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ANALYSIS OF FERTILITY IN HAITI AND ITS DETERMINANTS FROM 1994-2012

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ABSTRACT

The demographic transition, the transition in countries from high fertility levels and high mortality to low fertility levels, has occurred in different countries at different times. In Haiti, the transition to lower fertility levels occurred in the 1980s, much later than in other Caribbean countries. The previously persistent high fertility in Haiti has been well documented and analyzed but the transition to lower fertility has not. This paper will focus on analyzing the the determinants responsible for Haiti's fertility transition will be analyzed over the years of 1994-2012. Using a multivariate reduced-form regression model, the effect of women's schooling is uncovered as having a large impact on the decline of fertility rates in Haiti during this time period.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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Chapter 1

Introduction

The demographic transition, the transition in countries from high fertility levels and high mortality to low fertility levels, has occurred in different countries at different times. In Haiti, the transition to lower fertility levels occurred in the 1980s, much later than in other Caribbean countries, as is evident from the diagram below.

Figure 1. Total Fertility Rates in the Caribbean: 1950-2015
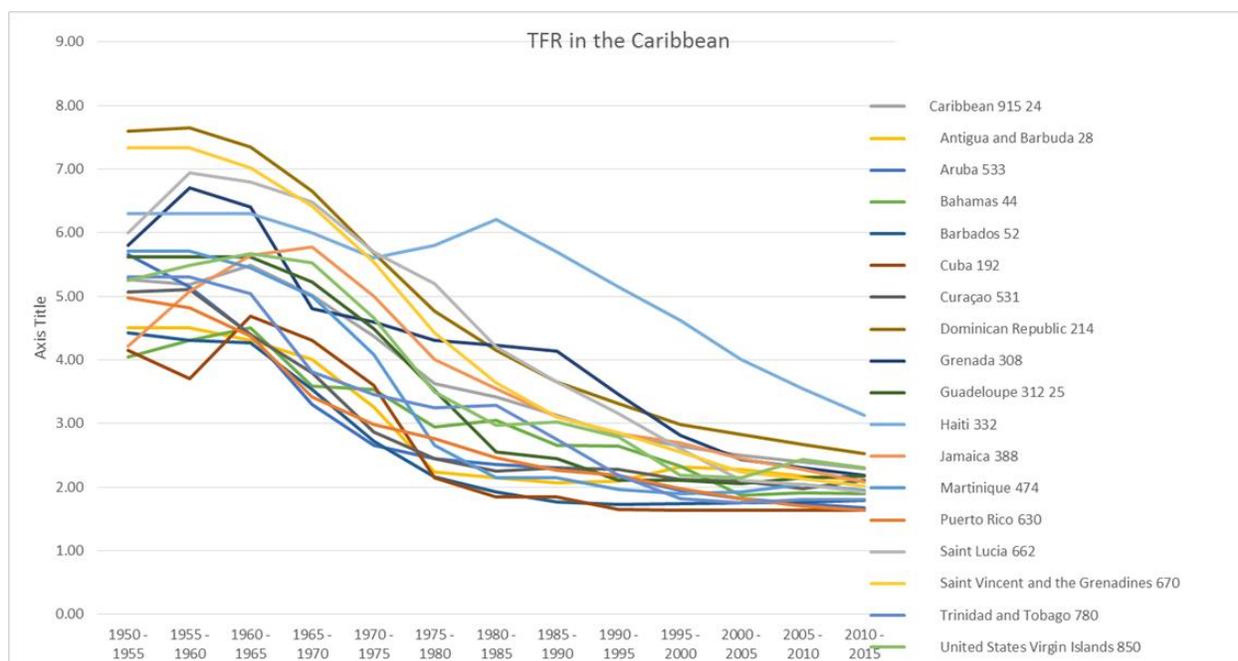
Source: Demographic and Health Surveys

Since the 1970s, the Haitian government, as well as outside actors, have been trying to address Haiti's high fertility. Fertility has been identified as a crisis in Haiti and economists, anthropologists, and sociologists have been trying to discover the determinants of high fertility levels that were sustained longer than in other Caribbean counterpart countries (Maternowska,

2006; Schwartz, 2009). Although high fertility has been analyzed, its opposite, the transition to lower fertility in recent decades, has not.

With more recent data than either of the above authors had, I am able to uncover trends that can provide a clearer picture of the fertility situation in Haiti. With the recent data including years before and after the devastating earthquake that occurred in the capital, Port-au-Prince, I am able to focus on the main question of this thesis: how did the 2010 earthquake affect the determinants of fertility levels in Haiti?

With a specific focus on the highly complex relationship between education and fertility, the determinants responsible for Haiti's fertility transition will be analyzed over the years of 1994-2012. The importance of this study lies in the ability to predict and adjust for changes in fertility levels after natural disasters happen. In recognizing the complex nature of this issue, in addition to taking after the founder of this field, Gary Becker, this thesis will include analysis from other fields in collaboration with economic analysis to create a fuller picture of Haiti's fertility transition.

Chapter 2

Fertility and Economics

There are two economists who were the first to look at decisions of childbearing and microeconomics within the household. Their frameworks are still used today, therefore, their initial findings and theories are reviewed below.

Becker (1960) sets the demand for children in an economic framework and later discusses the implications of children's use of their parent's time. Then, Easterlin (1975) creates a more comprehensive framework by discussing the relationship between demand for children and supply of children, as well as their implications for use of fertility regulation. Fertility is dependent upon three aspects: demand for children, supply of children, and the cost of fertility regulation.

2.1 Becker

Becker was the first to try to analyze fertility using an economic framework. In his theory, he equated the decision to have a child with the decision to buy durable goods. Like a durable good, children have a cost and provide utility over time. Children's utility comes from the present value of the income they may generate and the value of their imputed services, and parents also receive consumption utility from their children. Children's costs come from the present value of required resources from the household in the form of direct expenditures and the opportunity costs of the parent's time spent in child care.

In this theory, demand for children is dependent upon the income of the parents, costs, knowledge, uncertainty and tastes. An increase in knowledge of contraception decreases the costs of fertility regulation, making use of contraception more attractive when supply exceeds demand. Tastes for children employ a less measurable form of analysis which leaves room for competing theories of the impact it has on fertility, especially among those from different academic backgrounds (Schwartz 2009, Becker 1960, Maternowska 2006). Tastes can be dependent on the family's race, religion, age and nativity. Tastes are also relative to other goods or services bought in the market place that provide the family utility.

Increases in income are more complex. An increase in income, as well as a decrease in price, is associated with an increase in demand for children, although the increase in income can often be offset by an increase in allocation per child, leading to higher quality children. The quality of a child is a result of expenditures on the child's human capital, usually education, and their health. Becker discusses this quality-quantity tradeoff and labels it as a key factor in fertility decline (Becker 1992).

Since children provide an economic return, allocating resources to a child can be thought of as an investment. When the investment will provide a higher return, more resources will be allocated per child, therefore reducing the number of children desired due to finite resources. Becker uses the example of a farming family. When primitive methods that require more manpower are used in farming, the return on investment in human capital, or quality, is low. As methods become more complex and mechanical, the return on investment increases and a child's education becomes a good investment. This leads to more resources allocated per child, and fewer children. This idea will be vital when looking at reasons for Haiti's lagging decline.

Significant in the discussion of demand for children is Becker's "Theory of the Allocation of Time" (1965). Using the assumption that households are not only consumers, but also producers of their own utility, Becker gives insight into what impact a child has on the household. The production of the child, a commodity that produces utility for the family, is highly time intensive for the mother. Revisiting the calculation for the net cost of children, it is easy to see that the cost of producing a child depends significantly on the opportunity cost of the mother's time. Therefore, if a woman has a higher potential market wage, the cost of children will be higher and this will decrease the demand for numbers of children (Becker 1992). Also, since higher educational attainment is associated with higher potential market wages, more education is also associated with lower fertility levels (Shapiro and Gebreselassie 2008, Bongaarts 2010).

Becker briefly touches upon supply of children when he explains that the number of children in a family is not only dependent upon its demand but also its ability to produce. Easterlin provides a fuller explanation of this idea as well as what causes motivation for fertility regulation.

2.2 Easterlin

The Easterlin Framework consists of two different types of determinants. There are basic determinants as well as proximate determinants. The basic determinants influence the demand for children, supply of children and the cost of fertility regulation. These then, in turn, indirectly affect fertility through their impact on the proximate determinants.

Basic Determinants   *Proximate Determinants*

Fertility

Easterlin defines the supply, or potential output, of children as, "the number of surviving

children parents would have if they did not deliberately limit fertility" (pg. 55, 1975). When

looking at the supply of children, the idea of natural fertility arises. This is the number of births a

couple would have if they took no action towards limiting fertility. Given that this is the case, the

probability that a child will survive has a significant impact upon the supply of children.

Therefore, a decrease in the child mortality rate would result in an increase in supply of children.

Natural fertility depends on basic determinants such as physiological factors as well as

cultural factors. When explaining the biological practices, Easterlin lists factors that impact

fecundity such as genetics, disease, malnutrition, coital frequency, and the capacity for the

mother to stay healthy all the way to the child's birth. Cultural factors can also contribute to the

variation in natural fertility levels. For example, factors such as prolonged breastfeeding, cultural

taboos towards sexual practices, religious beliefs, and unique ethnic rules can all impact this

variation. Other basic determinants are associated with modernization such as urbanization,

modern sector employment, and higher education.

These basic determinants affect the proximate determinants which then affect fertility

(Bongaarts 1978). Examples of proximate determinates include exposure to intercourse,

fecundability, duration of postpartum infecundability, sterility, and the deliberate use of fertility

regulation.

The decision to use fertility regulation is a central piece in Easterlin's framework. When the framework is applied, it is easy to see that if the supply of children is higher than the demand for children, then there is motivation for fertility regulation. This does not mean that fertility regulation will be carried out because the costs of fertility regulation, both psychic and market, have to be considered.

If Supply of Children > Demand for Children == Motivation for Fertility Regulation

If Supply of Children<Demand for Children == No Motivation for Fertility Regulation

Psychic costs result from the displeasure the couple receives by using fertility regulation. Market costs are the time and money needed to learn about fertility regulation techniques as well as the execution of the regulation measures. Factors such as the societal attitude towards fertility regulation and the accessibility to fertility regulation resources impact the costs. The use of fertility regulation depends upon the level of motivation or the level of supply relative to demand.

Chapter 3

Consequences of High Fertility

The importance of this study lies within consequences of high fertility or spikes that lead to high fertility. In the early 1970s, international organizations and NGOs flocked to the Caribbean to address the issue of high fertility (Schwartz, 2009). In addressing this issue, they wanted to alleviate these countries of the negative consequences of high fertility while unlocking the perceived socioeconomic advantages of lower fertility. These consequences and repercussions are multifaceted.

Through the age structure, changes in fertility can indirectly affect economic growth. During very high fertility, there is an abundance of youth. A rapid decline in fertility creates an age structure such that when the last cohort of high fertility becomes another abundant working age population, they have significantly fewer people depending on them. This creates what is called the "demographic dividend." The demographic dividend represents an opportunity to reap economic gains (May 2012). Lower dependency on the working age population, and the government, results in more money to invest in capital, both human and physical. Increased human capital can lead to increased productivity per capita which can, in turn, lead to economic growth (Lee and Mason 2006). If executed correctly, the country can improve socioeconomic conditions significantly (Eloundou-Enyegue 2013).

Specifically, opportunity for education is impacted by changes in fertility levels. Studies have shown that in places where a transition to lower fertility levels occurred rapidly, children were in school for longer periods of time and the allocation per child increased (Bongaarts et al., 2012). This reaction is the result of the quality versus quantity tradeoff

discussed by Becker. On a macro scale, sustained high fertility leads to higher dependency on the public services provided by government. With high fertility comes high population growth which makes it difficult to accommodate the volume. In attempting to compensate, resources are diverted away from other investment opportunities.

There are also certain public health benefits that come with lower fertility. Areas with higher fertility have been shown to correlate with shorter inter-pregnancy intervals, or time between birth and the next conception (Casterline and Lazarus, 2010). Conceptions taking place within 18 months of each other have been shown to increase rates of fetal death, low birth weight, and prematurity (Conde et al. 2006, Zhu 2005). Along with timing of conceptions, volume of births has also posed a threat to infant's health. Women who have 2 to 3 children experience the lowest rates of neonatal mortality while women who have 7 or more children are shown to have a 43% increase in the chance of neonatal mortality (Mahy, 2003). Mothers are also put at risk when fertility is high. Studies have shown that women who have 5 or more children encounter a 50% higher mortality than those with lower fertility (Davanzo, 2004).

The empowerment of women and increased gender equality are also affected positively when transitions to lower fertility have been made. A UN study showed that in certain cases, as fertility has fallen, women's participation in the labor force has increased (Lim, 2012). Also, some have cited that family planning, and hence lower fertility, gives women the fundamental right to select the number and timing of their births, which gives women more power (Bongaarts et al., 2012).

Finally, the environment is also a factor impacted by fertility. When looking at a resource such as water, it is easy to see that due to the finite amount, rapidly growing populations can put intense strains on water supply. Water is not only needed directly for humans but also

needed to produce the grain to feed humans themselves and livestock which can serve as income. A similar argument can be made for land use. As populations increase, more land or more intense use of land is needed to sustain life. This has been shown to reduce forest cover in Central and South America (Casterline and Lazarus, 2010). High fertility has also been shown to indirectly negatively impact other environmental factors such as air quality, global warming, and biodiversity (Casterline and Lazarus, 2010).

Chapter 4

Relationship between Education and Fertility

The complex relationship between education and fertility reaches across categories of determinants. Since education will play a major part in the empirical aspect of this paper, it is important to understand the complexity of this relationship. As mentioned earlier, it is clear that there is an overall negative correlation between the total fertility rate and the level of education. Within this relationship, there are nuances that exist which are important to discuss before observing empirical data supporting this claim.

In the short term, increased education can actually have a positive correlation with fertility (Nag, 1979). Aspects such as better production of the infant's or child's health, better maternal health and the abandonment of infecundity-inducing practices can all lead to a higher natural birth rate.

Table 1. Rate of Childhood Mortality: Mortality before the Child's 5th Birthday

Survey	Total	No education	Primary	Secondary	Higher
2012 DHS	88	113	90	76	34
2005-06 DHS	86	123	97	66	51
2000 DHS	119	150	140	75	51
1994-95 DHS	131	158	126	95	68

Source: Calculated from Haiti Demographic and Health Surveys

Table 1 above shows this relationship between education and the ability of the mother to produce a child's health. Childhood mortality, death before the child's fifth birthday, decreases with increased schooling of the mothers. The differences are quite large, as by 2012 those with higher education experience less than a third of the rate of childhood mortality among those with no education.

After a short period, the fertility-suppressing factors become more influential. One of the fertility-suppressing factors that comes along with an increase in level of women's schooling is an increased age at marriage (Castro Martin, 1995). In her 1995 analysis, Castro Martin discusses how a later age at marriage coincides with a later first exposure to pregnancy. Along with this delay, an increased age at marriage is correlated negatively with family sizes (Castro Martin 1995). In certain countries, Haiti included, it is found that exposure to pregnancy can come before marriage. Education has also been found to postpone first births in this type of situation, therefore leading to lower fertility rates (Westoff et al., 1994).

Table 2. Median age at first birth for women age 25-49 by Level of Schooling

Survey	Total	No education	Primary	Secondary
2012 DHS	22.3	20.1	20.9	24.7
2005-06 DHS	21.9	20.5	21.3	-
2000 DHS	21.9	20.6	21.4	-
1994-95 DHS	22.1	21.1	22	-

Source: Calculated from Haiti Demographic and Health Surveys

From Table 2 above, one can see that there is a relationship between education and the age of women at their first birth. Although data was scarce for this variable, a trend is still evident. Finishing primary school was consistent with delaying the age at first birth by slightly less than a year consistently throughout the surveys. In addition, large delays in first birth are found in the 2012 survey between those with little to no education and those with a secondary education.

Table 3. Median age at first birth for all women age 25-49 by Residence

Survey	Total	Urban	Rural
2012 DHS	22.3	23.5	21.3
2005-06 DHS	21.9	23.3	21.2
2000 DHS	21.9	23.3	21
1994-95 DHS	22.1	23.1	21.4

Source: Demographic and Health Survey

Also impacting the age of women at their first birth is their place of residence. In Table 3 above, across the four surveys, those living in urban areas delayed their first birth by about two years more than those in rural areas. It is important to note that the community effects of schooling may be impacting this trend also. It is well known that there tends to be less education among rural women which could be a factor in this delay. The community effects of schooling refer to the influence that a general level of schooling has on others. Cochrane (1979) was able to analyze this trend and determine that the aggregate level of schooling can affect others through channels such as access to information, attitudes and market opportunities.

Frequency of intercourse is another factor of fertility that is highly affected by level of education. This provides a way to analyze the exposure to pregnancy among women that is more nuanced than age at marriage.

Table 4. Recent sexual activity of all women: Active in last 4 weeks

Survey	Total	No education	Primary	Secondary	Higher
2012 DHS	46.6	63.9	48.2	39.6	44.6
2005-06 DHS	46.1	62.6	42.9	38.4	47.1
2000 DHS	45.2	60.7	42.2	33.3	43.3
1994-95 DHS	42.7	56	38.5	28.6	49.4

Source: Demographic and Health Survey

In Haiti, since 1994, frequency of intercourse has been consistently higher among those with no schooling than those with some schooling. This leaves those with less schooling with a higher exposure to the possibility of becoming pregnant. When comparing those with primary schooling to those with secondary or higher education, sex is more frequent for primary than for secondary school, but then more frequent for higher than for secondary. It is important to note that although those with higher education seem to engage in intercourse at a similar rate as those with primary education, those with higher education are also more likely to use contraception. It is also important to note that the results of this graph may be reflecting better educated women being less likely to be in union. In addition, as seen in Table 5 below, rural areas tend to have higher frequency of intercourse when compared to urban areas, although the gap has been closing over time.

Table 5. Recent sexual activity of all women: Active in last 4 weeks

Survey	Total	Urban	Rural
2012 DHS	46.6	43.3	49.5
2005-06 DHS	46.1	42.6	49.1
2000 DHS	45.2	38.7	50.6
1994-95 DHS	42.7	35.8	48.1

Source: Demographic and Health Survey

Another fertility-suppressing factor, which was also mentioned briefly in the Fertility and Economics Overview, is that education can also have an impact on demand for number of children. A child requires a lot of time on the mother's part, and the decision to have children is dependent on this. Therefore, with more value placed on the mother's time, the more opportunity cost in having a child. In addition, the quality-quantity tradeoff affects the cost of children as

better educated and healthier kids are cost more. Also, the woman's time becomes more valuable

with more education (Becker, 1992).

Inherent in ideal family size is the perception of the costs and benefits of children as well

as the family's ability to support the child financially. The ideal family size has been shown to

have a strong positive correlated with actual fertility (Westoff et al., 2013; Shapiro, 2016) and is

also subject to change based on different variables. Also, it has been found that women with

higher education have lower ideal family sizes than women with little to no education (Castro

Martin, 1995).

Table 6. Ideal Number of Children
Percentage Distributions and Means

Ideal Number of Children	0	1	2	3	4	5	6+	Mean: all women	Mean: currently married
2012 DHS	0.8	5.1	45.4	23.8	18.2	2.5	3.2	2.8	3
2005-06 DHS	0.4	3.7	39.3	25	22.3	3.8	5.3	3	3.2
2000 DHS	0.1	3.8	35	24.9	25.4	3.1	5.1	3.1	3.3
1994-95 DHS	0.2	2.8	29.8	26.4	27.6	5.4	6.3	3.3	3.4

Source: Demographic and Health Survey

Evident in Table 6 above, over time the mean ideal number of children has come down

among all women and has decreased slightly among those who are married. In addition, the

percentage of women who believe that their ideal number of children is 0, 1 or 2 has risen, while

the number of women who want 3, 4, 5, or 6 or more children has decreased.

Since more educated women tend to desire smaller families, this also creates motivation

to regulate fertility (Castro Martin, 1995). Within this aspect there are nuances between the

levels of educated women. Among more educated women, "because of their literacy and greater familiarity with formal institutions and health providers, educated women are also better informed about available contraceptive options and sources" (Castro Martin, 1995, pg. 194). In addition, better educated women also have the tendency to use modern methods more effectively than lesser educated women (Grady et al., 1981). This relationship will be addressed in the context of Haiti in the next section.

Chapter 5

Disaster and High Fertility

In her analysis of the fertility increases in the aftermath of the 2004 Indonesian tsunami, Nobles (2014) found that there were significant increases in the likelihood that mothers who lost their children in the tsunami would give birth. In addition, there was also an increased likelihood of pregnancy among those women who had not borne children yet. In this case, the disaster was a complete shock which led to a lot of uncertainty.

The increase in fertility is explained by the "insurance fertility" principle, which says that if parents anticipate that some children will not survive, they will increase their birth rate to make sure they can attain their desired number of children (Nobles 2014, Finlay 2009). In addition, as the job market collapses after a disaster, the value of an education can diminish due to low job prospects. Therefore, time becomes less valuable for potential parents, most importantly mothers, and having a child is more easily justifiable.
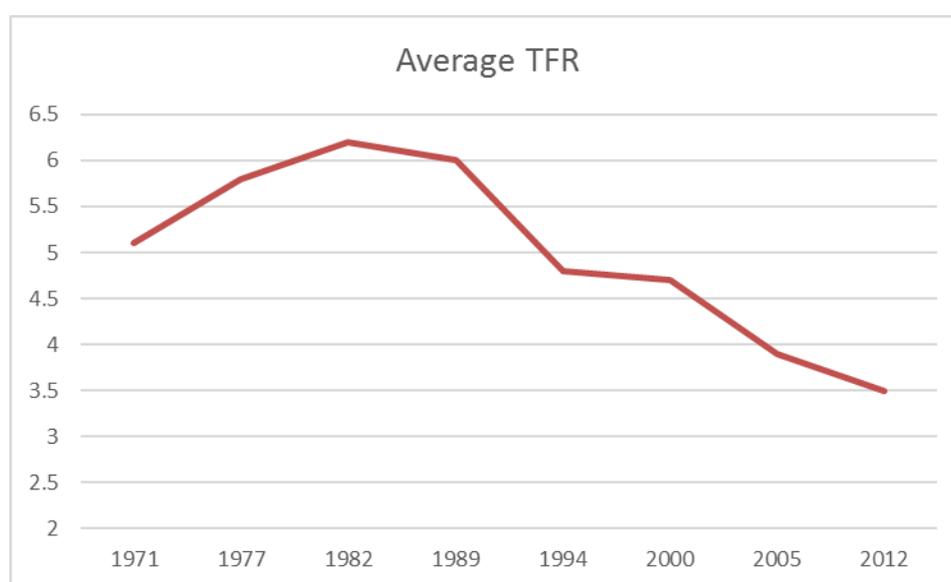
Lastly, the increase in fertility has also been explained by the devastation to healthcare infrastructure, limiting access to contraception (Finlay 2009).

Chapter 6

Overview of Fertility and its Determinants within the Easterlin Framework

6.1 General Total Fertility Rate Trends

Figure 2. Haiti Total Fertility Rate 1971-2012

Sources: Allman and May 1971-1977, Demographic and Health Survey Program (1982-2012)

In 1971 the Total Fertility Rate (TFR) in Haiti was estimated to be around 5.06 births per woman (Allman and May, 1979), and it increased through the 1970s until the early 1980s, when it began to decrease. In 1982, it hit a local maximum when it climbed over 6 births per woman. Although this looks abnormal, countries often experience an increase in the TFR before the decline begins. In 1994, the Haitian Survey on Mortality, Morbidity and the Utilization of Services found that the fertility rate had declined considerably since the early 1980s and overall fertility was around 4.8 births per woman, mostly due to the decline in urban fertility rates

(EMMUS, 1994). By 2000, the TFR decreased only marginally to 4.6 but by 2005 it was slightly

below 4 births per woman. The TFR kept decreasing until 2012 when it reached 3.5 births.

Table 7. Age Specific Fertility Rates for five-year periods 1994-2012

Age	1994-5	2000	2005-6	2012	% Change: 1994-2012
15-19	76	86	68	66	-13%
20-24	179	183	161	146	-18%
25-29	233	198	169	159	-32%
30-34	206	219	175	147	-29%
35-39	166	161	132	121	-27%
40-44	78	74	65	53	-32%
45-49	19	17	13	15	-21%

Source: Demographic and Health Surveys

Moving into more granular data, age specific fertility rates can more clearly distinguish in

which age groups the largest fertility transitions were made. The age specific fertility rate

represents the number of births per year per 1000 women in this specific age group. As one can

see from the table above, the largest transitions were made by the age groups in between ages 25-

44. The smallest transitions were made by the age groups at the extremes of the childbearing

years.

Many determinants influenced the changes in the TFR and ASFRs. Below, the

determinants and their respective paths throughout recent Haitian history have been divided into

the different elements of the Easterlin Framework: demand, supply, fertility regulation, and the proximate determinants.

6.2 Demand

As mentioned in the literature review, tastes, preferences, costs and benefits differ depending on the area in which people live. That is reflected in the urban-rural differentials in total fertility rates.

**Figure 3. Total Fertility Rate by Place of Residence**
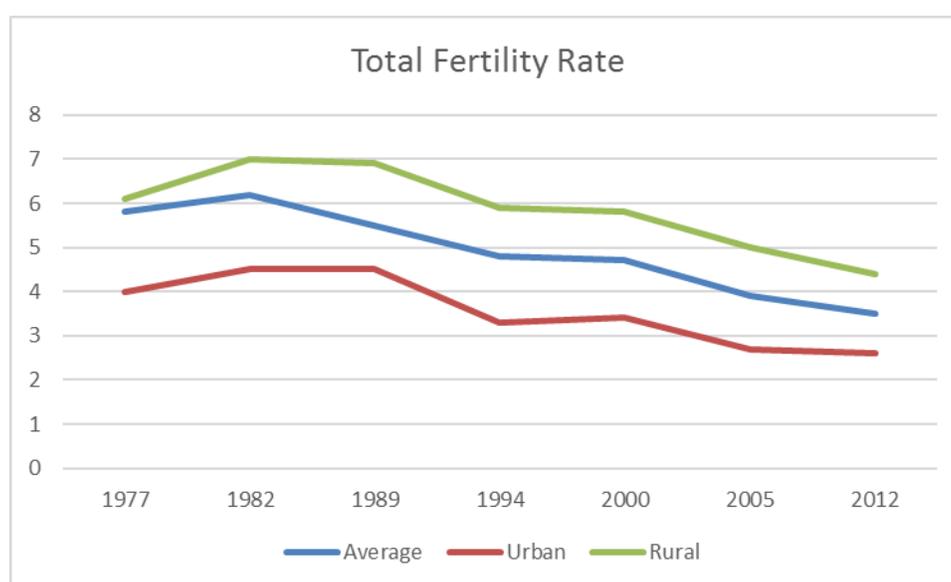
Source: Demographic and Health Survey Program, Allman and May 1979

In 1977, the TFR was 4 in the urban areas and slightly above 6 in the rural areas. In 1989 the TFR ranged from 4.5 in urban areas to 6.9 in rural areas, which are both significant increases from the 1977 survey. In 1994, the same number was 3 in the capital Port-au-Prince and 5.9 in

the rural areas (EMMUS, 1994). With the most recent data, the rural TFR is found to be around

4.4 births per woman and the urban areas are around 2.5 births per woman.

Figure 4. GDP per Capita 1990-2014 (real US$)
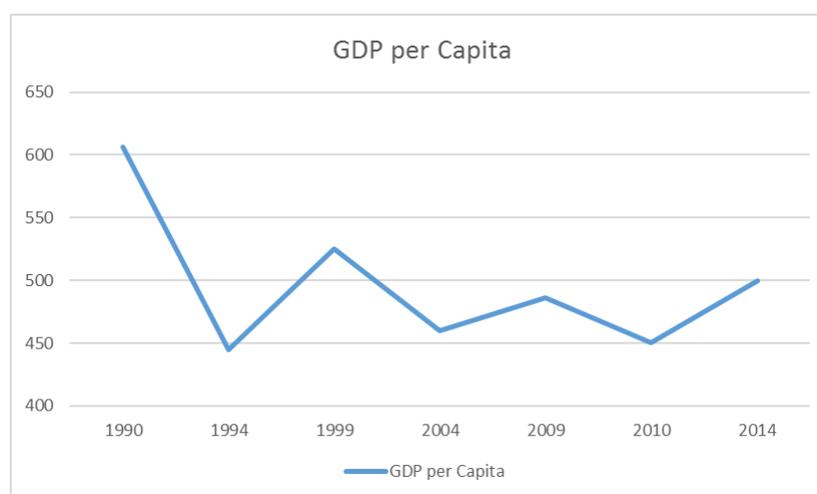
Source: Trading Economics 2014

Since 1990, there have been volatile changes. In 1990, income per capita was over $600.

Economic sanctions were put on Haiti after a military leader took power during a coup d'état and

its GDP per capita plunged to below $450. It came out of the sanctions and peaked again at

around $525 but fell to $475 where it stayed until the earthquake in 2010. After the earthquake, it

fell to $450 before beginning to ascend again. (Trading Economics, 2017).

Also impacting the demand for children is women's education levels. The rate of women

without any schooling has dropped by over half of what it was in 1994. Although there has been

some progress overall, it is important to notice the differences in urban and rural populations. In

2012, the percentage of rural women without any schooling was three times as high as that in the
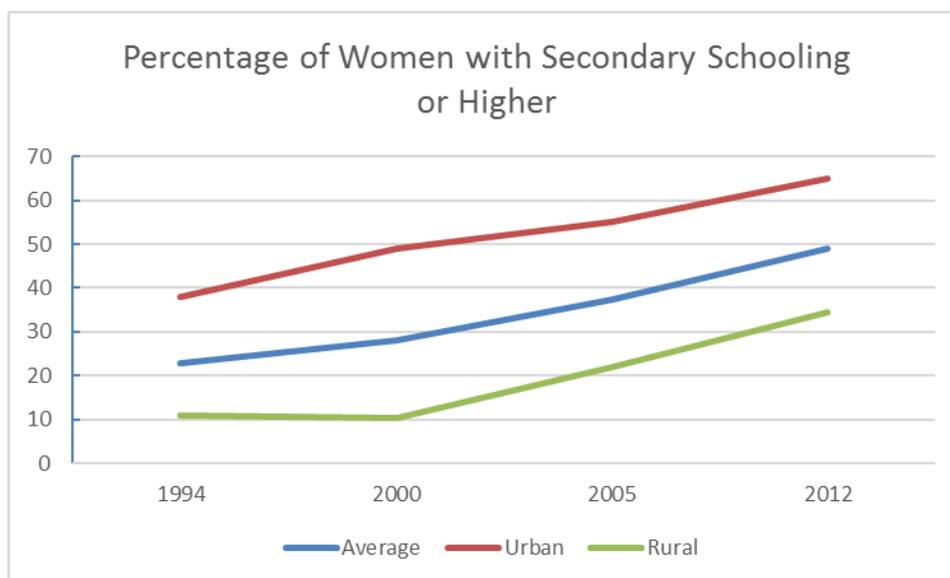
urban population.

Figure 5. Percentage of Women with No Schooling
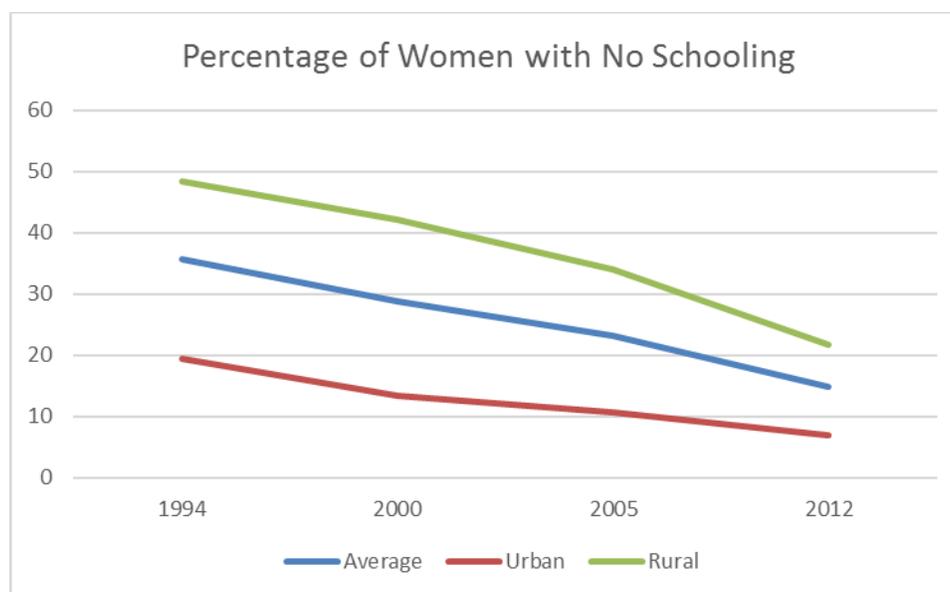
Source: Demographic and Health Surveys

Meanwhile, the rate of women living in rural areas who have completed some secondary

schooling has more than tripled. Women living in urban areas realized a more than 20

percentage point (more than 50%) increase in the rate of those with secondary schooling.

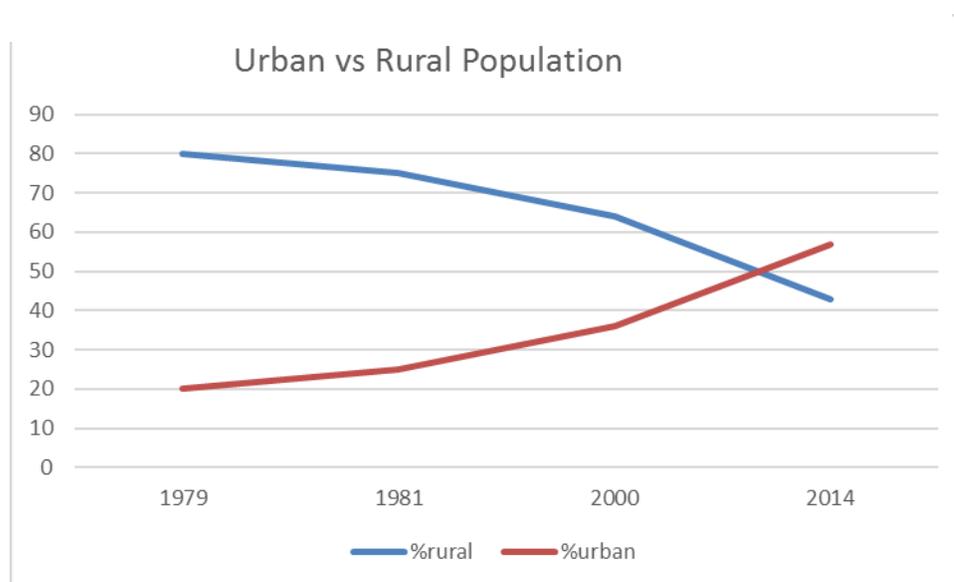**Figure 6. Percentage of Women with
Secondary Schooling**

Percentage of Women with Secondary Schooling or Higher

Source: Demographic and Health Surveys

It is also important to examine Haiti's transition from being predominantly rural to being

moderately urban.

Figure 7. Urban vs Rural Population Distribution

Urban vs Rural Population

Source: Allman and May 1979, Demographic and Health Surveys

In 1979, Allman and May evaluated information from the available census report in Haiti, which was conducted in 1971. Allman and May learned that only 20% of the Haitian population were living in urban areas. In 1981, down from 80%, around 75% of people were still living in rural areas (Haiti Health Child Institute and CDC, 1989). In 2000, that number came down to 64% and has decreased since then to around 41% in 2015 (World Bank, 2017).

6.3 Supply

As discussed in the literature review, the infant mortality rate directly affects the supply of children. It is calculated by taking the number of deaths in the first year of life, dividing that by the number of live births and then multiplying the number by 1000.

Figure 8. Infant Mortality per 1,000 Births
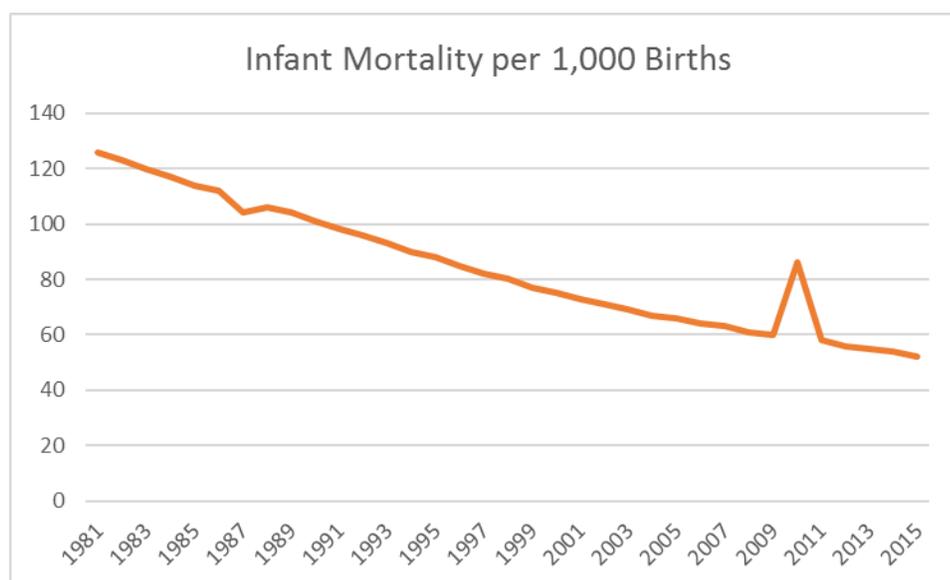
Source: World Bank Haiti Infant Mortality Rate (per 1,000 Births)

The infant mortality rate has been on a steady decline since 1981. The earthquake in 2010 is the reason for the spike around that time. Infant mortality is another basic determinant that shows differences between rural and urban communities.

Figure 9. Infant Mortality by Place of Residence 1994-2012
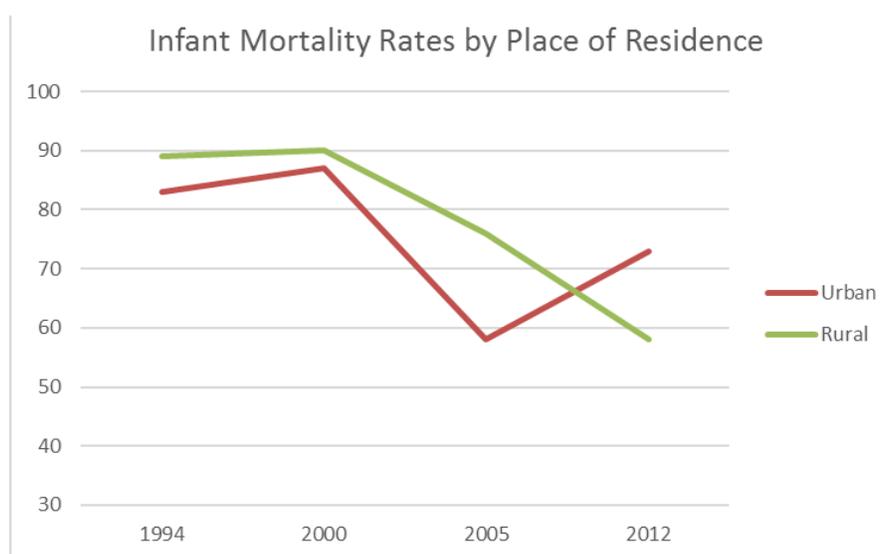
Source: Demographic and Health Surveys

In 1994 the infant mortality rates were fairly close across different residence types in Haiti. Between 2000 and 2005, the rural infant mortality rate dropped more slowly than the urban rate. In addition, it is important to note that the rates on the graph represent the five-year period before the survey was conducted. Therefore, the 2012 rate includes measures from 2007-2012, which would include data from the year of the earthquake. This is represented by the increase in the urban infant mortality rate between the 2005 and 2012 rates.

6.4 Proximate Determinants

In Allman and May's analysis of the 1971 Census, as well as their personal experience in Haiti, they determined that use of modern contraception methods was at a marginal level with rare use. In 1977, the Haitian Fertility Survey showed that women were not content with their high fertility, with 43% of women in any type of union saying that they would not want another child. Although 85% of women, who were already in some form of union, knew about modern contraception methods, only about 7% of women were using it (Allman and May, 1979).

Figure 10. Current Use of Any Modern Contraception Method for all Women 15-49
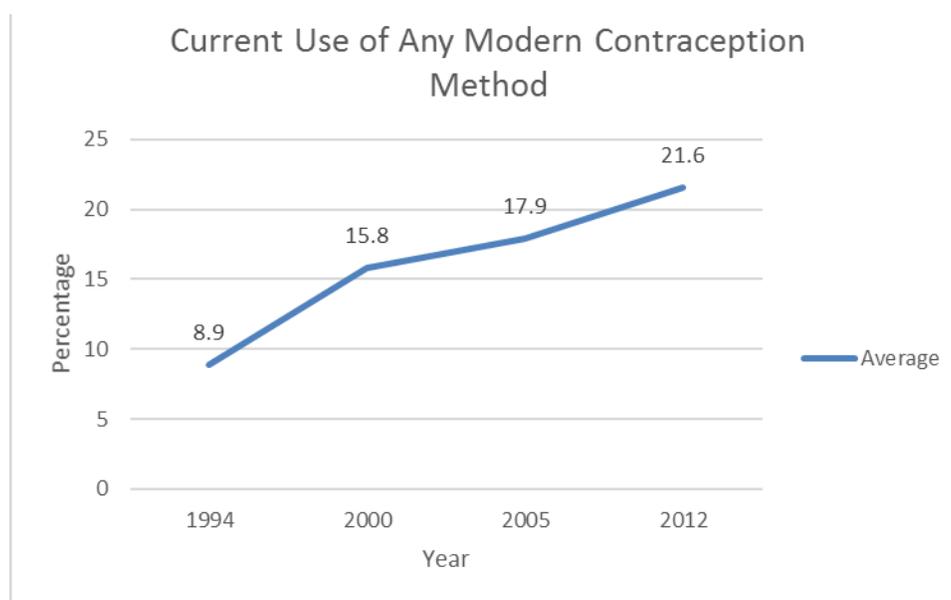
Source: Demographic and Health Surveys

The use of contraception methods among all women has been rising since 1994. It is important to note that Figure 10 above depicts the percentage of women using modern contraception methods such as the pill, condoms, or injections. This is not depicting those women who are using contraceptive methods that are ineffective such as rhythm.

Figure 11. Percentage of Currently Married or In Union Women Currently using a Modern Method of Contraception by Place of Residence

Percentage of Currently Married or In Union Women Currently Using any Modern Method of Contraception by Place of Residence
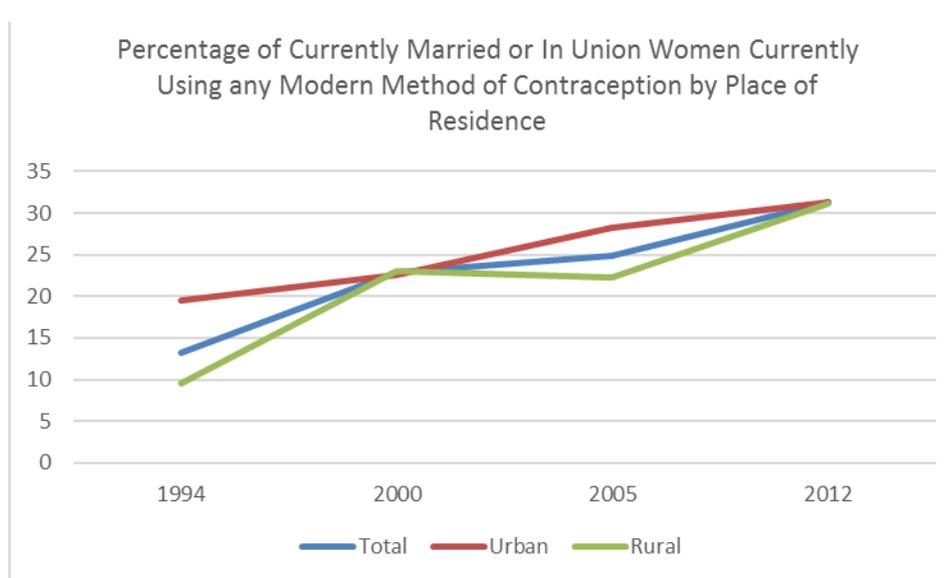
Source: Demographic and Health Surveys

In addition, the use of modern contraception methods has been increasing for those women who are married or in union. Large gains have been made in the rural population between 1994-2000 and between 2005-2012. Steady increases in modern contraception use can also be seen for the urban population.

Figure 12. Percentage of Currently Married or In Union Women Currently Using any Modern Method of Contraception, by Woman's Education

Percentage of Currently Married or in Union Women Currently Using any Modern Method of Contraception
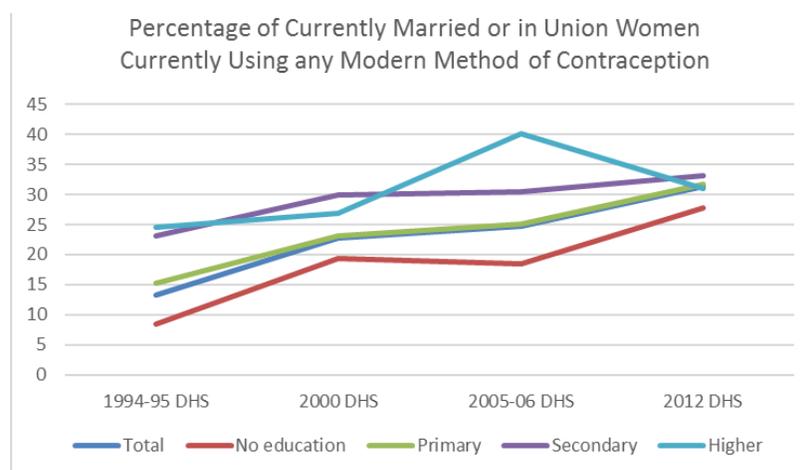
Source: Demographic and Health Surveys

When separated by education level, the same trend can be seen for most levels of education. The use of modern contraception has been rising since 1994. There is a distinct pattern to the higher than secondary level of education. Although it jumped from about 27% to 41% between 2000-2005 among this education level, it decreased almost 10 percentage points over the next five years.

Figure 13. Median Age at First Marriage or Union among Women Age 25-49
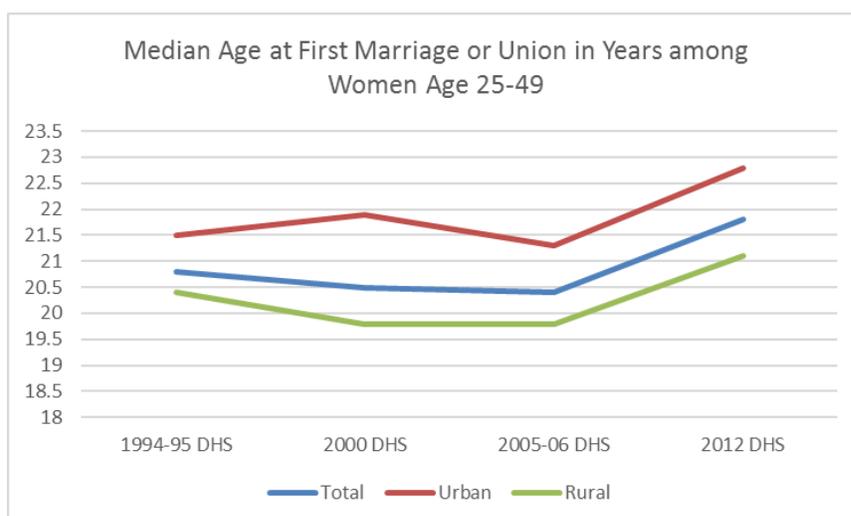
Source: Demographic and Health Surveys

Age at first marriage is another proximate determinant that is important to analyze. It gives information about when women are first exposed to the possibility of sexual intercourse. In Haiti, it is important to include those who are not officially married but in union with a partner. Costs for official marriage can be too high for some and instead an unofficial union is formed. As expected, although it has been rising, the rural population has a consistently lower median age at first marriage or union. Meanwhile, the median age of first marriage for the urban

population fluctuated around the 21.5-year mark until after 2006 when it started rising and almost reaching 23 years.

Other proximate determinants include postpartum insusceptibility, postpartum amenorrhea and postpartum abstinence. High levels of these three determinants, relative to other Caribbean countries (Demographic and Health Surveys, 2012), should serve as a suppression to high fertility but fertility has remained at comparatively high levels despite these factors.

6.5 Fertility Regulation

The unmet need for contraception is the percentage of women of child bearing age who are at risk of becoming pregnant and do not want to have more kids in the next two years but are not using contraception.

Figure 14. Unmet Need for Contraception
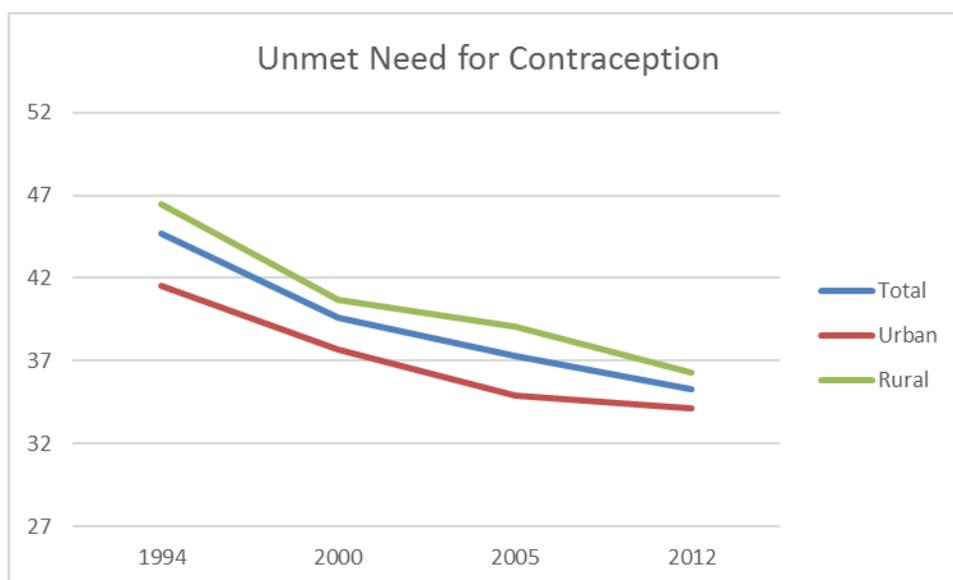
Source: Demographic and Healthy Surveys

Unmet need was first recorded in 1994 and was at 45% with a differential when comparing urban versus rural areas. In 1994, if all unwanted pregnancies were prevented, the TFR would have been 2 whole births per woman less. Overall, unmet need has been decreasing but it is very high relative to most of the rest of the world, aside from sub-Saharan Africa. Haiti has the second highest unmet need for family planning in the world (Demographic and Health Surveys, 2012).

Knowledge of contraception is an important factor in reducing the costs of fertility regulation. Since 1977, knowledge of modern contraception methods has been at least 85%. By 1994, 98% of the people interviewed in the Haitian Survey on Mortality, Morbidity and the Utilization of Services were aware of a modern form of contraception.

Chapter 7

Methodology

The data used for the empirical study of fertility in Haiti and its determinants will come from surveys, performed at different times, and analyze children ever born based on three variables. The data for this model are from the Demographic and Health Surveys Program.

I employ a reduced-form equation where children ever born will serve as the dependent variable. Although it does not give as much clarification of the mechanisms by which the variables affect fertility as some other models, the reduced-form equation is used because of its "unbiased approximation for the total effect of the constraint on fertility" (Schultz, 2001, pg. 4).

The independent variables are age, schooling and place of residence. Place of residence will be split into three different categories: rural, capital and other urban. The reason for splitting up the other urban and capital residences is that significantly lower fertility is found in the capital and cannot be included with the rest of the urban Haitian cities.

Haiti's education system follows that of France, where primary school covers the 1st-6th years of schooling, middle school covers 7th-8th years of schooling and secondary school covers 9th-12th years of schooling. Normally, schooling is broken up into only four categories: no schooling, primary, secondary and higher education. Due to the granularity of DHS data, I am able to further differentiate between levels of schooling. Levels of schooling will be broken up into 7 categories: none, some primary 1-5 years, completed primary 6 years, some middle school 7-8 years, completed middle school 9 years, some secondary 10-11 and completed secondary 12 years and above. The importance of separating the schooling levels like this shows more clearly that the rate of declines in fertility can increase as education increases (Shapiro, 2012). Finally, controlling for age is needed to take into account the amount of time a woman has been exposed

to the possibility of pregnancy (Shapiro 2012). Age squared is also included to allow for a

nonlinear relationship between age and children ever born.

Chapter 8 Results and Discussion

Table 8 below depicts the regression performed to analyze the effects that age, schooling and place of residence have on children ever born for 1994, 2000, 2005 and 2012.

Table 8. Regression Results for Multivariate Regression Run for 1994, 2000, 2005 and 2012

Variable	1994-5	2000	2005-6	2012
Age	0.32814	0.32127	0.25235	0.19175
Age Squared	-0.0024	-0.0021	-0.0011	-0.0003
No Schooling	-	-	-	-
Some Primary School	-0.3922	-0.6663	-0.6926	-0.472
Completed Primary School	-0.6747	-0.9585	-0.981	-0.7803
Some Middle School	-0.685	-0.9492	-1.0882	-0.9381
Completed Middle School	0.25382	0.28944	0.39856	0.45933
Some Secondary	-1.2322	-1.7102	-1.7555	-1.5126
Completed Secondary	-1.8208	-2.6201	-2.2267	-2.204
Port-au-Prince	-0.7654	-0.7582	-0.705	-0.52
Other Urban	-0.3675	-0.5326	-0.4306	-0.4109
Constant	-4.1273	-3.8589	-2.8541	-2.2104
R^2	.5444	.5932	.6205	.6182

All coefficients were significant at the .01 level

8.1 Education's Increased Effect with Increased Education

The negative correlation between level of education and children ever born has been well documented and is evident in this regression. As discussed in previous sections, with education comes higher opportunity cost for having children, knowledge about contraception and how to properly use it, and increased decision making in favor of quality over quantity.

One noticeable aspect of these regressions is, in the highest two education groups, there is an increasingly negative correlation between education and children ever born as education is increased. This effect has been previously documented. For example, in the 2000 survey, some secondary schooling is correlated with 1.7102 less children while completed secondary schooling is consistent with 2.6 fewer children, compared to women with no schooling, other things equal. This trend is consistent across all surveys and is particularly surprising as a few extra years of schooling, or sometimes even one extra year of schooling, can result in a decrease in almost a full birth. In addition, as previously documented, not only do the coefficients increase (in absolute value) but the differentials between coefficients increase with educational attainment (Shapiro, 2012). This confirms Becker's theory of opportunity costs. As potential parents are more educated, their time job prospects and the quality of those job prospects increase, making the opportunity costs of having a child increase.

The only variable that did not have a negative correlation with children ever born was "completed middle school" and that may be due to a small number of observations for this variable.

One more factor of note is the effect living in Port-au-Prince has on fertility. Although it did not change much throughout time, its effect on children ever born stayed consistently higher

than that in other urban areas. Being the capital and the hub for most business, there are many more opportunities for work, creating a higher opportunity cost for children. It is also noticeable that the coefficient has decreased over time. As depicted in the Overview section, since the 1980s there has been a large migration of people to the urban areas. Therefore, the effect of living in Port-au-Prince could be decreasing due to populations with rural backgrounds migrating to Port-au-Prince. The last and largest decrease between 2005-2012 may be explained by aspects of the earthquake which will be explained in section 8.3.

8.2 Changes in Education's Effect Over Time

Over time, levels of education have an increasingly negative effect on children ever born. For example, in the 1994-1995 survey, having some middle school education, all else equal, corresponded with having .685 fewer kids. In the 2000 survey, some middle school became consistent with having .9585 fewer kids and continued to become increasingly negative in the 2005-2006 survey corresponding with .981 fewer kids. This trend is consistent for the "some primary school" level, completed "primary school level," and the "some high school level."

One explanation is the slow but evident integration of sex education in schools in Haiti. At the end of the Duvalier era in 1986, thousands of non-governmental organizations (NGOs) flocked to Haiti to try and address food security, access to water, fertility rates, infant mortality and many other issues. With that has come NGOs, like CARE and Red Cross, who are trying to incorporate sex education into the school curriculum as well as teaching it themselves. With more information available, this would increase the effect the ability to grasp that information, education and literacy, would have on fertility.

Secondly, education can become more potent as the general level of education increases. When parents and family members are more educated, students may be able to better grasp concepts. In addition, and in conjunction with the argument made above, as the general level of education increases, information about contraception becomes more accessible and can be disseminated to students through channels outside of the classroom. This would leave the students in a higher educated environment more informed than students at the same level in an environment with lower levels of education.

8.3 Changes in Education's Effect on Fertility after the Earthquake

It is important to note that this particular trend does not carry over into the 2012 survey. In addition, it is equally as important to note that the 2012 survey reflects children ever born in the three years prior to the survey. Therefore, the 2012 data is vulnerable to being skewed because it reflects some fertility from before the earthquake. With this in mind, a change in the coefficient is still noticeable across many education levels. One possible explanation could include implications from the devastating earthquake that occurred in Port-au-Prince in 2010. After the earthquake, the fertility rate in Port-au-Prince tripled according to a United Nations Fund for Population Action report (UNFPA, 2011). This follows other trends that document similar increases in fertility after natural disasters, war or genocide (Nobles 2014, Frankenburg 2015). There are a few explanations that have been put forward in deciphering this fact. First, stress has certain effects on coital frequency as well as the ability to carry a child to pregnancy resulting in effects on demand for children (Frankenburg 2014). Second, devastation of infrastructure can affect family planning services and, more generally, health services.

It is clear that the variables affecting fertility are interdependent. In the case of Haiti, the earthquake was unanticipated and most likely influenced the effect education had on fertility. The factors discussed in Chapter 6 can be responsible for the fall in education's impact on fertility. An increase in infant mortality could have led to a desire to engage in the "insurance policy" way of thinking about fertility as found in previous studies (Finlay 2009). In addition, a collapse of the labor market makes women's time less valuable, diminishing opportunity costs associated with having a child.

Therefore, the factors discussed above highly affected the decision to bear children of women of all levels of education. This can be seen specifically in the change in the Port-au-Prince coefficient between the 2005-2006 survey and the 2012 survey. It can be assumed that, had the earthquake not occurred or if it had had a lesser impact than it did, education would have continued on its trend of having increasingly negative correlations with fertility.

Chapter 9 Conclusion

In this thesis, the fertility decline in Haiti has been analyzed and the effect education has had on fertility over this period has been examined. Since the 1980s, Haiti has gone through a demographic transition to lower fertility. During this time, the determinants of fertility have followed trends contributing to this decline. The most important finding of this paper is the significant impact that education had on fertility. The progress in women's education seems to be a main driver of lower fertility. Moving forward, it would be recommended to support the trend of more women being educated and for women to stay in school through the later levels of schooling. The benefit of this is evident from the regression results as with higher levels of schooling came larger negative impacts on fertility.

A secondary finding in this paper has been revealing, especially when there is a shock, the dynamic nature of determinants of fertility. Depending on the circumstances, different determinants can have more or less of an influence on fertility. In Haiti, before the earthquake, education had a large impact on fertility and its impact was increasing with time. After the earthquake, the effect education had on fertility was still high but decreased slightly. One can assume that replacement fertility's effect increased due to uncertainty about the future.

Moving forward, a comparison of effects of education on fertility in other countries would be helpful to see if Haiti was unique in this regard. It would also be interesting to study areas that have suffered from disasters in order to see if education's coefficient decreases and this trend persists across borders.

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