THE CHANGING SIGNIFICANCE OF EDUCATION FOR FERTILITY INEQUALITY IN CAMEROON (1991 – 2011)

A Thesis

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by

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ABSTRACT

This thesis examines the changing significance of education for fertility inequality in Cameroon. It uses data from demographic and health surveys from 1991 to 2011 and a mix of linear regression and decomposition analysis to identify the factors contributing most strongly to the changes in inequalities in Cameroon, with a specific focus on the contribution of composition and behavioral effects. The findings show a rise in fertility inequality during the study period, with an increasing concentration of births among women of lower levels of schooling.

The results from the decomposition analysis suggest that the main driver of this growing inequality is behavioral differentiation. Importantly, the study highlights both the quantitative and the qualitative effects of education (the magnitude and the pathways through which it contributes to inequality). Quantitatively, the contribution of education to reproductive inequalities increases overtime. Qualitatively, the contribution shifts from mainly behavioral effect to predominantly compositional mechanisms. The study concludes by a discussion of the implications of this rising fertility inequality on prospects of demographic dividend in Cameroon.

BIOGRAPHICAL SKETCH

Omar Ali was born in Djibouti on June 17th, 1987. He received a Bachelor's degree in Administration and Economics from the University of Djibouti in 2008 and a Master's degree in Demography with honor from the *Institut de Formation et de Recherche Démographiques* (**IFORD**) of the University of Yaoundé II in Cameroon in 2011. In January 2014, he joined the graduate program in the department of Development Sociology at Cornell University.

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My deepest gratitude and love go to my beloved parents whose presence in my heart has been my constant source of strength, faith and hope over the past three years. Thank you, Mum and Dad, for all your love, support and prayers and for being my best friends in life.

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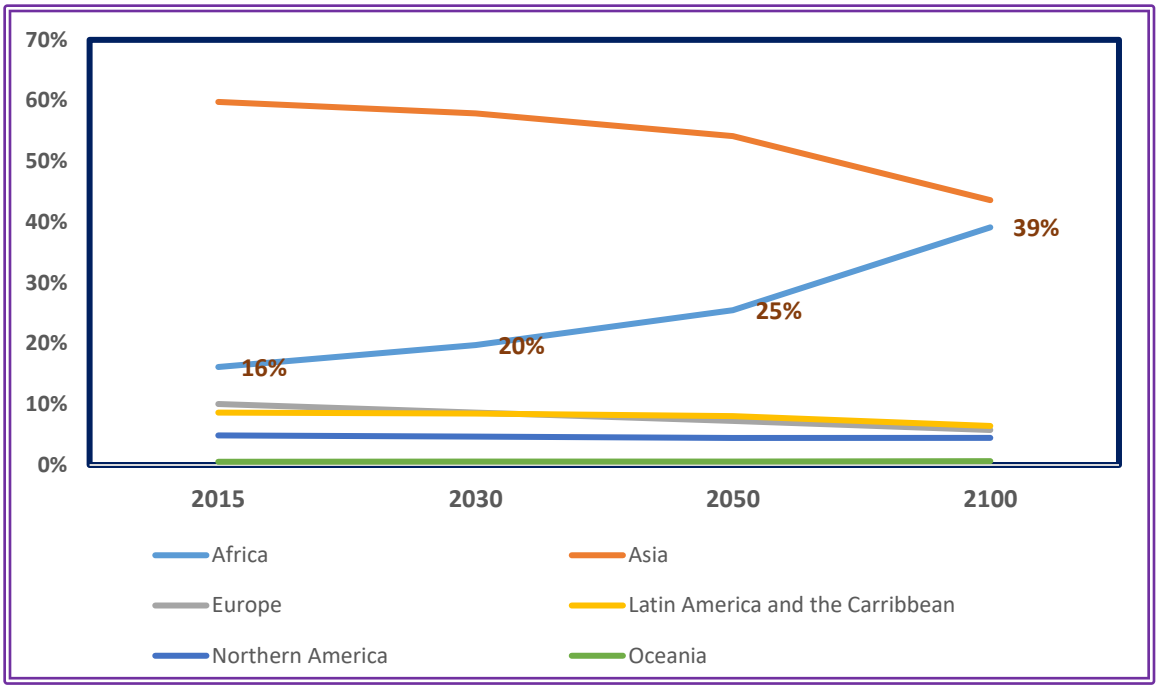
CHAPTER 1.
INTRODUCTION AND BACKGROUND

General Overview

In 2014, the world's population reached 7.2 billion people and was increasing by nearly 82 million more every year. Much of this growth stems from fertility trends, which, according to UNICEF estimates, contributed for over 300 000 new babies born every day (UN, 2014; UNICEF, 2016). This remarkable expansion does not occur evenly across all countries and continents. In fact, the bulk of the growth comes mostly from the developing world, and in particular from Sub-Saharan Africa (SSA),[1]currently the fastest-thriving region (see **Figure 1.1**). Because of the pace of its population growth, SSA's share of the world's overall population is expected to increase from 13% today to 20% in 2050 (Tabutin et al. 2004; CEPII, 2014).

Figure 1.1: Contribution of major areas to the world population 2015, 2030, 2050 and 2100

[1] The term ***"Sub-Saharan Africa"*** used here refers to the area of the African continent which lies south of the Sahara Desert. Geographically, the demarcation line is the southern edge of the Sahara Desert. There are 42 countries located on the sub-Saharan African mainland, in addition to six island nations (Madagascar, Seychelles, Comoros, Cape Verde and São Tomé and Príncipe).



Other regions, by that time, are expected to experience a population decline and aging due to below-replacement fertility rates (Stark & Kohler, 2002). The challenges of this *demographic divide* are thus numerous and relevant for a variety of reasons. In a globalized and interconnected world, the consequences of Africa's population trends will extend beyond the region, as it's already the case with signaled the flows of migrants from the poorest nations to the more developed countries in search of a better life and material security.[2] Within the region itself, these trends will present both opportunities and challenges. According to current projections, the number of young sub-Saharan Africans reaching working age (15-64) by 2035 will far exceed that of the rest of the world combined. Already, the region is confronted with a population structure made up of a large proportion (over 50 percent) of young adults in the working-age population which means a high rate of workforce growth and an equally large proportion of children and under 15 years old

[2] See Somini's Sengupta: "Heat, Hunger and War Force Africans onto a 'Road of Fire'" https://www.nytimes.com/interactive/2016/12/15/world/africa/agadez-climate-change.html?_r=0

population (over 40 percent) as well as a growing school age population (Cincotta, 2010). If well harnessed, this youth bulge could spur a significant socioeconomic development and turn the region into a major actor in the world economy (Malmberg, 2008). But, for now, Sub-Saharan Africa remains the poorest region in the world. Despite substantial economic growth since the turn of the millennium,[3] its average Human Development Index[4] value (0.475) is the lowest of any region but it's nonetheless rising at a very rapid pace. [5](World Bank, 2015; UNDP, 2013)

The driving factor of SSA's exceptional population expansion is high fertility, indeed the highest in the world. Despite some decline in most African countries since the 1990s, fertility rates have remained high in the last two decades mainly because of improvements in maternal and child health (Bongaarts and Casterline, 2013; Tabutin et al. 2004). Recent studies show signs of stalls and reversals of fertility rates in several countries (Bongaarts 2006; Bongaarts 2008; Shapiro and Gebreselassie 2008). According to data from the USAID-funded Demographic and Health Surveys, the total fertility rate in SSA in 2013 averaged 5.4 children (Westoff et al., 2013. Such high fertility rates could represent an obstacle to socioeconomic development both at the national and local level.

Conversely, reductions in fertility may translate into a substantial demographic bonus because delayed childbearing results in a larger portion of the population being found in the productive ages. This is known as the demographic dividend.

[3] 6.4 percent on average during 2002-2008 according to the World Bank.
[4] HDI.
[5] "Since 2000, Sub-Saharan Africa has experienced the fastest annual growth rates in the Human Development Index (HDI) among all regions - growing at an annual rate of 1.7 percent between 2000 and 2010 and 0.9 percent between 2010 and 2014. Twelve countries in the region, including Botswana, Cap Verde, Congo, Equatorial Guinea, Gabon, Ghana, Mauritius, Namibia, Sao Tome and Principe, Seychelles, and Zambia have levels that put them in the high or medium human development group, individually. However Sub-Saharan Africa, on average, remains in the low human development category and HDI levels are still low: a shortage of good work opportunities is preventing many from reaching their full potential and making decent livelihoods." (UNDP, 2013)

Dividends from fertility decline

According to the theory of the demographic dividend, a fertility decline can modify population structure and positively affect socio-economic development both at the individual and national level. At the individual level, a decrease in the number of children per family tends to raise the average amount of resources available per child (Blake 1981). At the national level, the shift from high to low fertility alters the age structure of the population thereby improving the support ratio (the proportion of people of working age, compared to dependents, especially children). With more adults than children, countries can now concentrate more resources towards the education, health and overall wellbeing of children and invest to raise their human capital resources in ways that create the conditions for further demographic dividends and economic development (Bloom, Canning & Sevilla 2003).

By changing the age structure of a society, a fertility decline could spur socioeconomic development. When countries succeed in adequately taking advantage of their population potential, societies experience a virtuous cycle of lower dependency ratio, an increase of their labor force and an important economic boom which, in turn, improves socioeconomic indicators (Crenshaw et al. 1997). Hence, a more favorable age structure generates a human capital dividend, specifically by improving the schooling and health of the population (Anh et al. 1998; Bhat 2002; Knodel et al. 1990). Higher levels of human capital, especially better educated girls, also translate into lower fertility rates by delaying marriage, reducing desired fertility, and increasing the use of modern methods of contraception (Diamond et al. 1999; Jejeebhoy 1995; Muhuri et al. 1994). Furthermore, improvements in the quality of education and schooling affect long-term prospects for socioeconomic development as the benefits resulting from a high human capital spread over into adulthood and to the next generation (Bloom, Canning & Sevilla 2003; Mason & Lee 2004).

The expansion of schooling creates a highly skilled and more entrepreneurial workforces and it reduces gender inequalities. It also reduces infant and child mortality while improving child nutrition (UNESCO 2010).

Most sub-Saharan African countries have yet to accrue a demographic dividend. With young people making up the greatest proportion of its population, SSA will be the only region of the world where the number of young people will continue to grow substantially, and as indicated earlier in this chapter, more than half of the global population growth between now and 2050 is expected to occur in the continent (Ashford 2007; UNFPA and PRB 2012; UN 2015). The question therefore is how governments in the region can create the social, economic and institutional environment necessary to trigger a continuous fertility decline that spreads to all groups and induces a shared demographic bonus.

The purpose of this thesis is to add to the literature on fertility transitions by looking specifically at the historical trends and drivers of reproductive inequalities in Cameroon and their significance for future socioeconomic trends. Using data from 4 waves of Demographic and health surveys conducted in Cameroon between 1991 and 2011, and a mixed method of regression analyses and decomposition methods, the analyses investigate:

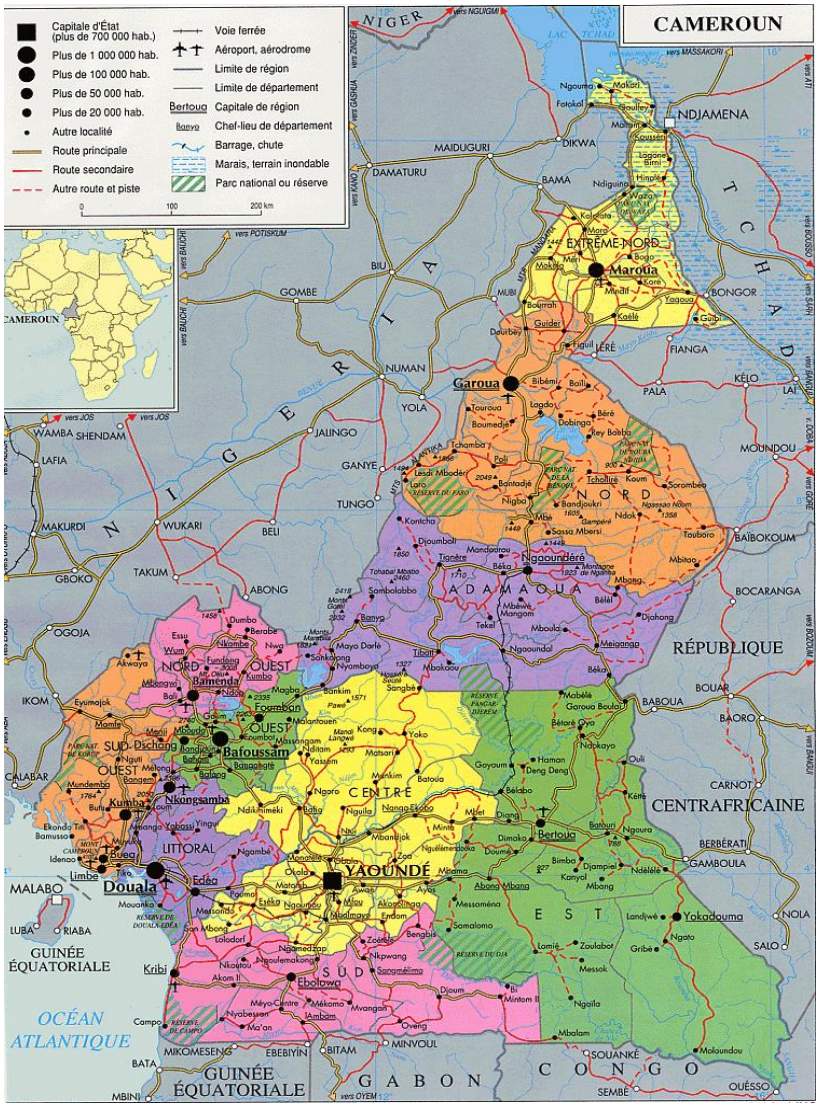
1) The changes in reproductive inequalities in Cameroon;
2) The main sources of these changes in reproductive inequalities; with specific attention to the significance of education in these processes.

Study Setting

The setting for this study is Cameroon, a central African country located in the Gulf of Guinea and extending over an area of 475,650 sq.km. Rich of an extreme diversity of landscapes and the

variety of its climate, the country is often referred to as Africa in miniature and constitutes a true human and cultural mosaic with more than 230 different ethnic groups divided into six major categories.[6]

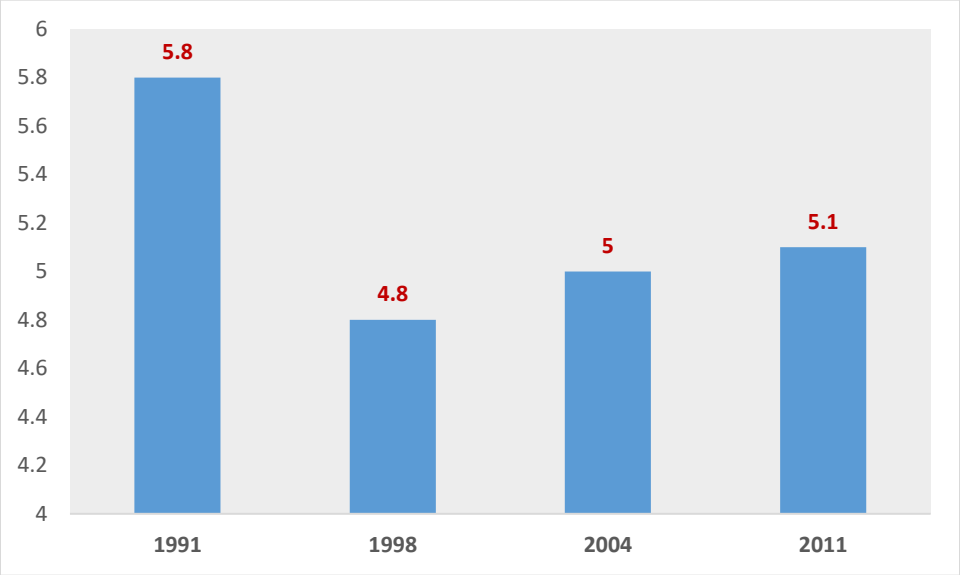
Figure 1.2: Map of the administrative Divisions of Cameroon



[6] The Sudanese, Hamites and Semites living in the regions of Adamawa, North, and Far North; usually Muslim. The Bantu, Semi-Bantu and related, and the Pygmies who occupy the rest of the country and are generally animists or Christians (DHS 2011).

The country's demographics and economic profile resemble that of other SSA countries. Its population, estimated currently at more than 23 million people is characterized by its extreme youth. According to recent United Nations estimates, the proportion of the population under 15 represents 40.5%[7] of the total population and the dependency ratio is 78.1% (UN 2012).[8] The country figures in the list of SSA countries where fertility transition started but has now stalled (5.1 children on average per women in 2011)[9]. After a period of decline (1991 - 1998), fertility rates reversed after 1998 as shown in Figure 1.4

Figure 1.3: Trends in total fertility rates in Cameroon 1991 – 2011



Cameroon's economy is based primarily on the revenues of the primary sector and its agriculture is a source of national pride for its diversity and unique richness in Central Africa. Added to this

[7] This proportion is 55.3% for the population under 20. (CDHS-2012).
[8] This number means that each individual of working age in Cameroon must provide for himself and cover one child or one aged person additionally.
[9] There are nine other SSA countries which have experienced a stall in their fertility transitions and that includes: Benin, Burkina Faso, Cote-d'Ivoire, Gabon, Guinea, Mozambique, Nigeria, Zambia, and Zimbabwe. (Harper, 2015)

are the oil and forestry revenues that had allowed the country to record a steady growth of its GDP at around 5% in the first two decades following its independence and to achieve a significant socioeconomic progress and a marked improvement in the living conditions of the population (Roubaud et al. 2000).

But after 1986, economic mismanagement coupled with the drop of import commodities price, which Cameroon is still heavily dependent upon, precipitated the country into a period of deep recession and social downturn. In the late 1980s, the country finally resorted to external borrowing and accepted to put in place a structural adjustment program under the supervision of the International Monetary Fund (IMF). Despite the return of economic growth since the year 2000 and numerous development projects initiated by the government, Cameroon remains in the list of the world poorest countries (INS and MINFI 2010). According to the most recent Household survey data, the country has a poverty rate of 40% coupled with a 70% rate of underemployment among the occupied working-age population (ECAM 2011). Unemployment affects particularly the younger generations, as the economy does not create enough employment opportunities.

The health of the economy has an important impact on population dynamics. In fact, several studies have examined the relationship between poverty and demographic behaviors in SSA in general (Boserup 1985; Lesthaeghe 1989; Lamlenn 1992; Schoumaker and Tabutin 1999; Vimard 2003) and in Cameroon in particular over the last 20 years (Eloundou Enyegue and Stokes 2000; Nouetagni 2004). Poverty is associated with high fertility (Schoumaker and Tabutin 1999). Poor households tend to rely on children for their old-age support (Caldwell 1982; Lesthaeghe 1989). According to this theory, that is the main reason why fertility has remained high in SSA and more so among the lowest SES groups (the least educated, poor rural women).

A study by Eloundou and Stokes (2000) showed a pattern of fertility decline following the country's economic downturn in the mid-1980s. Its findings indicated the existence of a divergent fertility trends between rural and urban areas (with the bulk of the decline confined to urban areas). Within urban areas, Nouetagni (2004) highlighted the existence of reproductive inequalities between women of poor households and those of rich households due to unequal access to contraceptive methods.

The next chapter reviews previous studies on reproductive inequalities and discusses the theoretical and empirical contributions of the present thesis. Chapter 3 presents the data and methods used in this work. The findings of the analysis followed by a general conclusion of their implications for understanding future directions and consequences of fertility transitions in Cameroon are examined in chapter 4 and 5.

CHAPTER 2.
PREVIOUS STUDIES AND THEORETICAL FRAMEWORK

Previous Studies

Inequality has economic, social, as well as political dimensions. It can be studied at the micro, meso, and macro levels. It generally presupposes an imbalance in the distribution of resources, services and positions between individual and societies (Grusky, 2001; Kerbo, 2000). Whether socioeconomic, cultural, or political, some degree of inequality exists in all societies, past or present, because of the uneven character of the distribution and access to limited goods and services, honors and prestige that are concentrated rather than diffused. Hence, the literature on the nature and magnitude of different types of inequalities (mostly economic) is abundant and transdisciplinary, with its first modern instances dating back to the 18th and early 19th century (Piketty, 2013). Many reasons explain this burgeoning interest at that time. In fact, with the advent of the industrial revolution, the issue of the distribution of wealth becomes central, and social scientists, philosophers and novelists have begun to undertake a profound examination of the "deep structure of [income] inequality, the way it is justified, and its impact on individual lives" (Piketty, 2013).

Today, more than a century later, this debate continues and the study of inequalities has opened a vast field of inquiry and spread across several scientific disciplines, with a constant renewal in its theoretical approaches as well as its methodological tools. One of the earliest and most used method of capturing inequality is the Lorenz curve, also known as Lorenz' concentration curve.

In 1905, M. O. Lorenz, an economist, published his "methods of measuring the concentration of wealth" in order to describe "at what point a community is to be placed between the two extremes,

-equality, on the one hand, and the ownership of all wealth by one individual on the other." (Lorenz, 1905)

At issue then is the dire importance of knowing whether or not the distribution of income is becoming more or less unequal and contrarily to other authors at that time, Lorenz puts an emphasis on the "need to take account simultaneously of changes in wealth [distribution] and changes in population [composition]" (Lorenz, 1905). He proposes a graphical representation of the percentage share of the accumulated wealth detained by a particular segment of the total population.

The success of Lorenz' method quickly transcended the narrow field of the social sciences (economics, sociology, etc.) to find applications in other scientific disciplines such as biology and business for instance.

However, it is not until the late 1980s that demographers started using Lorenz' concentration method to capture population inequalities and to measure the differences, disparities and heterogeneities in the risk of occurrence of demographic phenomena (such as fertility, mortality, morbidity) within a particular population or subgroups. Traditionally, demographers resort to summary measures (such as rates and ratios) and use differentials to account for population heterogeneities. These instruments, when broken down into individual components, give an idea of the effect of proximate determinants on the risk of occurrence of the phenomena.

But an exclusive reliance on differentials, though very useful, can be misleading in terms of policy-decision making (Giroux et al, 2008). Indeed, cross-sectional measures can oversimplify and mask important differentiations (and differentiating processes and mechanisms from a longitudinal perspective or in the long run) among different population subgroups since it's very seldom the case that there exists homogeneous population with respect to fertility, mortality, marriage, etc.

(Pullum, Casterline, and Shah, 1987). As Lutz (1987) highlighted, "there are always some subgroups of the population that have a higher risk of death, marriage, or divorce at certain ages. There is also no population where all women bear the same number of children" at the same time and/or over time. In order, therefore, to avoid this oversimplification, demographers developed fuller measures of population inequality to account and adjust for variations in the demographic risks.

Concentration analyses are one example of such fuller measures. Because they are not consisting only of mere differentials in rates but also account for the variation in the size of the population, concentration measures "can shed light on many topics of demographic interest [and] may be relevant to policy decisions, especially those relating to the targeting of an intervention. If one-fifth of women are bearing half the children, perhaps policies to reduce (or to increase) births should be directed toward this group" (Vaupel & Goodwin, 1987).

Until recently, the first studies using concentration to study fertility inequalities focused mainly on the developed countries. In 1987, Vaupel and Goodwin found that for the cohort of U.S women born in 1930, 36 percent who had four or more children accounted for fully 63 percent of all children born in this cohort. Ten percent of the women were childless, and the 32 percent of the women with one or two children accounted for only 17 percent of all births. For this author, this constitutes a "**division of labor**" in the sense that a portion of the cohort produces most of the offspring and the remaining portion of the cohort staying childless or with few descendants. Similarly, a more recent study by Martin (2000) analyzing fertility pattern of cohorts of women from the mid-70s to the mid-90s, highlights the changes in reproductive behaviors across different cohorts of women. His findings show that up to the mid-1970s, most women were entering unions before the age of 30, regardless of their educational attainment, except a substantial part of college

educated women who were postponing childbearing past age 30 and a large majority of these college educated women were remaining childless past that age. The reason, according to Martin, lies in the labor force participation, which conflicts with traditional family roles and acts to increase childlessness and childbearing at later ages among them.

Fertility trends observed from 1975 to 1995 indicate an overall decline of first births for women at all education levels revealing "that role competition has increased for women at all educational levels, not only for the most highly educated." Interestingly, however, for women of four years' college graduate and age 30, the study shows an increase in first birth rates while at the same time a significant portion of non-college graduates were experiencing an increasing childlessness. This shows a growing reproductive inequality between college graduates women and their counterparts and an increased ability of the first group to time their births. Also, economic inequalities may fuel heterogeneity in reproductive behavior, which, in its turn, may affect the opportunities and outcomes of the next generation. In this case, a concentration of fertility has a direct impact on the future prospects of the offspring and can both cause and be a resulting consequence of social inequalities.

The association between current fertility inequalities and future economic inequality in the US is examined in Lichter and Wooton (2005). Seeking to understand 'why families in the developed countries are shrinking and what it means', they found that the increasing concentration of birth in the US over the past 100 years hasn't resulted in more concentration of births among women of historically disadvantaged groups but rather a growing share of the newborns was due to women presenting social and demographic characteristics "that place them at less risk of long-term social and economic disadvantages." They find no evidence that America's future generation is at risk of poor socioeconomic outcomes based on current trends in the concentration of reproduction.

Q*uid* of developing countries, and especially Sub-Saharan Africa? And, furthermore, what are the consequences of a concentration of reproduction on the individuals and societies in the context of countries that have yet to complete their demographic transition?

Lutz (1987) observed an increase in the concentration when fertility starts to decrease, presumably because fertility decline is driven by women of higher SES having more control over their fertility. Lutz highlights that inequalities in desired family sizes tend to be higher in less developed countries than in more developed modern societies and contribute significantly to a greater heterogeneity in the distribution of births with its host of potential social, economic and demographic implications. Using a different approach and a fuller measure of reproductive inequalities (the CV squared), Giroux et al. (2008) confirm the hypothesis of a "transition-dependency" in the concentration of fertility over time in sub-Saharan Africa. They find that, as the total fertility rate (TFR) declines, the concentration of births increases significantly. Moreover, their study shows that the increasing heterogeneity in fertility is caused both by behavioral differences between groups but also change in their composition.

Eloundou-Enyegue et al. (2017) proposes a "demographic Kuznets" (*dK*) hypothesis to understand the recent trends in fertility inequality in sub-Saharan Africa and some of their broader implications. The *dK* theory stresses that reproductive inequalities evolve in a bell-shaped curve and go through three subsequent phases as countries experience a fertility transition scenario overtime. In the first period, inequalities increase rapidly due to economic factors (socioeconomic differentiation initiated by women of higher SES who play a leading role in the decline in national fertility). During the second phase, the level of inequalities continues to increase but at a much slower rate than previously observed due this time to changes in the population composition (for instance a massive education program which results in a larger share of women with high level of

schooling in the overall population). The third and final phase is one characterized by declining reproductive inequalities as a result of cultural diffusion. Under this scenario, fertility rates decline for all socioeconomic groups and not just for the highly educated women thus resulting in a shared dividend. This final stage doesn't necessarily mean a complete absence of uneven distribution of births within the population but rather that the disparities in fertility rates across different socioeconomic groups are less abyssal.

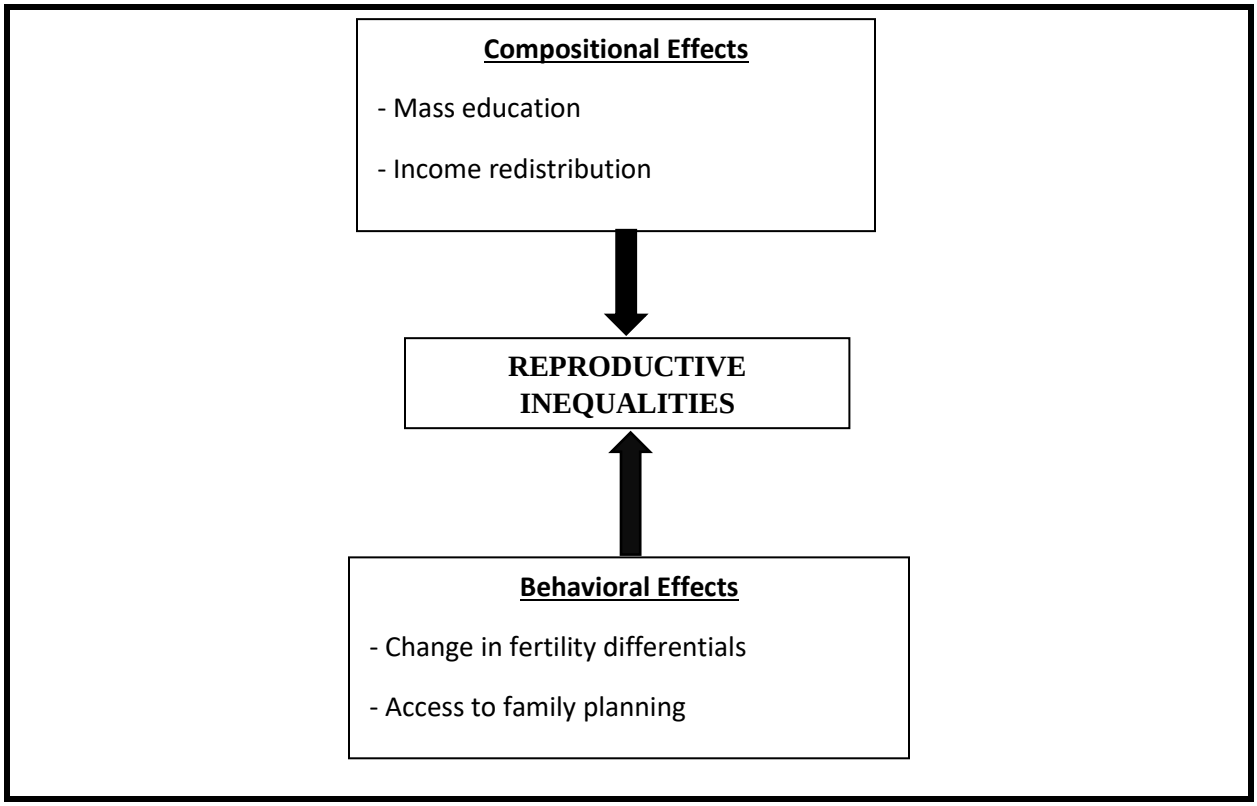
Armed with this theoretical tool and using several measures of fertility inequalities, the study finds that sub-Saharan African countries are currently experiencing growing reproductive heterogeneities because they are at the beginning of their fertility transitions. Moreover, in all the countries in the study, the main factor of the change in fertility inequalities is a behavioral differentiation.

Theoretical Framework

Building on these empirical results, the central premise of this thesis is that reproductive inequalities in Cameroon have increased over time. I argue that the changes in the levels and trends in reproductive inequalities are driven by behavioral changes as well as ongoing changes in the population composition (Figure 2.1).

B*ehavioral effects* comprise factors related to reproductive and other socioeconomic attitudes and conducts. C*ompositional effects* comprise elements that alter population structures such as an increase in the proportion of educated women or a rise in urbanization that might affect the distribution of births.

Figure 2.1: Conceptual framework



CHAPTER 3.
DATA AND METHODS

Study Contributions

Building on our previous work on the historical drivers of fertility change in Cameroon this study seeks to contribute to the literature on reproductive inequality in sub-Saharan Africa (Kirk and Pillet, 1998; Shapiro and Tambashe, 2002; Bongaarts, 2003; Giroux et al. 2008, Eloundou-Enyegue et al. 2017). Its contributions are both theoretical and methodological. Past studies have looked at the levels and trends of reproductive inequality in the developing countries but they focused primarily on fertility differentials as their principal tool for measuring such inequality (considering only the changes in the average difference in fertility levels between different socioeconomic groups and the determinants of these changes at the individual level). By doing so, they enriched the body of knowledge now available on the determinants of fertility transitions in SSA. However, their exclusive reliance on differentials as an indicator of overall reproductive inequalities limits policy making as well as analyses of historical changes of fertility inequalities (Bongaarts 2003; Lichter and Wooton 2005; Giroux et al. 2008, Eloundou-Enyegue et al. 2017). The main reason being that by looking only between-groups differences in rates, differentials can be misleading and not account for instance for the changes within groups such as a variation in the relative sizes of different groups along with their changing average performances.

Using a more complete measure of reproductive inequality (the squared coefficient of variation, or CV^2), helps to overcome such limitations and examine the primary driving factors of fertility inequalities in Cameroon. Such factors include, among others, socioeconomic inequalities with regard to human capital, access and uses of family planning, norms and values in family size and

fertility preferences, mass education, etc. that contribute significantly to the magnitude of fertility inequalities.

Substantively, this thesis makes a number of key contributions. Using both differentials (micro level) and concentration measures (macro level), it, first, illustrates the trends in fertility inequalities in the last twenty years in Cameroon. Studies have done similar work but comparing across different SSA countries (Giroux et al. 2008). The idea here is the same: to highlight the influence of educational composition on the level of reproductive heterogeneities but within the context of one particular country. In other words, the goal is to look at how reproductive inequalities evolve in Cameroon and how the effect of education on reproductive inequalities changes. Furthermore, this research also examines the changes in wanted fertility inequality. This addition will improve the conclusion results by drawing attention to both wanted fertility and overall fertility inequalities.

The second substantive contribution of this study is to identify the main sources of change in recent trends in fertility inequalities in Cameroon. Using decomposition methods, it identifies factors contributing most strongly to the changes in reproductive inequalities over time looking both at the compositional and the behavioral effects. It then highlights the individual contribution of different educational groups to the sources of change in CV. Based on the above considerations, this study hypothesizes the following:

H1. Fertility is increasingly concentrated in Cameroon over the last two decades (1991 - 2011);

H2. Ongoing behavioral differentials and changes in the educational composition of the population account for the growth in fertility inequality in Cameroon between 1991 and 2011;

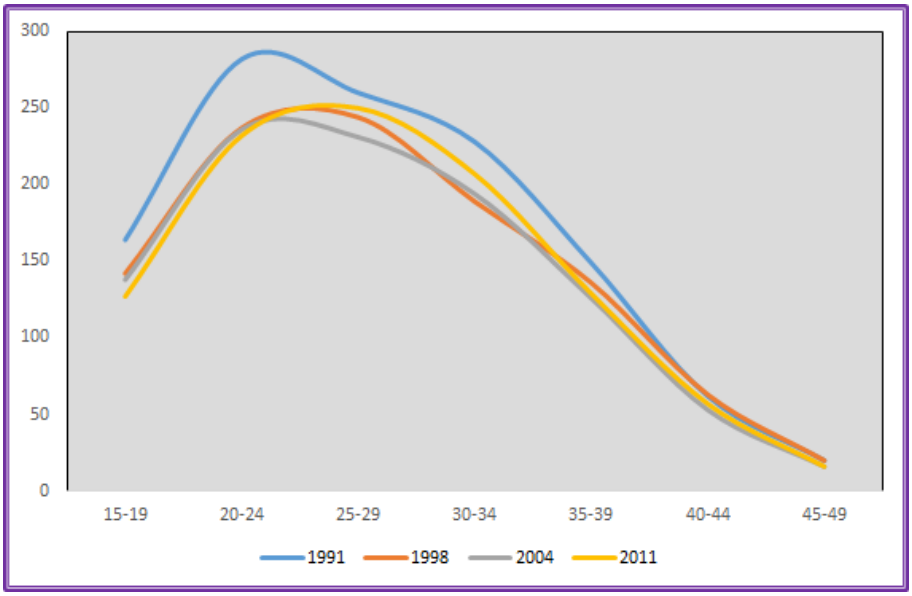
H3. The overall contribution of education to reproductive inequalities has changed quantitatively and qualitatively. Quantitatively, it has increased over time. Qualitatively, the contribution shifts from behavioral to compositional mechanisms.

Data and Measures

The study uses data from four waves of demographic and health surveys fielded in Cameroon in 1991, 1998, 2004 and 2011. These DHS data are useful to study demographic change and allow in-depth analysis of fertility levels and changes over time. I primarily use data from the individual women module of the survey directed specifically to a nationally representative sample of women of childbearing age (15 - 49) and which captures information on reproduction, knowledge and use of contraception, pregnancy and prenatal care, plus a number of other variables related to immunization and child health, marriage, maternal mortality, etc. Altogether, the analyses focus on 3871 women aged 15 - 49 in 1991, 5019 in 1998, 10656 in 2004 and 13359 in 2011, and cover a period of 20 years.

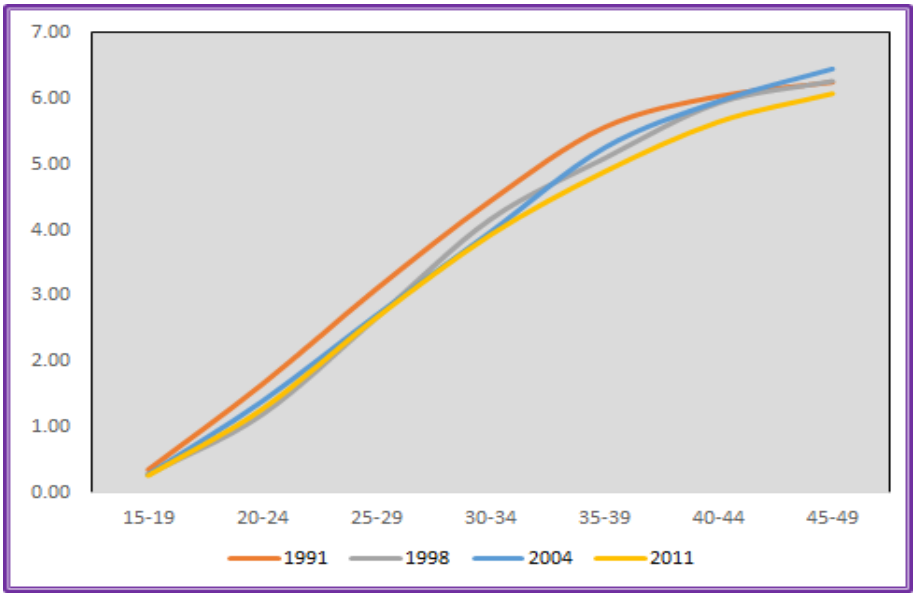
Figure 3.1 illustrates the trends in age-specific fertility rates in Cameroon between 1991 and 2011. We observe that there was a decline in fertility in all ages, and more particularly among younger women (15-34) from 1991 to 2004. In 2011, fertility rates at these age groups start to increase and return at almost the same level as in 1998. On the graph, one can see a reversal in the fertility trends in Cameroon, especially among the younger age groups (25-34), contributing to the increase in the nation total fertility rate in 2011 (5.1 children on average per women). (CDHS, 2012)

Figure 3.1: Trends in age-specific fertility rates in Cameroon 1991 - 2011



The next figure (3.2) shows the trends in the mean number of children ever born (CEB) and the results reveal a slightly different story. As the graph shows, women at the end of their childbearing age still have a large offspring but recent trends indicate a downward direction. For instance, women aged 45-49 in 2011 had on average fewer births than previous generations of the same age groups.

Figure 3.2: Trends in the mean number of children ever born in Cameroon 1991 - 2011

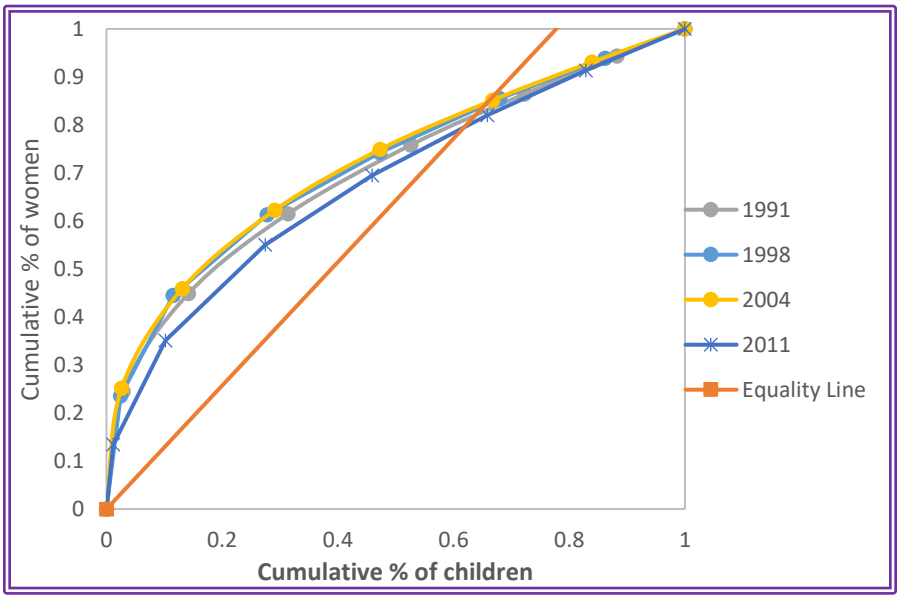


The CEB is a cohort-based measure of fertility and as such a good indicator of difference in reproductive behaviors between different cohort groups. However, its utility is limited to comparing past generations fertility behaviors and it tells us nothing about the behavior of women who have yet to complete their reproductive lives. In other words, since the CEB is a summary of the completed fertility of women at the end of their childbearing years, it can be problematic to use it for a comparative purpose of fertility inequality between different groups. For this reason, most analyses on fertility inequality use the TFR instead which is a hypothetical measure of completed (cohort) fertility that can be computed for different socioeconomic groups. This study uses both the CEB (for the regression analyses at individual level) and the TFR (to account for inequalities at the national level) as dependent variables.

In addition to monitoring the patterns of age-specific fertility rates to identify reproductive inequalities over time, there is also another simple way to do so graphically. A popular measure used in the study of income inequalities for instance is the Lorenz curve (or the concentration

curve) which shows what proportion of overall income belongs to what proportion of the population. This can be adapted to the study of fertility inequality to see, for a particular time period for example, what proportion of women bears what proportion of the total offspring. Figure 3.3 represents the different reproductive concentration curves in Cameroon between 1991 and 2011. A perfectly equal distribution of births would be one in which all women have the same number of children. But we know that "there is no population where all women bear the same number of children" (Lutz, 1987). On the extremely opposite side, a perfectly unequal distribution of births would be one in which a limited portion of women bear all the children and the rest has none. Cameroon does not fit in either category. As seen in figure 3.2, fertility in Cameroon is still at a high level and has not declined but rather reversed. The consequences of this trend is that the concentration curves follow almost a similar pattern over time as shown in figure 3.3.

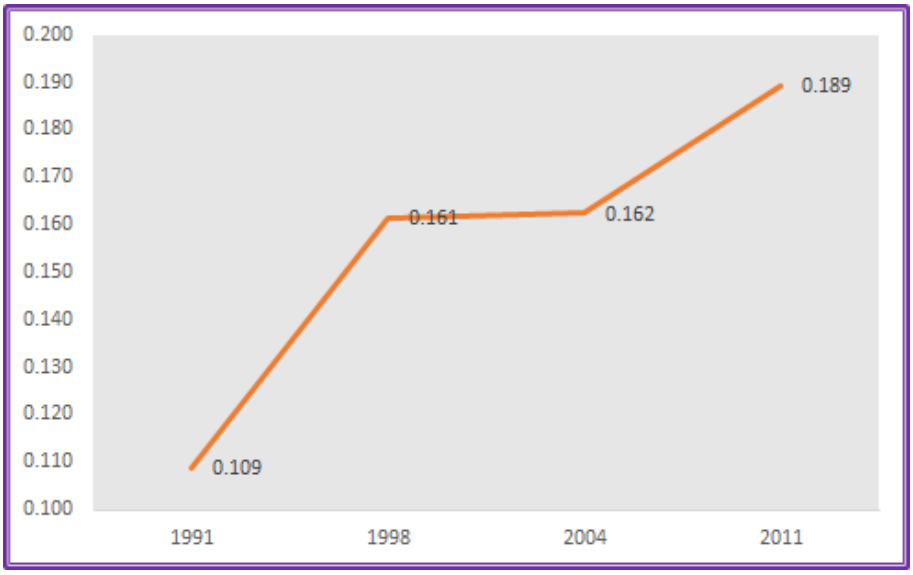
Figure 3.3: Trends in the concentration of reproduction in Cameroon 1991 – 2011



To complete the Lorenz curves, a numerical measure of inequality called the Gini coefficient developed by Corrado Gini (1912) is used. An increasing value of the Gini coefficient simply

corresponds to an increasing level of reproductive inequality. In Cameroon, the level of fertility concentration increased significantly between 1991 and 1998 (from 11 to 16 %) as illustrated by figure 3.4 and from 2004 to 2011 (from 16 to 19%).

Figure 3.4: Trends in the Gini coefficient in Cameroon 1991 - 2011



Analytic Approach

Given the dynamic nature of our research question, the study uses classic regression analysis coupled with decomposition methods to document recent trends in fertility inequality in Cameroon. The measures used to measure inequalities are differentials (in the mean number of children ever born and the mean ideal number of children) and concentration (of the total fertility rate and the wanted fertility rate using the CV^2). The CV^2 is a full measure that integrates information about components of group sizes as well as group differentials in fertility rates. The CV^2 constitutes the main outcome variable for the decomposition analyzes and the comparison variable is the level of educational level. The level of education (or instruction) is an important

SES variable and a measure of the last grade completed by the woman. It has three modalities, namely: No education, primary, and secondary and higher.

The analytical chapter proceeds in three steps: First, it starts with the estimation of the level of overall fertility differentials and concentration over time by educational attainment using the coefficient of variation. It then adds an analysis of wanted fertility inequalities (both at the individual and national level). Second, it determines the sources of change in fertility inequalities using a simple decomposition method. Third and finally, it highlights the substantive contribution of different socioeconomic categories in the overall behavioral effects to determine which groups have the most important influence in the increase of inequalities in Cameroon overtime.

Step 1: Description of the trends in fertility inequalities

The formula of the CV^2 is obtained as in Firebaugh (1999), adapted for the study of reproductive inequalities in Sub-Saharan Africa by Giroux et al. (2008)

$$\overline{CV^2} = [\sum_{i}^{k} w_i(1 - r_i)^2]$$

Where *i* indicates the different groups of our classification variable (educational level), *wi* refers to the relative size of these groups, and *ri* the ratio of the fertility of these groups to the overall fertility level. A higher/increasing value of the CV overtime would indicate an increasing concentration of reproduction in Cameroon.

Step 2: Basic decomposition of trends in fertility inequalities

Once the value of the CV^2 is obtained for each period, it becomes possible to decompose the changes in the CV^2 into behavioral effects and compositional effects, as in the formula below

$$\Delta\ CV^2 = [\sum_i^k \bar{w} * \Delta(1 - r_i)^2] + [\sum_i^k \Delta w_i (1 - \bar{r})^2]$$

The first part is the contribution of changes in behavioral differentiation in the overall rate. The second part is the overall contribution of changes in population composition to the overall rate change. A preponderance of the behavioral effect will indicate a differentiation scenario whereas a greater share of the compositional effect will indicate a simple demographic distribution/composition scenario (Eloundou – Enyegue et al., 2017).

Step 3: Contributions of socioeconomic categories to the overall behavioral effects

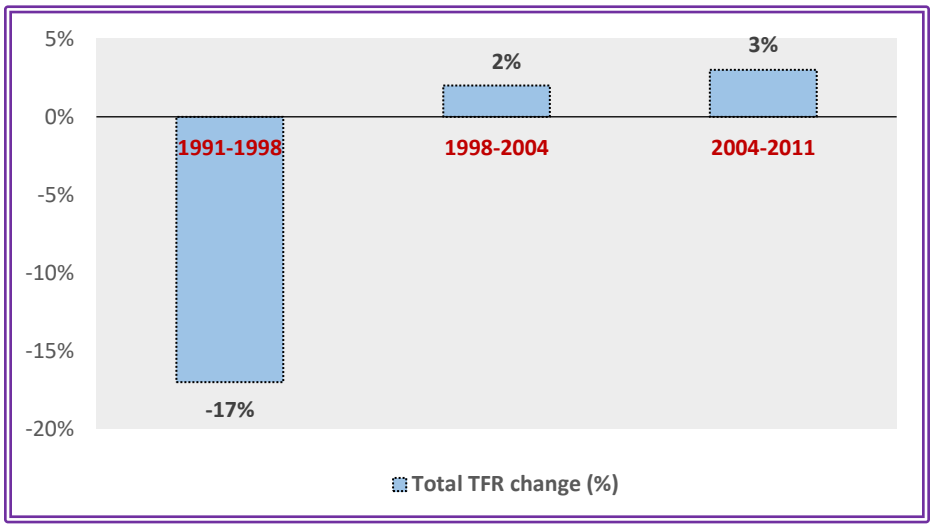
Once the first two steps are completed, the substantive contributions of different socioeconomic groups are highlighted with the percentage share of each individual educational group to the overall behavioral effects on the changes in fertility inequalities, thus allowing to identify which groups a potential policy decision to decrease fertility inequalities should target.

CHAPTER 4.
FINDINGS

Trends in fertility inequalities

How do reproductive inequalities evolve in Cameroon as the national fertility rate changes? We first begin to look at the evolution of the TFR from 1991 to 2011. In the first period (1991–1998), the change is negative and the total fertility rate declines by 17 %.[10] For the two following periods, the changes in the TFR are positive (2% and 3%) indicating an upsurge in fertility in Cameroon.

Figure 4.1: Changes (%) in fertility rates in Cameroon (1991 – 2011)



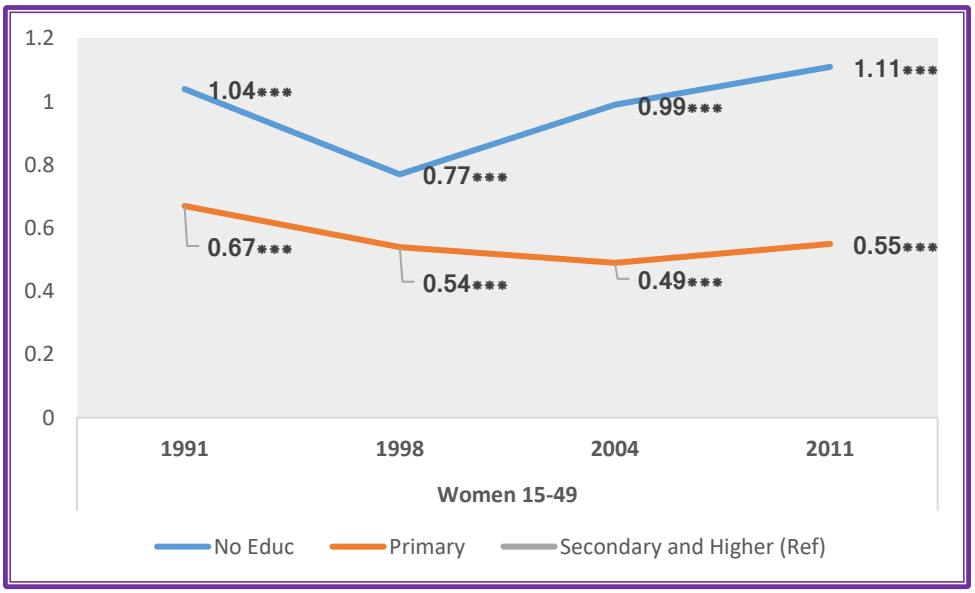
What factors account for these changes and more importantly what caused the reversal in fertility rates in Cameroon in recent years? The results of the decomposition analyses reveal that the main source of changes in fertility is a behavioral effect. (See Figure **A.2** in the Appendix)

[10] During that period, the TFR decreased from 5.8 to 4.8.

Across all three study periods, behavioral differentiation constitutes the major driver of the changes in the TFR specially during 1998 - 2004. If we look at the substantive contribution of different educational categories, we see that it's mostly women with primary education level that contributed both to the decrease in fertility observed in the first period (1991 – 1998) as well as to the reversal of fertility in the following period (1998 – 2004). In the last period, the contributions of the different educational groups to the behavioral effect are almost equal. (See Figure **A.3** in the Appendix)

With regards to fertility inequalities, Figure 4.2 shows that the trends in fertility differentials between women of higher SES and their counterparts decrease in the first place and then start to increase.

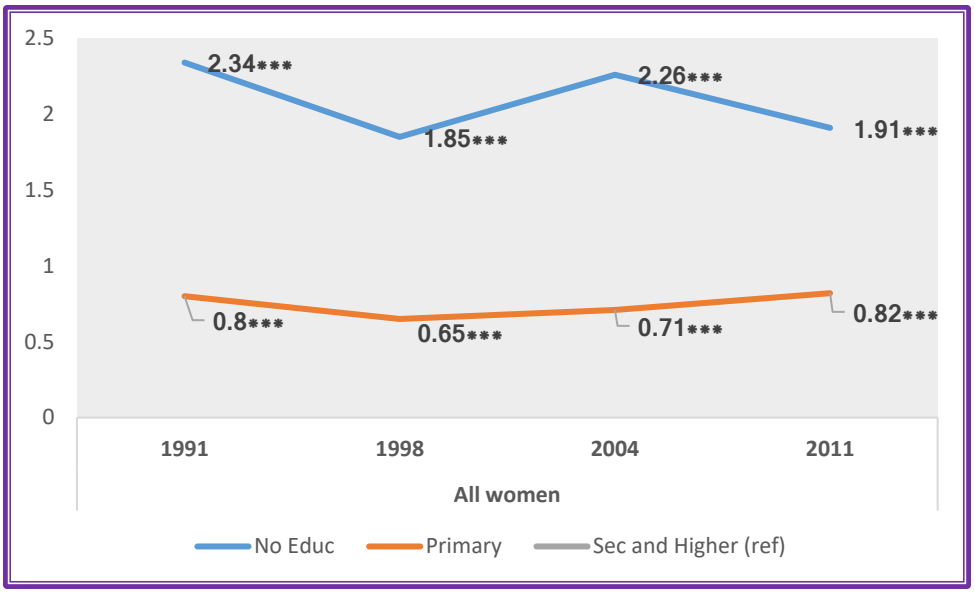
Figure 4.2: Trends in fertility differentials in Cameroon (1991 – 2011)



Next, we consider inequalities in wanted fertility, and the results indicate that the level of differentials is higher between women with a secondary and higher education and their

counterparts. The results show that women without education have on average a desire for more children (2 or more on average) than women with secondary and higher education overtime. The same is true for women with primary education level.

Figure 4.3: Trends in (wanted) fertility differentials in Cameroon (1991 – 2011)



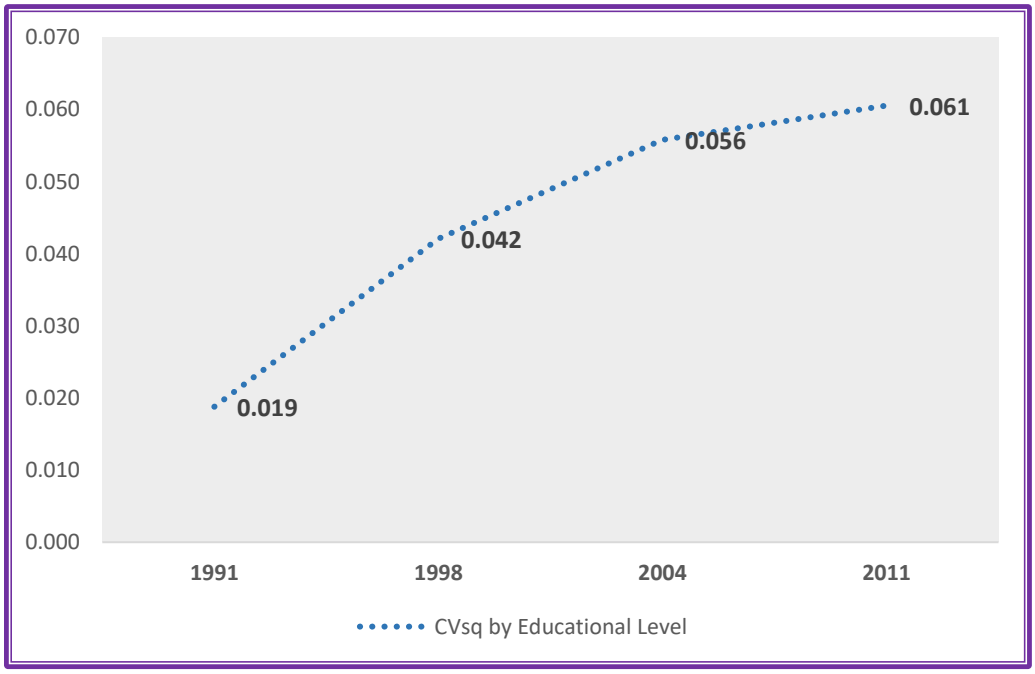
Based on the results above, a woman with no education in 2011 had on average 1.11 more children than a woman of secondary and higher education level. But she also wanted 1.91 more children than a woman with secondary and higher education level. And a woman of primary education level had on average 0.55 more children than women of secondary and higher educational level and desired 0.82 more children than the women of the reference group.

When we separate women of reproductive age between younger generations (15 – 34) and older generations (35 – 49), the disequalizing effect of education is even more significant, especially between older women generations. (See Figure **A. 5** and Table **A.1** in the Appendix).

Next, we observe the trends in national fertility inequality in Cameroon between 1991 and 2011.

Figure 4.4 illustrates the evolution of the squared coefficient of variation (CVsq) by educational level. In the first period (1991 – 1998), the level of fertility concentration by educational level increases by 124 % indicating growing reproductive inequalities. The pattern in this graph is consistent with expectations. Between 1998 and 2004, the CVsq increases by 33%. Finally, for the last period (2004 - 2011), fertility concentration increases slightly by 9%.

Figure 4.4: Trends in fertility concentration in Cameroon (1991 – 2011)



The general conclusion from this graph is that we see a continuous concentration in fertility in Cameroon between 1991 and 2011 but not in a monotonous pace. In fact, the concentration is sensitive to the magnitude of the change in the nation fertility rate. When the TFR decreases at an important pace, the change observed in the level of fertility concentration is important. However, in case of a slow change in fertility trends, the results indicate that the level of fertility

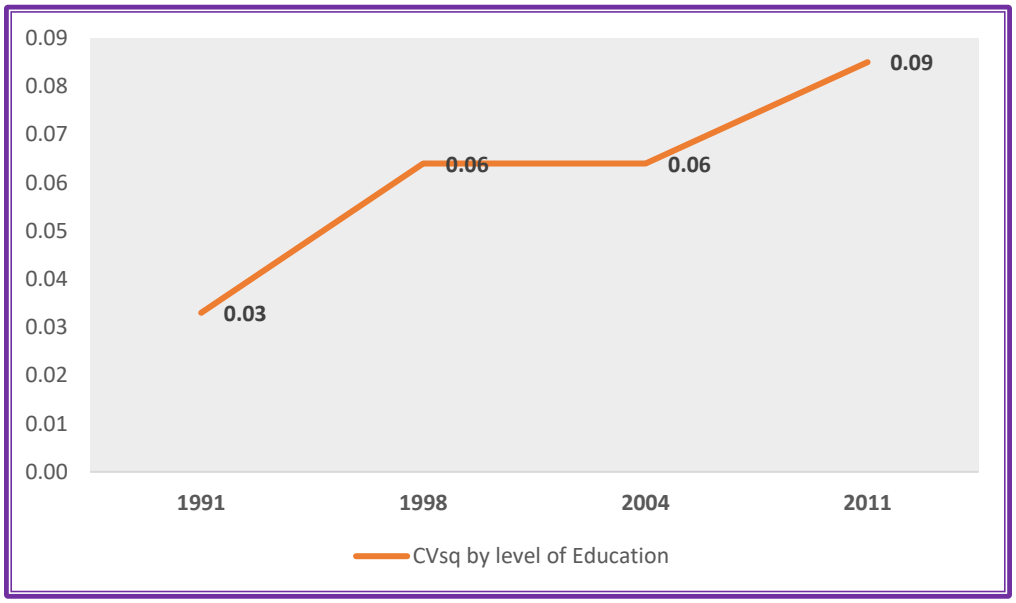
concentration is less important, although the overall level of inequalities remains high. Inequalities still exist but they increase at a slower pace.

What about wanted fertility inequalities?

Figure 4.5 represents the change in wanted fertility inequalities using the CVsq. Data show a decrease in the level of wanted fertility over time but still remaining high (at 4.1 in 2011. See Figure **A.6** in Appendix). As illustrated by figure 4.5, the inequalities in wanted fertility have risen over time.

We note an increase of the CVsq by 94 % between 1991 and 1998 followed by a stagnation phase between 1998 and 2004. Finally, the last period is characterized by an increase in the concentration of wanted fertility, which increased by 33%.

Figure 4.5: Trends in wanted fertility inequality in Cameroon 1991 - 2011



Basic decomposition of trends in fertility inequalities

This section identifies the main drivers of changes in reproductive inequalities over time and their historical evolution using a decomposition method. (Table 4.1) The prime driver of the change in the national reproductive inequalities for the first two periods is mostly a behavioral effect. Between 1991 and 1998, the share of the behavioral effect in the change in inequality was 102%. Between 1998 and 2004, 98% of the change in reproductive inequalities reflected behavioral influences. And finally, between the last two survey years (2004 – 2011), behavioral effects accounted for 47 % of the total change in the inequalities in reproductive behaviors. Overtime, the compositional effect becomes the main driver of the increase in fertility inequalities.

Table 4.1: Basic decomposition of trends in overall fertility inequality in Cameroon 1991 – 2011

Educational levels	Time 1			Time 2				Decomposition of change		
	TFR	% of women	Inequality	TFR	% of women	Inequality	Change in Inequality	Compositional effect	Behavioral effect	Groups contribution
No education	6.2	40.2	**0.0019**	6.1	28.1	**0.0206**	0.019	-0.0035	0.023	98%
Primary	6.4	33.3	**0.0036**	5	38.6	**0.0007**	-0.003	0.0003	-0.003	-14%
Secondary and higher	4.5	26.5	**0.0133**	3.6	33.3	**0.0208**	0.007	0.0038	0.004	15%
Total	5.8	100	**0.0188**	4.8	100	**0.0421**	**0.023**	**-0.001 (-2%)**	**0.024 (102%)**	100
Educational levels	**Time 2**			**Time 3**						
	TFR	**% of women**	**Inequality**	**TFR**	**% of women**	**Inequality**	**Change in Inequality**	**Compositional effect**	**Behavioral effect**	**Groups contribution**
No education	6.1	28.1	**0.0206**	6.3	22.4	**0.0151**	-0.005	-0.0040	-0.001	-11%
Primary	5	38.6	**0.0007**	5.6	38.6	**0.0056**	0.005	0.0000	0.005	37%
Secondary and higher	3.6	33.3	**0.0208**	3.5	39	**0.0351**	0.014	0.0043	0.010	74%
Total	4.8	100	**0.0421**	5	100	**0.0558**	**0.014**	**0.001 (2%)**	**0.013 (98%)**	100%
Educational levels	**Time 3**			**Time 4**						
	TFR	**% of women**	**Inequality**	**TFR**	**% of women**	**Inequality**	**Change in Inequality**	**Compositional effect**	**Behavioral effect**	**Groups contribution**
No education	6.3	22.4	**0.0151**	6.8	20	**0.0222**	0.007	-0.0021	0.009	408%
Primary	5.6	38.6	**0.0056**	5.9	33.8	**0.0083**	0.003	-0.0009	0.004	164%
Secondary and higher	3.5	39	**0.0351**	3.8	46.2	**0.0300**	-0.005	0.0055	-0.011	-472%
Total	5	100	**0.0558**	5.1	100	**0.0606**	**0.005**	**0.003 (53%)**	**0.002 (47%)**	100%

With regards to wanted fertility inequalities, the results of the decomposition in table 4.2 indicate that the primary source of the changes in wanted fertility inequalities is the behavioral effect.

Table 4.2: Basic decomposition of trends in wanted fertility inequality in Cameroon 1991 - 2011[11]

Educational levels	1991			1998				Decomposition of change in Inequality		
	WTFR	% of women	Inequality	WTFR	% of women	Inequality	Change in Inequality	Compositional effect	Behavioral effect	Groups contribution
No education	5.9	40.2	0.0080	5.9	28.1	0.0224	0.014	-0.0054	0.020	68%
Primary	5.4	33.3	0.0006	4.3	38.6	0.0016	0.001	0.0000	0.001	3%
Secondary and higher	3.6	26.5	0.0244	3	33.3	0.0402	0.016	0.0072	0.009	29%
Total	5.17	100	**0.0330**	4.6	100	**0.0642**	**0.031**	**0.001 (4%)**	**0.030 (96%)**	100%
Educational levels	2004			2011						
	WTFR	% of women	Inequality	WTFR	% of women	Inequality	Change in Inequality	Compositional effect	Behavioral effect	Groups contribution
No education	6	22.4	0.0248	6.1	20	0.0476	0.023	-0.0040	0.027	115%
Primary	5.1	38.6	0.0068	5.2	33.8	0.0243	0.018	-0.0019	0.020	84%
Secondary and higher	3.2	39	0.0325	3.4	46.2	0.0134	-0.019	0.0038	-0.023	-99%
Total	4.5	100	**0.0641**	4.1	100	**0.0853**	**0.021**	**-0.002 (-11%)**	**0.023 (111%)**	100%

[11] There were no changes in Inequalities between 1998 and 2004

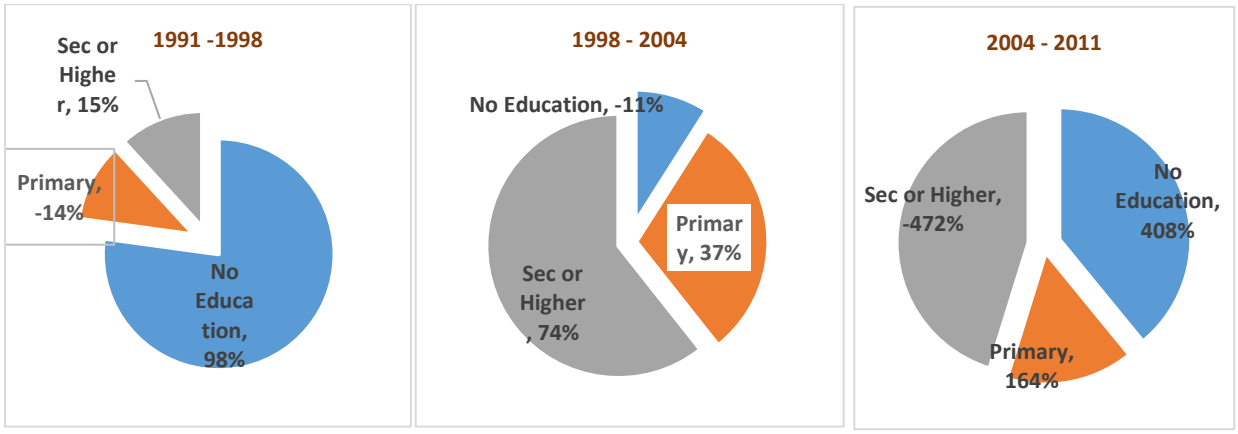
Substantive contributions of different categories of educational level (1991 – 2011)

This section shows how different educational categories contribute to the overall effect of the behavioral factor on reproductive inequalities. In other words, if fertility has become increasingly concentrated in Cameroon and that this concentration comes mainly from a behavioral effect in the first two study periods, to what particular educational group's influence is this behavioral effect due?

From Figure 4.6, it appears that for the first period, 98% of the behavioral effect is due to women with no education who are the main drivers of the increase in reproductive inequalities between 1991 and 1998, given that they are those who experienced the lowest decrease in their fertility. Between 1998 and 2004, women of secondary or higher educational level are the ones contributing the most to the increase in inequalities because they are the only ones for whom the TFR had decreased (by 0.1 child on average)..

Finally, for the last two periods, women with secondary and high educational level contribute the most to the change in fertility inequalities.

Figure 4.6: Contributions of the different education categories in the total behavioral effect



CHAPTER 5.
GENERAL CONCLUSION

This study examined the evolution of fertility inequalities in Cameroon and how the contribution of education in accounting for the change in reproductive heterogeneities evolved over time. The general concern about Sub-Saharan African fertility, and the insufficiency of strong theoretical and empirical studies linking it to broader socioeconomic inequalities makes this research's contribution extremely timely. In fact, what is at stake is whether or not Sub-Saharan Africa will experience a steady demographic dividend, like other regions of the world, and to what extent and how the prospects of a potential demographic dividend will unfold evenly across social classes given the current context of staggering social differences in reproductive behaviors.

The study results provide evidence of growing inequalities in fertility in Cameroon in the course of recent years both at the micro as well as the macro level. At the micro level, results from the regression analysis reveal that the differences in childbearing between women of different educational level remain increasingly significant. The higher the educational level, the lower the number of children and vice versa. At the macro level, the concentration in fertility increased by 221 % between 1991 and 2011 led by a behavioral differentiation. Indeed, the results from the decomposition analysis demonstrate that the behavioral differentiation played a key role in the increase in fertility inequalities between 1991 and 2004 with educated women being the leaders in terms of fertility decline.

In the last period (2004-2011), however, the main factor contributing to the increase in inequalities is the compositional effect (53%) while the behavioral effect contributes to the overall change by

47%. It appears here that the effect of education shifts from a dominantly qualitative effect (behavioral) to a quantitative one (mass education).

While these results contribute to a better understanding of the ongoing demographic changes in Cameroon, the study falls short in illustrating how fertility inequalities contribute or have an impact on the current and future distribution of resources, especially among children, in Cameroon. Furthermore, the data used for this work do not allow an in-depth analysis of the intergenerational consequences of fertility inequalities. Future studies should look at the importance of the intergenerational transmission of inequalities using micro-level historical data.

APPENDIX

Table A.1: Population of the world and major areas 2015, 2030, 2050 and 2100 according to the medium-variant projection **(UN, 2015)**

	2015	2030	2050	2100
World	7349 **(100)**	8501 **(100)**	9725 **(100)**	11213 **(100)**
Africa	1186 **(16%)**	1679 **(20%)**	2478 **(25%)**	4387 **(39%)**
Asia	4393 **(60%)**	4923 **(58%)**	5267 **(54%)**	4889 **(44%)**
Europe	738 **(10%)**	734 **(9%)**	707 **(7%)**	646 **(6%)**
Latin America and the Carribbean	634 **(9%)**	721 **(8%)**	784 **(8%)**	721 **(6%)**
Northern America	358 **(5%)**	396 **(5%)**	433 **(4%)**	500 **(4%)**
Oceania	39 **(1%)**	47 **(1%)**	57 **(1%)**	71 **(1%)**

Figure A.1: Decomposition of changes in Total fertility rates in Cameroon (1991 – 2011)

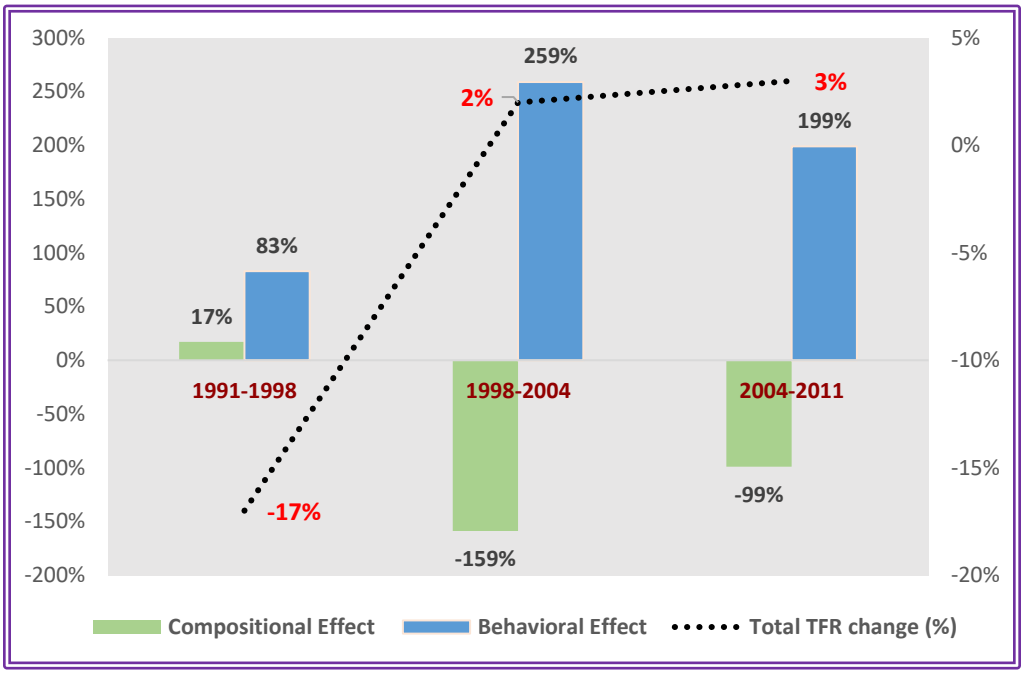


Figure A.2: Substantive contribution of educational groups to the behavioral effect on changes in Total fertility rates in Cameroon (1991 – 2011)

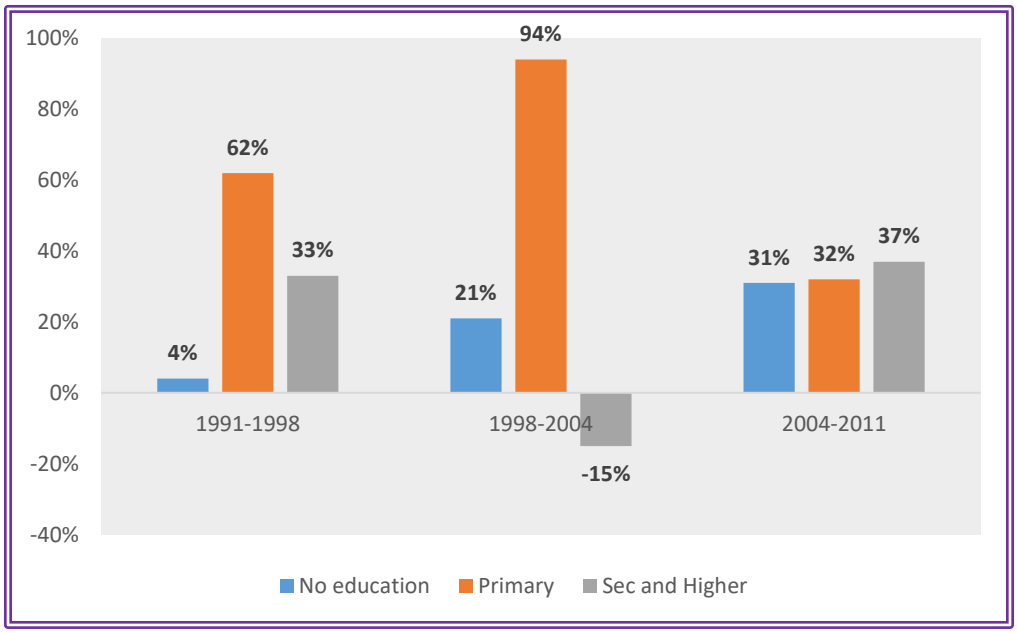


Figure A.3: Substantive contribution of educational groups to the Compositional effect on changes in Total fertility rates in Cameroon (1991 – 2011)

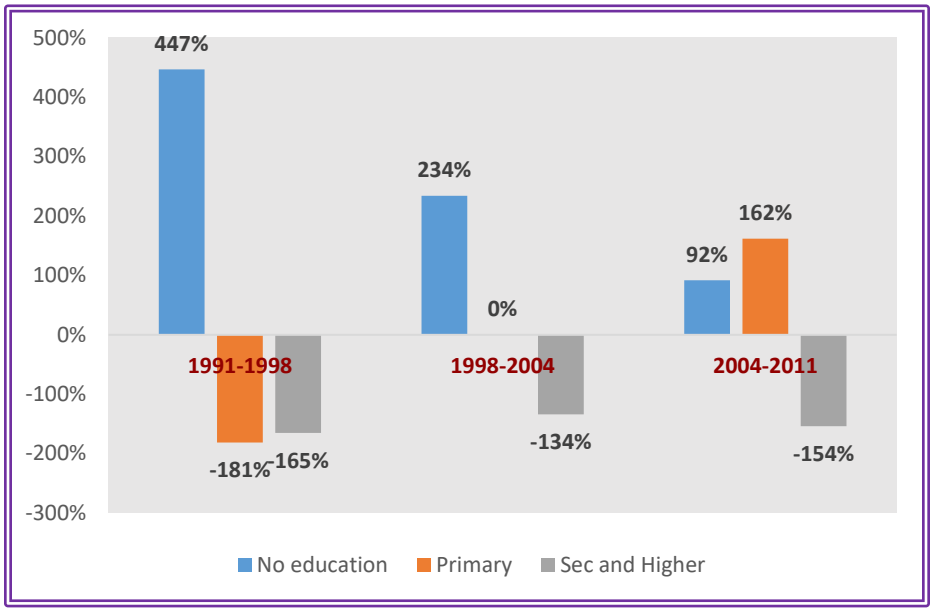


Table A.2: Regression results of fertility differentials in Cameroon (1991 – 2011)

	1991			1998			2004			2011		
	All women(15-49)	**15-34**	**35-49**	**All women(15-49)**	**15-34**	**35-49**	**All women(15-49)**	**15-34**	**35-49**	**All women(15-49)**	**15-34**	**35-49**
No education	1.04***	0.74***	1.42***	0.77***	0.67***	1.11***	0.99***	0.81***	1.36***	1.11***	0.70***	1.81***
Primary	0.67***	0.56***	0.57	0.54***	0.30***	0.95***	0.49***	0.42***	0.65***	0.55***	0.38***	0.89***
Secondary and Higher	ref	Ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
TFR		**5.8**			**4.8**			**5**			**5.1**	
Age	0.52***	0.28***	0.64	0.43***	0.14**	0.8*	0.41***	0.17***	0.48	0.41***	0.24***	0.39*
Age ²	-0.005***	-0.0005	-0.007	-0.003***	0.002*	-0.008*	-0.003***	0.001	-0.004	-0.003***	-0.00006	-0.003
Nbr of Obs	2591	1834	757	3705	2430	1275	7137	4723	2414	10099	6514	3585
R-squarred	48.1	47.11	8.82	49.35	50.22	10.87	53.36	49.47	16.99	52.53	50.94	23.84
F	146.31	88.02	7	227.3	141	11.21	436.11	208.23	25.46	497.67	289.34	55.51

Table A.3: Regression results of (wanted) fertility differentials in Cameroon (1991 – 2011)

	1991			1998			2004			2011		
	All women(15-49)	**15-34**	**35-49**	**All women(15-49)**	**15-34**	**35-49**	**All women(15-49)**	**15-34**	**35-49**	**All women(15-49)**	**15-34**	**35-49**
No education	2.34***	2.58***	1.85***	1.85***	1.94***	1.84***	2.26***	2.36***	1.97***	1.91***	2.00***	1.77***
Primary	0.80***	0.89***	0.32	0.65***	0.52***	1.08***	0.71***	0.71***	0.63***	0.82***	0.78***	0.90***
Secondary and Higher	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	Ref	ref
WFR	**5.2**			**4.6**			**4.5**			**4.1**		
Age	0.04	-0.15	1.04	-.001	-0.06	0.23	0.008	-0.07	0.006	-0.0034	-0.10**	-0.13
Age ²	-0.000	0.0041	-0.012	.001	0.002	-0.002	0.0008	0.002	0.0009	0.001	0.003***	0.002
Nbr of Obs	3002	2720	791	4737	3610	1127	9012	6970	2042	14341	10645	3696
R-squared	24.92	27.35	15.69	23.69	21.60	16.51	31.12	30.29	21.03	25.06	25.25	13.80
F	48.48	45.19	9.76	74.28	48.94	13.79	161.59	106.50	29.80	174.76	112.80	337.92

Figure A.4: Trends in (overall) fertility differentials in Cameroon (1991 – 2011)

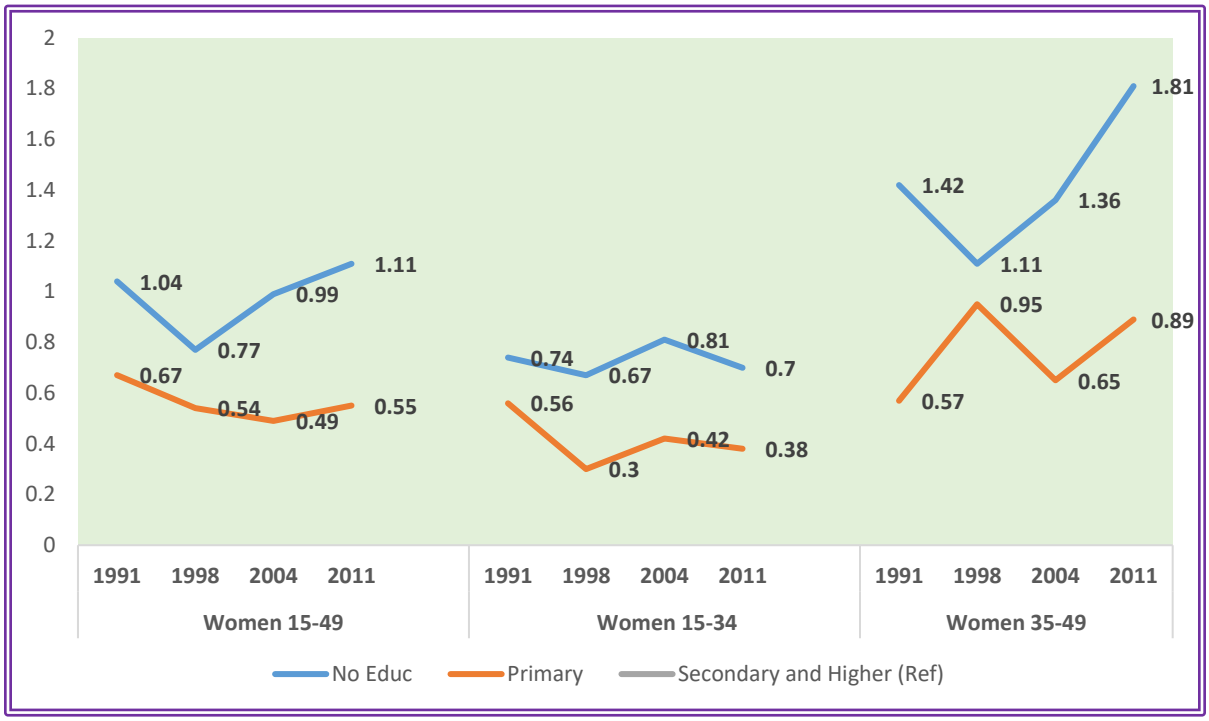


Figure A.5: Trends in (wanted) fertility differentials in Cameroon (1991 – 2011)

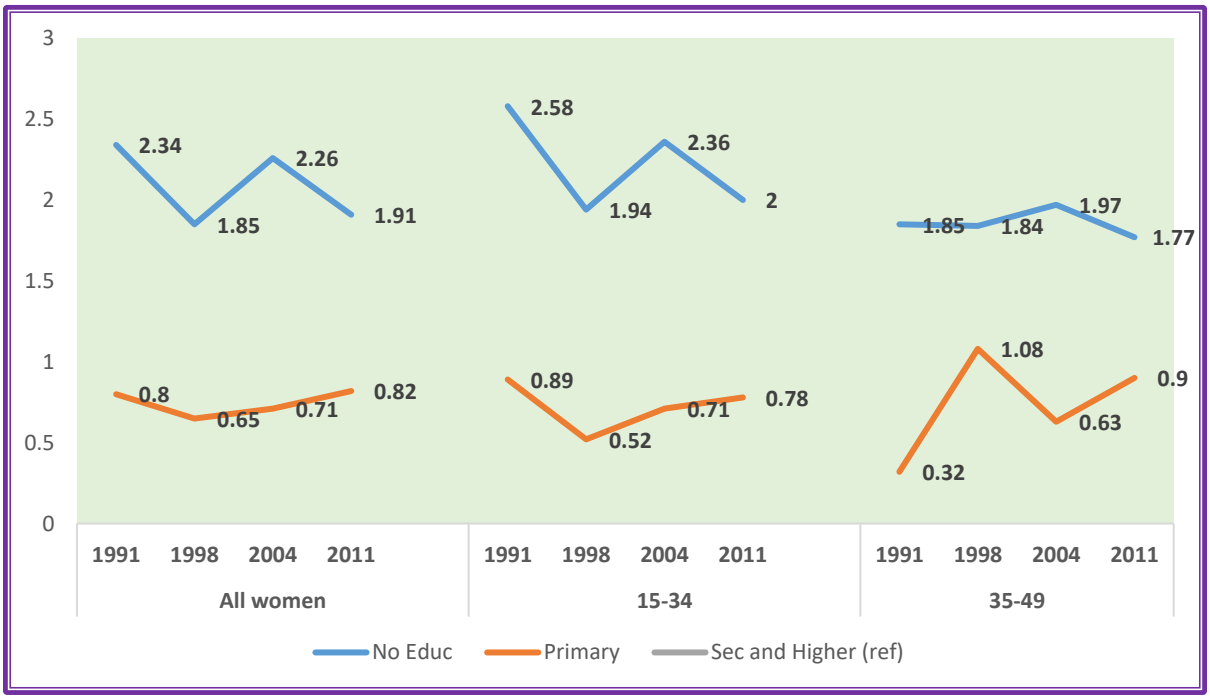


Figure A.6: Trends in Wanted fertility rates and changes in wanted fertility rates in Cameroon (1991 – 2011)

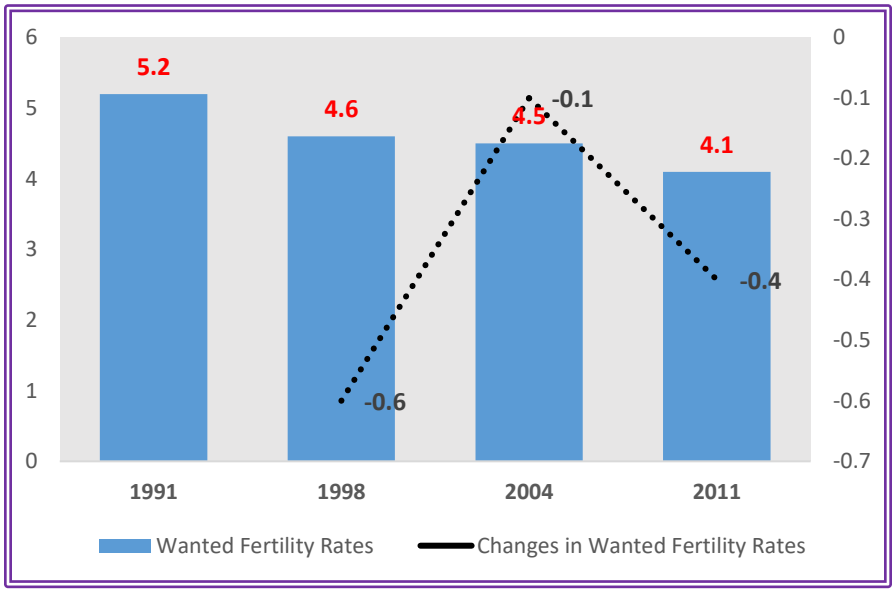
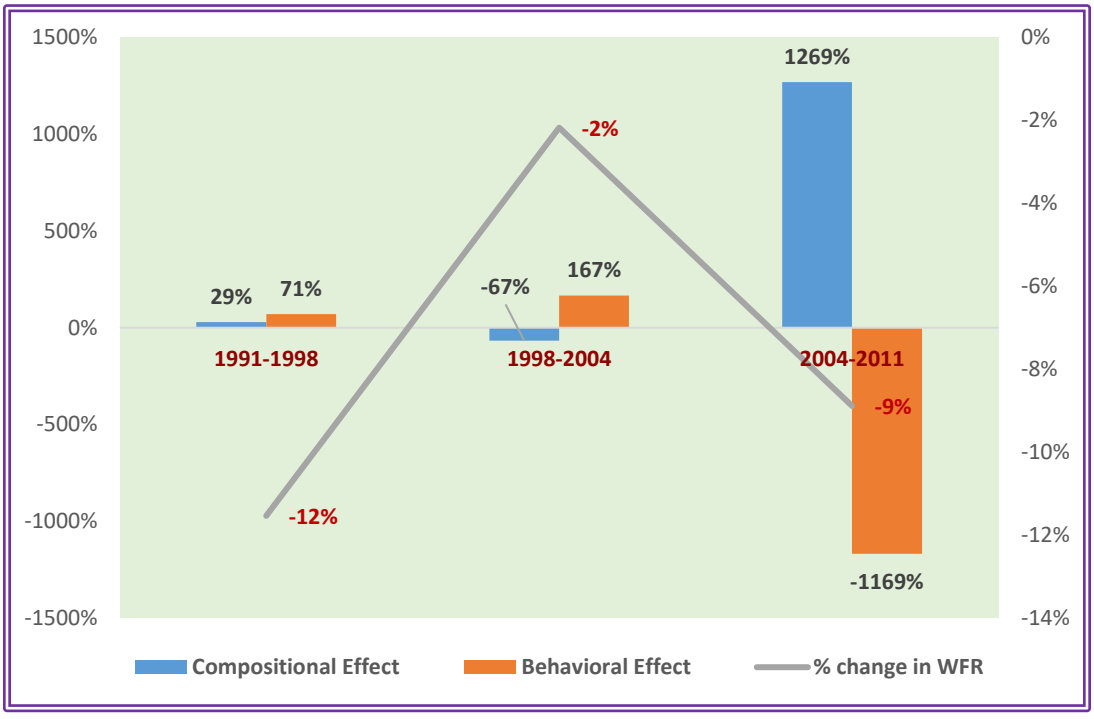


Figure A.7: Decomposition of changes in Wanted fertility rates in Cameroon (1991 – 2011)



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