.44	No child	273	6.95
bgg	169	5.34	g	218	5.55
		Not virgin			
bg	684	43.73	bg	1,220	41.4
xx	154	9.85	xx	442	15
No child	114	7.29	x	254	8.62
g	112	7.16	No child	172	5.84
b	78	4.99	g	171	5.8

Table A2.1: Top 5 preferred composition, women without children, Brazil, 1996 and 2006 (FINAL).

			Virgin		
bg	1,317	49.55	bg	707	40.03
xx	231	8.69	xx	230	13.02
bgg	153	5.76	No child	170	9.63
No child	137	5.15	g	119	6.74
bbg	130	4.89	x	111	6.29
			Not working		
bg	1,091	49.64	bg	1,098	41.72
xx	185	8.42	xx	359	13.64
g	125	5.69	x	193	7.33
No child	120	5.46	No child	176	6.69
bgg	107	4.87	g	159	6.04
			Working		
bg	910	44.96	bg	829	39.84
xx	200	9.88	xx	313	15.04
No child	131	6.47	x	172	8.27
bgg	116	5.73	No child	166	7.98
g	115	5.68	g	131	6.3

Table A2.2: Proportion of women who desires additional children given her current composition and probabilities that the proportions are the same, women with only one child, Brazil, 1996 and 2006.

	2006			1996		
	Had a Boy	Had a Girl		Had a Boy	Had a Girl	
	% wants more	% wants more	Probability	% wants more	% wants more	Probability
TOTAL	0.52	0.50	95.00	0.53	0.52	82.77
Race						
White	0.50	0.49	58.80	0.58	0.55	85.83
Blacks and Brown	0.52	0.50	83.00	0.51	0.49	75.09
Religion						
Catholic	0.51	0.48	90.70	0.55	0.51	98.37
Protestant	0.60	0.57	73.97	0.50	0.60	1.48
Non Religious	0.64	0.63	45.62	0.38	0.51	2.52
Urbanicity						
Urban	0.49	0.46	98.29	0.52	0.50	77.16
Rural	0.61	0.62	33.00	0.62	0.59	68.42
Region						
North	0.56	0.60	10.53	0.51	0.55	20.12
Northeast	0.55	0.54	66.03	0.51	0.50	58.01
Southeast	0.44	0.43	65.37	0.53	0.47	97.00
South	0.48	0.39	99.81	0.55	0.55	46.20
Center-West	0.61	0.61	44.91	0.63	0.63	45.74
Education Level						
0	0.40	0.41	40.75	0.48	0.45	69.16
1	0.56	0.53	84.17	0.58	0.55	90.21
2	0.57	0.51	97.96	0.56	0.53	75.72
3	0.50	0.47	85.99	0.50	0.49	57.18
4	0.47	0.53	5.10	0.42	0.52	6.35
Wealth Index (percentile)						
0	0.67	0.63	73.30	0.54	0.45	91.10
1	0.58	0.54	77.33	0.57	0.57	48.81
2	0.53	0.52	67.63	0.51	0.51	50.55
3	0.53	0.49	95.94	0.54	0.54	46.40
4	0.40	0.43	12.31	0.52	0.48	85.95
Church attendance						
No	0.46	0.46	50.56	0.52	0.47	92.75
Yes	0.53	0.51	96.12	0.55	0.54	74.56
Work Status						
No	0.56	0.55	78.70	0.54	0.56	15.67
Yes	0.48	0.45	94.25	0.53	0.47	99.34
Marital Status						
Married	0.57	0.55	80.42	0.59	0.56	95.11
Separated/Divorced	0.39	0.29	99.48	0.42	0.33	97.67
Single	0.44	0.42	68.62	0.38	0.49	0.58

Note: Binomial distribution was assumed. Where the probability is smaller than 5%, the null hypothesis (the hypothesis that the proportions are the same) can be rejected. That means in those cases, the proportions are statistically different. Some values are significant due to discrepant sample sizes. Those won't be commented.

Table A2.3: Proportion of women who desires additional children given her current composition and probabilities that the proportions are the same, women with two children, Brazil, 1996 and 2006.

	2006						1996					
				Probabilities						Probabilities		
	% wants more			GG vs. BB	GG vs. BG	BB vs. BG	% wants more			GG vs. BB	GG vs. BG	BB vs. BG
	Had BB	Had GG	Had BG				Had BB	Had GG	Had BG			
TOTAL	0.24	0.20	0.15	96.10	0.62	0.00	0.22	0.24	0.24	12.41	41.18	81.80
Race												
White	0.22	0.19	0.12	80.69	0.10	0.00	0.16	0.21	0.19	8.21	29.24	77.07
Blacks and Brown	0.23	0.19	0.18	89.61	26.21	1.01	0.26	0.28	0.28	25.85	51.20	73.58
Religion												
Catholic	0.24	0.19	0.14	96.66	0.73	0.00	0.22	0.24	0.24	17.43	43.21	75.98
Protestant	0.23	0.25	0.17	30.32	5.14	11.07	0.30	0.28	0.19	50.85	9.42	4.28
Non Religious	0.10	0.67	0.24	56.95	88.31	72.12	0.12	0.25	0.43	5.78	74.14	99.33
Urbanicity												
Urban	0.23	0.17	0.13	98.52	3.42	0.00	0.19	0.22	0.22	18.19	59.01	86.12
Rural	0.25	0.25	0.19	44.81	2.82	2.10	0.31	0.39	0.31	9.66	9.32	42.91
Region												
North	0.27	0.26	0.23	45.30	19.71	17.65	0.39	0.29	0.31	78.05	49.10	12.67
Northeast	0.35	0.18	0.17	99.55	37.66	0.00	0.22	0.28	0.29	5.15	48.03	92.38
Southeast	0.16	0.15	0.10	58.36	5.72	1.93	0.19	0.23	0.21	13.75	26.67	64.16
South	0.18	0.20	0.10	33.12	0.05	0.11	0.16	0.15	0.20	48.67	75.30	69.86
Center-West	0.27	0.23	0.22	70.55	38.76	13.93	0.24	0.30	0.21	18.74	9.60	24.64
Education Level												
0	0.36	0.31	0.15	63.38	0.56	0.01	0.25	0.25	0.24	43.33	33.36	33.26
1	0.27	0.21	0.17	96.41	9.43	0.07	0.24	0.26	0.27	31.65	60.31	75.01
2	0.18	0.14	0.14	84.08	51.91	10.13	0.18	0.22	0.19	15.33	21.81	52.18
3	0.20	0.21	0.15	34.60	4.06	5.09	0.12	0.25	0.21	0.89	20.19	90.49
4	0.20	0.18	0.11	49.96	5.94	2.46	0.25	0.13	0.18	76.39	50.89	12.61
Wealth Index (percentile)												
0	0.25	0.33	0.25	12.13	11.17	37.44	0.26	0.35	0.40	9.00	63.16	92.15
1	0.45	0.17	0.23	99.95	71.25	0.01	0.34	0.22	0.27	94.69	73.32	8.93
2	0.33	0.20	0.18	99.82	21.45	0.00	0.16	0.25	0.24	0.89	33.38	94.91
3	0.14	0.18	0.13	5.69	3.22	34.04	0.23	0.29	0.18	11.68	1.38	9.88
4	0.16	0.19	0.07	21.52	0.02	0.07	0.11	0.11	0.19	38.38	87.94	90.85
Church attendance												
No	0.26	0.16	0.11	94.63	8.75	0.02	0.24	0.21	0.24	63.59	63.29	43.93
Yes	0.23	0.20	0.16	87.77	1.02	0.00	0.21	0.25	0.23	7.70	20.04	68.54
Work Status												
No	0.26	0.25	0.18	69.03	0.57	0.05	0.27	0.25	0.24	64.22	30.94	15.55
Yes	0.21	0.14	0.13	98.30	18.70	0.02	0.16	0.23	0.24	1.57	53.07	98.73
Marital Status												
Married	0.25	0.22	0.14	85.55	0.01	0.00	0.24	0.26	0.26	20.66	46.33	76.17
Separated/Divorced	0.16	0.10	0.20	89.30	97.62	73.16	0.13	0.20	0.17	5.52	21.27	67.61
Single	0.27	0.64	0.18	0.19	0.01	12.07	0.78	0.73	0.15	56.42	30.10	67.45

Note: Binomial distribution was assumed. Where the probability is smaller than 5%, the null hypothesis (the hypothesis that the proportions are the same) can be rejected. That means in those cases, the proportions are statistically different. Some values are significant due to discrepant sample sizes. Those won't be commented.

Table A2.4: Parity Progression Rates by selected variables, all women with children, Brazil, 1996.

1996

	Total	White	Black	Urban	Rural	North	Northeast	Southeast	South	Center-West	Wealth Level 0	Wealth Level 1	Wealth Level 2	Wealth Level 3	Wealth Level 4	Catholics	Protestants	No affiliation	Less than elementary	Elementary	Middle School	High School	College
b	0.77	0.76	0.79	0.76	0.83	0.80	0.78	0.76	0.73	0.80	0.84	0.80	0.76	0.75	**0.75**	0.77	0.82	0.72	0.88	0.78	0.68	0.65	0.70
g	0.76	0.74	0.78	0.75	0.83	0.76	0.79	0.74	0.72	0.79	0.84	0.80	0.74	0.74	***0.73***	0.76	0.81	0.67	0.87	0.76	0.66	0.69	0.69
In-group significance		0.000		0.000		0.008 (1 and 4)					< 0.061					0.002			0.000				
b_b	**0.65**	**0.60**	**0.68**	0.62	**0.75**	**0.66**	0.70	0.62	**0.57**	**0.64**	0.80	0.75	**0.66**	**0.54**	0.50	**0.64**	0.71	0.64	**0.84**	**0.62**	0.50	***0.42***	0.41
b_g	**0.62**	***0.52***	0.68	**0.60**	0.71	0.68	**0.70**	0.57	***0.48***	0.55	0.74	0.72	***0.64***	0.55	0.43	0.62	0.65	0.67	0.81	***0.58***	0.46	***0.46***	0.34
g_b	0.64	0.57	***0.69***	0.62	***0.72***	***0.69***	0.69	0.60	0.55	***0.63***	0.79	0.73	0.62	***0.57***	0.50	***0.64***	0.67	0.56	0.84	**0.59**	0.49	***0.43***	0.45
g_g	0.66	0.61	0.69	**0.63**	0.75	0.70	**0.72**	0.59	0.59	0.63	0.76	0.77	0.64	0.58	0.51	0.65	0.71	0.64	***0.80***	0.64	0.56	***0.53***	0.47
In-group significance		0.000		**0.000**		0.004 (except 2).					0.000					**0.006 (except No Affiliation) 0.090 (except Catholic)**			0.000				
b_b_b	**0.59**	**0.58**	0.58	0.53	**0.76**	**0.60**	0.65	0.52	**0.53**	0.57	0.78	**0.67**	0.55	0.44	0.40	0.61	0.54	0.44	**0.76**	0.53	0.33	0.33	0.22
b_b_g	**0.52**	0.39	0.59	0.48	0.64	**0.65**	0.60	0.39	0.45	0.51	0.73	0.61	0.51	0.40	**0.27**	0.52	0.56	0.41	0.68	0.46	0.34	0.36	0.11
b_g_b	0.57	0.51	0.59	0.54	***0.70***	0.56	0.60	0.54	0.53	0.56	0.69	***0.67***	**0.56**	0.46	0.38	0.56	0.64	0.54	***0.74***	0.47	0.40	0.39	0.17
b_g_g	0.57	***0.44***	0.63	0.52	0.69	0.65	0.66	0.48	0.46	0.38	0.75	0.68	0.49	0.50	0.22	0.57	0.54	0.61	0.73	0.47	0.37	0.34	0.33
g_b_b	0.57	0.49	0.62	0.51	0.74	0.60	0.69	0.52	0.43	0.46	0.80	0.66	0.53	0.55	0.32	0.58	0.61	0.56	0.71	0.52	0.35	0.40	0.12
g_b_g	0.60	0.51	0.63	0.55	0.73	0.61	0.70	0.48	***0.59***	**0.46**	0.81	0.68	0.56	0.48	0.28	0.61	0.55	0.63	0.77	0.54	0.30	0.29	0.15
g_g_b	0.57	0.52	0.60	0.53	0.71	0.65	0.66	0.50	0.49	0.40	0.73	0.64	0.56	0.45	0.38	0.58	0.55	0.53	0.72	0.60	0.41	0.20	0.20
g_g_g	0.58	0.49	0.62	0.53	0.71	0.63	0.66	0.49	0.54	**0.42**	0.76	0.65	**0.55**	0.44	**0.42**	0.59	0.54	0.69	0.74	0.56	0.38	0.23	0.43
In-group significance		0.000		0.000		0.000 (except 2)					0.000					non-sig			0.000				

Notes: Statistically significant differences are in bold when reference category is b_b or b_b_b. Statistically significant differences are in red when reference category is g_g or g_g_g. If red and bold, number is statistically different than both reference categories.

In group significance denotes the p value for the X^2 test of within group differences.

Table A2.5: Parity Progression Rates by selected variables, all women with children, Brazil, 2006.

	2006																						
	Total	***White***	***Black***	***Urban***	***Rural***	***North***	***Northeast***	***Southeast***	***South***	***Center-West***	***Wealth Level 0***	***Wealth Level 1***	***Wealth Level 2***	***Wealth Level 3***	***Wealth Level 4***	***Catholics***	***Protestants***	***No affiliation***	***Less than elemen***	***Elementary***	***Middle School***	***High School***	***College***
b	0.35	0.68	0.75	0.69	0.78	0.75	0.72	0.71	0.69	0.74	0.78	0.74	0.72	0.71	**0.69**	0.73	0.74	0.66	0.90	0.78	0.66	0.57	0.59
g	0.35	0.69	0.73	0.69	0.77	0.76	0.72	0.68	0.68	0.74	0.80	0.74	0.72	0.72	***0.64***	0.71	0.77	0.64	0.89	0.80	0.64	0.57	0.58
In-group significance		0.000		0.000		0.004 (except Region 5).					0.006					0.000			0.000				
b_b	**0.56**	**0.49**	**0.60**	0.52	**0.63**	**0.68**	0.59	0.53	**0.48**	**0.53**	0.77	0.62	**0.60**	**0.52**	0.37	**0.56**	0.55	0.53	**0.76**	**0.61**	0.44	***0.41***	0.28
b_g	**0.52**	***0.43***	0.58	**0.49**	0.59	0.64	**0.56**	0.50	***0.42***	0.52	0.70	0.66	***0.51***	0.50	0.34	0.54	0.51	0.45	0.77	***0.54***	0.43	***0.34***	0.30
g_b	**0.53**	0.46	***0.56***	0.50	***0.58***	***0.60***	0.60	0.49	0.49	***0.46***	0.74	0.62	0.60	***0.47***	0.34	***0.52***	0.56	0.53	0.77	**0.57**	0.43	***0.33***	0.31
g_g	0.57	0.49	0.61	**0.54**	0.62	0.65	**0.63**	0.54	0.48	0.54	0.77	0.67	0.58	0.52	0.41	0.57	0.56	0.51	***0.81***	0.61	0.47	***0.35***	0.34
In-group significance		0.000		**0.000**		0.003					0.000					**0.077 (except Prot.)**			0.000				
b_b_b	0.49	**0.38**	0.54	0.42	**0.58**	**0.61**	0.53	0.44	**0.37**	0.45	0.64	**0.60**	0.50	0.42	0.26	0.49	0.49	0.46	**0.68**	0.45	0.39	0.28	0.19
b_b_g	0.44	0.33	0.50	0.40	0.52	**0.48**	0.53	0.38	0.40	0.41	0.68	0.55	0.48	0.37	**0.16**	0.45	0.42	0.41	0.63	0.44	0.35	0.21	0.13
b_g_b	0.46	0.37	0.50	0.45	***0.47***	0.58	0.46	0.45	0.38	0.40	0.62	***0.45***	**0.59**	0.39	0.22	0.46	0.46	0.48	***0.59***	0.48	0.32	0.26	0.15
b_g_g	0.51	***0.49***	0.53	0.48	0.57	0.64	0.55	0.46	0.41	0.45	0.72	0.64	0.47	0.48	0.20	0.52	0.53	0.48	0.67	0.51	0.37	0.36	0.17
g_b_b	0.48	0.34	0.56	0.45	0.54	0.62	0.56	0.40	0.42	0.38	0.69	0.62	0.52	0.37	0.31	0.49	0.50	0.33	0.65	0.49	0.28	0.33	0.25
g_b_g	0.47	0.39	0.51	0.43	0.54	0.59	0.43	0.46	***0.36***	**0.49**	0.64	0.55	0.50	0.42	0.20	0.48	0.47	0.38	0.63	0.50	0.30	0.34	0.14
g_g_b	0.47	0.39	0.52	0.44	0.52	0.55	0.53	0.41	0.48	0.40	0.67	0.53	0.47	0.42	0.30	0.47	0.50	0.41	0.60	0.47	0.41	0.29	0.13
g_g_g	0.48	0.44	0.51	0.46	0.53	0.55	0.47	0.38	0.50	**0.53**	0.72	0.54	**0.45**	0.46	**0.29**	0.51	0.46	0.29	0.65	0.47	0.37	0.32	0.30
In-group significance		0.000		0.000		0.000					0.000					0.016 (Except Prot.)			0.000				

Notes: Statistically significant differences are in bold when reference category is b_b or b_b_b. Statistically significant differences are in red when reference category is g_g or g_g_g. If red and bold, number is statistically different than both reference categories.

In group significance denotes the p value for the X^2 test of within group differences.

Does intention translate into behavior?

In light of the Theory of Conjunctural Action, I now move to the realms of outcomes to see whether a women's preferences can be noticed in her wish and likelihood of progressing to higher parity order births. So far, I know that women's intentions are different than what would be expected from the preferences once they start having children, as suggested by the analysis of post-rationalization. But who are more likely to proceed to higher parities according to their existing composition? In the previous sections, I observed that the most desired composition is the balance (bg). Therefore, I expect that women who already have two children of the same sex might show a greater propensity to desire more children and to continue childbearing in order to have them.

In Table A2.2 and A2.3 (Appendix 2: Chapter 2) I present the proportion of women who desires an additional child given the composition of the existing children (only women who has had at least one child ever born). I utilized the same datasets to calculate these proportions, but I used women's answers to the question "would you like an additional children"? The results are showed separately by survey year and can be seen on Table A2.2 for women who had one child wishing a second child and on Table A2.3 for women who had two children wishing a third child.

I ran Binomial tests in order to check whether the proportions of women who wishes to have an additional child is different according to the sex of existing children. On Table A2.2, I compared women who had a boy with women who had a girl. The probabilities can be seen on the columns to the right. Where the probability is smaller than 5%, the null hypothesis (the hypothesis that the proportions are the same) can be rejected. That means in those cases, the proportions are statistically different. On Table A2.3, I first compare women who had two girls compared to women who had two boys (Column GG vs. BB), then women who had two girls compared to women who had one of each (GG vs. BG). Last, I compared the women who had two boys compared to women who had one boy and a girl (BB vs. BG).

For Table A2.2, at the level of 5% in 1996, Protestants, people without religious affiliation and singles have slighter higher proportions of wishing an additional child if the first is a girl. For example, while 60% of the Protestants who had a girl say they want an additional child, only 50% who had a boy say so. It is impossible to know, however, whether this is a search for balance or a son preference. I also believe that those values only came up significant due to the small sample sizes in those categories (not shown). In 1996, very few people who have children are not Catholic or are single. In 2006, as can be seen in Table A2.2, all proportions for parity one were not statistically significant. That is, there are no significant differences for women that had a boy or a girl in their odds of wishing to have a second child.

For parities of two children moving forward to parity 3, as can be seen in Table A2.3, the socio-demographic groups start to look more different. In 1996, however, given that the sample sizes are still small for some groups and there is no clear tendency (not even a significant value at the country level), the results are not strong and won't be taken into consideration[1]. I believe that in the year of 1996, the sex of the existing children are less important for moving forward probably because desired family size and especially fertility rates, were still very high. It is also important to notice that comparing to 2006, 1996 has much less daughter preference in general.

In 2006, on the other hand, the values at the country level on Table A2.3 are significant: the proportion who wants a third child is much lower if the first two children are of opposite sexes than if the first are of the same sex. For example, while 24% of women who had two boys say they are willing to have a third child, only 15% of the ones who had a boy and a girl say so.

This is an indication of balance preference because the strength of the desire to continue is high for both people with two girls and two boys: those who had two girls also have higher chances of wishing more (20%). There is also a clear tendency when analyzing socio-demographic groups, with most of them following this national finding: this is the case of married, Catholics, South and Southeast, very low and very high educational levels, people who attend church, and people who don't work.

If the proportion is statistically significant for people with two girls and two boys when compared to women who have a sex mix, it is impossible to know for sure whether a certain group is looking for balance or has a son/daughter preference. However, if the direction of the strength goes in only one direction (if a person with two girls is more likely to wish an additional child, but those with two boys are not more likely to wish an additional child), I will assume there is a sex preference.

Thus, in 2006, I will deduce son preference for wealth level 3 and daughter preference for Blacks, Northeast, Education Level 1, wealth level 1 and 2, for those who don't go to church, and for people who work. Singles have too small of a sample size to be considered in this analysis.

Finally, intentions of having an additional children might not actually translate into behavior either. As a last attempt to evaluate sex preferences, I present real parity progression rates for all women until parity 4 (Table A2.4 for 1996 and Table A2.5 for 2006 in the Appendix 2: Chapter 2). Parity progressions are useful because they avoid *ex post-rationalization*, since women are not being directly asked about their preferences. I assume that in the past, when they decided to have an additional child, they took into account the composition of the children they already had. I neither also cannot affirm that a future child won't exist.

The numbers represent the proportion who moved forward in the childbearing process given the composition already had. The closer the number is to 1, the higher the proportion moving forward. For example, in Table A2.4, 77% of the women in 1996 who had a son has moved forward while 76% of those who had a girl moved forward. On Table A2.5, for the year of 2006, 35% moved forward.

In order to see if those proportions are statistically different from one another, I ran Bivariate logits to see if I can predict whether a person stopped at parity 1, 2 or 3 based on the sex composition already had. I investigated whether the proportions are different within groups (comparing Black and Whites, for example) and also by parity composition within category (comparing within a certain category for a certain year and parity, having a girl with having a boy, for example). The results are shown in the table (see Table A2.4 and Table A2.5 footnote for explanations about which differences are statistically significant).

Take, for example, Table A2.5, Center-West, progression for 3 birth. While 48% of the women who had two boys or two girls move forward, 42% of women who had a boy and then a girl and 49% of the ones who had a girl and a boy moved forward. The coefficients in bold (regardless of color) are statistically different than one another (bb compared bg). Likewise, the numbers in red are statistically different from each other as well (bg compared to gg).

Unfortunately, descriptive analysis such as these cannot inform about the proportion of these children who were unwanted, neither can they tell apart how much of this progression is due to different desired family sizes (or intrinsic differences in fertility levels). So, comparisons between groups' sex preferences should be made with caution.

Summing up, the progression to the 2nd child based on the sex of the first child is less dependent on the key covariates than I previously thought. Notice in Tables A2.4 and A2.5 how the sex of the first child matters very little for further progression. When it comes to two children and the progression to the 3rd birth, however, for every single group in both years the proportion progressing for higher parities is bigger if the first two children are of the same sex, regardless of being a boy or girl – a great suggestion of balance preference when it comes to real behavior. The differences in progression are less significant in 1996 probably because fertility was still high.

In general, the proportion of women progressing to higher order births decreased throughout the two years analyzed in this paper given the general decline in fertility that probably generated an increase in sex indifference. Much fewer people are willing to trade in family size for parity composition. One can also notice that progression declines with increasing education (notice in Table A2.4 and A2.5 how the proportion moving forward is smaller the higher the education level). Take, for example, Table A2.5, the proportion moving forward after having two sons. For the first education level, 64% will move forward. For the second level, 60%. For the third, 50%. For the forth, 42%. Finally, women with college education only progresses for a third birth 26% of the times in case of having two boys. The same behavior is found for wealth index, because more educated and wealthier people will always have fewer children than their counterparts. Likewise, inhabitants of rural areas will always be more likely to progress to higher order births than people who live in urban areas.

Much of this difference is explained by different levels of contraceptive access, as discussed in Chapter 1. This can be also suggested by the role of education, and urbanization in reducing gender preferences. Highly educated and urban women are the ones with the higher costs of opportunity when having children, so it is natural to think that they would be the first ones to give up on their desired composition and present indifference as observed in the data. Future work should illuminate the differences in post-rationalization by women of different social groups. It is possible that since educated and urban women are more indifferent, they should also be the ones with fewer levels of rationalization.

In an attempt to summarize the most important results of this Chapter, in the Box 2 below I summarize the hypotheses of this work and the most important indications of sex preferences found with the four different methods employed. Notice how for a Parity Progression and for the proportion of women who wishes an additional children, balance and indifference were aggregated due to the problems in telling them apart. I also included a row for the findings of Chapter 1. In that case, I listed just the variables which has higher values for the sex-preference factor (F_{SP}). That analysis, however, cannot tell much about the direction of that preference.

In a general sense, the findings are consistent with the hypothesis presented in this chapter and with the findings for chapter 1. For example, separated/divorced, virgin, women who work, singles and mid-educated women have more daughter preference, while region South is constantly preferring male, if not a balance. Married, Catholic, church goers and rural areas are more into balance, as predicted.

It is also possible to see that the more difficult it is for a women to trade in family sizes in order to achieve her desired composition, more difficult it is for her to match her intentions and outcomes (see, for example, urban women). Unless, of course, she mentions that she is indifferent. The fact that the parity progression of highly educated is unaltered by sex, also strengthens the hypothesis that they are indifferent and less willing to trade off quantity for quality given that their opportunity cost of having too many children is much higher.

Box 2: Summary of findings by type of sex preference and methods utilized in this chapter.

<table>
<tr><th></th><th>Daughter</th><th>Son</th><th>Balance</th><th>Indifference</th></tr>
<tr><td>Hypotheses
(Chapter 2)</td><td>Single
Divorced/Separated
Black
Low educated/Low income
Work
Virgin
Urban</td><td>South</td><td>Married
Rural
Catholic/Protestant
Church goers</td><td>Urban
High education</td></tr>
<tr><td>Desired Sex Ratio</td><td>Urban (2006)</td><td>South
Rural
High school</td><td></td><td></td></tr>
<tr><td>Multinomial Logits</td><td>Single
Separated/Divorced
Virgin (2006)
North/Northeast
Work
Church goers</td><td>South</td><td>Black
Urban (2006)
Non church-goers</td><td>Married
Old
Rural
Catholic
Church goers
Wealth
High education
Virgin (1996)</td></tr>
<tr><td>Proportion wishing an additional child giving the sex of the existing children</td><td>Black
Northeast
Education 1
Wealth 1,2
No church
Work</td><td>Wealth 3</td><td colspan="2">Married
Catholic
South
Southeast
Low and High education
Church goers
Don't work
Wealth 3 (1996)</td></tr>
<tr><td>Parity progression</td><td>Primary education (1996)
High wealth
High school</td><td>Low educated</td><td colspan="2">White
Black
Rural/Urban
North
Northeast
South
Center-West
Wealth 2, 3 and 4.
Catholic
Low educated
Primary
High school
Whites (1996)
South (1996)
Center-West (1996)</td></tr>
<tr><td>Bongaarts
(Chapter 1)</td><td colspan="4">Low educated (2006)
Rural, Highly educated, South, Center-West, Southeast, Catholic, Protestants, Whites (1996)</td></tr>
</table>

Notes:

For Odds Wishing and Parity progression, I united Indifference with Balance Preferences because it is impossible to tease them apart.

Unless otherwise specified in parenthesis, the relationship was found for both years (1996 and 2006).

All relationships found to be statistically significant are represented in this Box, even if the coefficients are small.

In conclusion, these finding shows the applicability of the Theory of Conjunctural Action to explaining sex preferences in Brazil. Although women have their intentions formed by their schemas as can be seen in the analysis of intentions, the conjunctures of life may even change what they consider to be good, as could be seen in the analysis of post-rationalization. For those who are unsatisfied, women still have the agency to keep going or at least, to say they "wish they could".

One thing to be learned from the analysis of the parity progressions and future intentions is that although the search for balance has been declining (lower proportions of people continuing childbearing regardless of sex composition), most social groups will still show some tendency of continuing when they are caught by surprise of having two of the same sex. Thus, for Brazilian women, sex preferences matters for progression, even if subtly, so family size increases in the same direction and with the strength of this preference.

It is also important to say that it has been 10 years since the last PNDS. It is very possible that such patterns have been totally transformed in the face of the most recent fertility decline.

APPENDIX 3: CHAPTER 3

Table A3.1: Population values for: mean years of education, mean age at first union and proportion of women in the labor force by year, Brazil, DHS (1986, 1996) and PNDS (2006).

	Mean years of education			Mean age at first union			Proportion of Women in the labor force		
	1986	1996	2006	1986	1996	2006	1986	1996	2006
Wealth le	2.24	2.93	4.69	19.06	18.86	18.09	40.73	44.5	29.94
Wealth le	3.96	4.48	5.96	19.04	19.18	18.85	37.5	45.29	36.11
Wealth le	5.85	6.18	7.08	19.81	19.82	19.39	45.58	48.9	43.89
Wealth le	7.26	7.13	7.88	20.53	20.35	19.80	46.74	54.18	48.92
Wealth le	9.13	9.01	10.37	21.54	21.07	21.68	47.66	58.8	60.18
Groupedu	1.53	1.62	1.66	19.09	18.86	18.21	38.55	44.25	34.81
Groupedu	4.89	5.06	5.18	19.43	19.38	18.72	39.46	44.82	39.62
Groupedu	8.73	8.63	8.71	20.43	20.09	19.46	38.58	46.88	40.28
Groupedu	11.00	11.00	11.00	21.89	21.68	21.12	60.41	66.67	55.71
Groupedu	12.00	12.00	12.00	23.59	23.62	23.30	76.01	80.16	75.84
Urban	6.43	6.71	8.28	20.05	20.03	20.08	44.68	51.43	51.07
Rural	3.16	3.79	6.09	19.43	19.29	18.91	41.65	46.07	35.82
North	6.06	6.57	7.49	18.78	19.07	18.77	40.48	50.3	40.76
Northeast	4.63	5.46	7.20	19.57	19.72	19.54	38.95	46.88	45.67
Southeast	6.29	6.70	7.83	20.56	20.55	20.39	46.88	52.22	46.75
South	5.70	6.67	7.85	19.54	20.16	20.14	48.82	56.97	54.76
Center-W	.	6.27	7.82	.	19.17	19.51	.	50.75	43.88
Catholics	5.65	6.07	7.56	19.92	19.92	19.74	44.38	50.59	47.34
Protestan	5.63	6.14	7.93	19.83	19.74	19.69	40.5	50.19	43.07
No-religio	5.17	6.08	7.46	19.29	19.21	18.73	40.92	44.67	38.75
Escola 0	1.51	1.61	1.65	19.11	18.88	18.23	38.5	44.37	34.97
Escola 1	4.76	4.98	5.08	19.44	19.40	18.76	40.4	45.38	40.44
Escola 2	8.27	8.40	8.50	20.48	20.08	19.52	38.92	47.4	44.06
Escola 3	10.50	10.72	10.65	21.81	21.57	20.99	54.24	63.08	51.34
Escola 4	11.63	11.74	11.62	23.10	23.48	22.98	68.1	73.99	66.49
White	.	6.97	8.15	.	20.25	20.17	.	51.98	50.11
Black	.	5.65	7.09	.	19.63	19.44	.	49.41	44.67

Table A3.2: Calculation process of Adjusted Deficit and Adjusted Surplus factors (CONTINUE)

	1986	1996	2006
		Total	
Total Neutral	1052	3153	4863
Total Surplus	-3900	-8513	-6739
Total Deficit	8067	12690	13814
CEB	12357	25513	41292
All children in the absence of deficit (CEB+deficit)	20424	38203	0.67
CEB/(CEB+deficit)	0.61	0.67	27478
All children in the absence of surplus (CEB-surplus)	8457	17000	20739
CEB/(CEB-surplus)	1.46	1.50	1.32
		Education Level 0	
Total Neutral	328	685	690
Total Surplus	-2752	-4982	-2416
Total Deficit	1632	2120	1098
CEB	6748	11032	7257
All children in the absence of deficit (CEB+deficit)	8380	13152	8355
CEB/(CEB+deficit)	0.81	0.84	0.87
All children in the absence of surplus (CEB-surplus)	3996	6050	4841
CEB/(CEB-surplus)	1.69	1.82	1.50
		Education Level 1	
Total Neutral	380	1163	1512
Total Surplus	-896	-2497	-2714
Total Deficit	3036	4548	2954
CEB	3637	8542	9807
All children in the absence of deficit (CEB+deficit)	6673	13090	12761
CEB/(CEB+deficit)	0.55	0.65	0.77
All children in the absence of surplus (CEB-surplus)	2741	6045	7093
CEB/(CEB-surplus)	1.33	1.41	1.38

Table A3.2: Calculation process of Adjusted Deficit and Adjusted Surplus factors (CONTINUE)

	Education Level 2		
Total Neutral	153	509	1060
Total Surplus	-123	-597	-904
Total Deficit	1567	2912	3941
CEB	878	2655	4587
All children in the absence of deficit (CEB+deficit)	2445	5567	8528
CEB/(CEB+deficit)	0.36	0.48	0.54
All children in the absence of surplus (CEB-surplus)	755	2058	3683
CEB/(CEB-surplus)	1.16	1.29	1.25

	Education Level 3		
Total Neutral	117	560	1127
Total Surplus	-91	-345	-589
Total Deficit	1242	2228	3885
CEB	694	2383	4226
All children in the absence of deficit (CEB+deficit)	1936	4611	8111
CEB/(CEB+deficit)	0.36	0.52	0.52
All children in the absence of surplus (CEB-surplus)	603	2038	3637
CEB/(CEB-surplus)	1.15	1.17	1.16

	Education Level 4		
Total Neutral	74	236	472
Total Surplus	-38	-86	-99
Total Deficit	590	877	1921
CEB	400	889	1564
All children in the absence of deficit (CEB+deficit)	990	1766	3485
CEB/(CEB+deficit)	0.40	0.50	0.45
All children in the absence of surplus (CEB-surplus)	362	803	1465
CEB/(CEB-surplus)	1.10	1.11	1.07

Table A3.2: Calculation process of Adjusted Deficit and Adjusted Surplus factors (CONTINUE)

	Catholic		
Total Neutral	830	2427	4065
Total Surplus	-3150	-6673	-5817
Total Deficit	6694	9858	10950
CEB	10015	19880	23350
All children in the absence of deficit (CEB+deficit)	16709	29738	34300
CEB/(CEB+deficit)	0.60	0.67	0.68
All children in the absence of surplus (CEB-surplus)	6865	13207	17533
CEB/(CEB-surplus)	1.46	1.51	1.33

	Protestant		
		500	630
Total Neutral	94	-1246	-694
Total Surplus	-343	1778	2219
Total Deficit	647	3978	3271
CEB	1176	5756	5490
All children in the absence of deficit (CEB+deficit)	1823	0.69	0.60
CEB/(CEB+deficit)	0.65	2732	2577
All children in the absence of surplus (CEB-surplus)	833	1.46	1.27
CEB/(CEB-surplus)	1.41		

	No religion		
Total Neutral	84	120	82
Total Surplus	-302	-442	-137
Total Deficit	503	616	250
CEB	819	1028	445
All children in the absence of deficit (CEB+deficit)	1322	1644	695
CEB/(CEB+deficit)	0.62	0.63	0.64
All children in the absence of surplus (CEB-surplus)	517	586	308
CEB/(CEB-surplus)	1.58	1.75	1.44

Table A3.2: Calculation process of Adjusted Deficit and Adjusted Surplus factors (CONTINUE)

	Urban		
Total Neutral	838	2650	3420
Total Surplus	-2402	-5960	-4380
Total Deficit	6243	10457	10150
CEB	8442	18977	17749
All children in the absence of deficit (CEB+deficit)	14685	29434	27899
CEB/(CEB+deficit)	0.57	0.64	0.64
All children in the absence of surplus (CEB-surplus)	6040	13017	13369
CEB/(CEB-surplus)	1.40	1.46	1.33

	Rural		
Total Neutral	214	503	1443
Total Surplus	-1498	-2553	-2359
Total Deficit	1824	2233	3664
CEB	3915	6536	9729
All children in the absence of deficit (CEB+deficit)	5739	8769	13393
CEB/(CEB+deficit)	0.68	0.75	0.73
All children in the absence of surplus (CEB-surplus)	2417	3983	7370
CEB/(CEB-surplus)	1.62	1.64	1.32

	Wealth Level 0		
Total Neutral	120	249	301
Total Surplus	-1371	-1870	-1194
Total Deficit	1091	1215	908
CEB	3136	4256	3334
All children in the absence of deficit (CEB+deficit)	4227	5471	4242
CEB/(CEB+deficit)	0.74	0.78	0.79
All children in the absence of surplus (CEB-surplus)	1765	2386	2140
CEB/(CEB-surplus)	1.78	1.78	1.56

Table A3.2: Calculation process of Adjusted Deficit and Adjusted Surplus factors (CONTINUE)

	Wealth Level 1		
Total Neutral	135	591	521
Total Surplus	-926	-3080	-1302
Total Deficit	1364	2641	1644
CEB	2507	7288	4193
All children in the absence of deficit (CEB+deficit)	3871	9929	5837
CEB/(CEB+deficit)	0.65	0.73	0.72
All children in the absence of surplus (CEB-surplus)	1581	4208	2891
CEB/(CEB-surplus)	1.59	1.73	1.45

	Wealth Level 2		
Total Neutral	400	901	1178
Total Surplus	-1131	-2131	-1865
Total Deficit	3121	3603	3194
CEB	3916	6591	7167
All children in the absence of deficit (CEB+deficit)	7037	10194	10361
CEB/(CEB+deficit)	0.56	0.65	0.69
All children in the absence of surplus (CEB-surplus)	2785	4460	5302
CEB/(CEB-surplus)	1.41	1.48	1.35

	Wealth Level 3		
Total Neutral	201	628	1948
Total Surplus	-317	-903	-2037
Total Deficit	1314	2480	4962
CEB	1558	3839	9580
All children in the absence of deficit (CEB+deficit)	2872	6319	14542
CEB/(CEB+deficit)	0.54	0.61	0.66
All children in the absence of surplus (CEB-surplus)	1241	2936	7543
CEB/(CEB-surplus)	1.26	1.31	1.27

Table A3.2: Calculation process of Adjusted Deficit and Adjusted Surplus factors (CONTINUE)

	Wealth Level 4		
Total Neutral	196	768	915
Total Surplus	-155	-509	-341
Total Deficit	1177	2684	3106
CEB	1240	3449	3204
All children in the absence of deficit (CEB+deficit)	2417	6133	6310
CEB/(CEB+deficit)	0.51	0.56	0.51
All children in the absence of surplus (CEB-surplus)	1085	2940	2863
CEB/(CEB-surplus)	1.14	1.17	1.12

	North		
Total Neutral	114	366	733
Total Surplus	-440	-982	-1725
Total Deficit	975	1240	2251
CEB	1558	2873	5555
All children in the absence of deficit (CEB+deficit)	2533	4113	7806
CEB/(CEB+deficit)	0.62	0.70	0.71
All children in the absence of surplus (CEB-surplus)	1118	1891	3830
CEB/(CEB-surplus)	1.39	1.52	1.45

	Northeast		
Total Neutral	249	939	820
Total Surplus	-2191	-4667	-1829
Total Deficit	2392	4858	2951
CEB	4867	10742	5747
All children in the absence of deficit (CEB+deficit)	7259	15600	8698
CEB/(CEB+deficit)	0.67	0.69	0.66
All children in the absence of surplus (CEB-surplus)	2676	6075	3918
CEB/(CEB-surplus)	1.82	1.77	1.47

Table A3.2: Calculation process of Adjusted Deficit and Adjusted Surplus factors (CONTINUE)

	Southeast		
Total Neutral	531	976	1110
Total Surplus	-997	-1723	-1177
Total Deficit	3448	3560	2851
CEB	4404	6229	5433
All children in the absence of deficit (CEB+deficit)	7852	9789	8284
CEB/(CEB+deficit)	0.56	0.64	0.66
All children in the absence of surplus (CEB-surplus)	3407	4506	4256
CEB/(CEB-surplus)	1.29	1.38	1.28

	South		
Total Neutral	158	512	1158
Total Surplus	-272	-543	-928
Total Deficit	1252	1497	2796
CEB	1528	2811	5272
All children in the absence of deficit (CEB+deficit)	2780	4308	8068
CEB/(CEB+deficit)	0.55	0.65	0.65
All children in the absence of surplus (CEB-surplus)	1256	2268	4344
CEB/(CEB-surplus)	1.22	1.24	1.21

	Center-West	
Total Neutral	360	1042
Total Surplus	-598	-1080
Total Deficit	1535	2965
CEB	2858	5471
All children in the absence of deficit (CEB+deficit)	4393	8436
CEB/(CEB+deficit)	0.65	0.65
All children in the absence of surplus (CEB-surplus)	2260	4391
CEB/(CEB-surplus)	1.26	1.25

Table A3.2: Calculation process of Adjusted Deficit and Adjusted Surplus factors (CONTINUE)

	Predicted education 0		
Total Neutral	327	681	686
Total Surplus	-2750	-4977	-2412
Total Deficit	1603	2052	1077
CEB	6733	11012	7238
All children in the absence of deficit (CEB+deficit)	8336	13064	8315
CEB/(CEB+deficit)	0.81	0.84	0.87
All children in the absence of surplus (CEB-surplus)	3983	6035	4826
CEB/(CEB-surplus)	1.69	1.82	1.50

	Predicted education 1		
Total Neutral	376	1162	1495
Total Surplus	-898	-2500	-2712
Total Deficit	2796	4279	2590
CEB	3635	8537	9780
All children in the absence of deficit (CEB+deficit)	6431	12816	12370
CEB/(CEB+deficit)	0.57	0.67	0.79
All children in the absence of surplus (CEB-surplus)	2737	6037	7068
CEB/(CEB-surplus)	1.33	1.41	1.38

	Predicted education 2		
Total Neutral	150	499	1018
Total Surplus	-123	-598	-904
Total Deficit	1245	2526	2689
CEB	867	2643	4567
All children in the absence of deficit (CEB+deficit)	2112	5169	7256
CEB/(CEB+deficit)	0.41	0.51	0.63
All children in the absence of surplus (CEB-surplus)	744	2045	3663
CEB/(CEB-surplus)	1.17	1.29	1.25

Table A3.2: Calculation process of Adjusted Deficit and Adjusted Surplus factors (CONTINUE)

	Predicted education 3		
Total Neutral	122	570	1158
Total Surplus	-91	-344	-594
Total Deficit	1555	2707	4864
CEB	706	2405	4261
All children in the absence of deficit (CEB+deficit)	2261	5112	9125
CEB/(CEB+deficit)	0.31	0.47	0.47
All children in the absence of surplus (CEB-surplus)	615	2061	3667
CEB/(CEB-surplus)	1.15	1.17	1.16

	Predicted education 4		
Total Neutral	77	241	504
Total Surplus	-38	-88	-100
Total Deficit	868	1121	2579
CEB	416	904	1595
All children in the absence of deficit (CEB+deficit)	1284	2025	4174
CEB/(CEB+deficit)	0.32	0.45	0.38
All children in the absence of surplus (CEB-surplus)	378	816	1495
CEB/(CEB-surplus)	1.10	1.11	1.07

	White	
Total Neutral	1409	2003
Total Surplus	-2132	-1701
Total Deficit	5019	5408
CEB	8648	9259
All children in the absence of deficit (CEB+deficit)	13667	14667
CEB/(CEB+deficit)	0.63	0.63
All children in the absence of surplus (CEB-surplus)	6516	7558
CEB/(CEB-surplus)	1.33	1.23

Table A3.2: Calculation process of Adjusted Deficit and Adjusted Surplus factors (FINAL)

	Black	
Total Neutral	1733	2625
Total Surplus	-6360	-4631
Total Deficit	7613	7411
CEB	16781	16644
All children in the absence of deficit (CEB+deficit)	24394	24055
CEB/(CEB+deficit)	0.69	0.69
All children in the absence of surplus (CEB-surplus)	10421	12013
CEB/(CEB-surplus)	1.61	1.39

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