The Impact of Family Planning Program Implementation on Fertility and Child Wellbeing: Evidence from Rwanda

Steve Mello*

Hamilton College
Arthur Levitt Public Affairs Center
Summer Fellowship Project
August 2010

Abstract

This paper examines whether an increase in the supply of contraceptives, provided by the implementation of the DELIVER project, created changes in short-term fertility for women in Rwanda. It also analyzes whether the change in supply affected certain child health outcomes and the distribution of births among mothers with certain characteristics. I employ Measure DHS surveys from 2000 and 2005, and exploit regional variation in across-time changes in access to contraception with a difference-in-differences framework. Via probit and OLS methodology, I find evidence that significant increases in condom availability reduced short-term fertility, increased average birth weight, and reallocated a higher percentage of births to educated women.

* Special thanks for Professor Stephen Wu, Hamilton College, who served as my advisor during the researching and writing of this paper. Thanks also to Professor Emily Conover, Hamilton College, who advised my research for a similar, previous study. Financial support provided by an Arthur Levitt Public Affairs Center Summer Research Grant.

1. Introduction

Although conventional logic would suggest otherwise, several prior researches have concluded that shifts in the supply of contraceptives do not yield actual fertility changes. They argue, rather, that changes in fertility rise only from shifts in demand for contraceptives.[1] Recent studies, however, show that exogenous changes in contraceptive supply have produced changes in fertility rates in countries all along the developmental spectrum, from Colombia (Miller 2009) and Romania (Pop-Eleches 2009) to the United States (Ananat & Hungerman 2008). I investigate whether an analogous relationship exists in Rwanda.

The exogenous changes examined by these researchers take a variety of forms. Pop-Eleches (2005 & 2009) and Ananat et al. (2008) investigate changes in contraceptive access resulting from stark alterations in family planning policies. Miller (2009) analyzes the impact of the implementation of a third-party aid program geared toward improving contraceptive access, a situation similar to that in Rwanda in the early 2000's.

In 2002, the DELIVER Project, a USAID program, began working in conjunction with the Rwandan Ministry of Health (MOH) with the goal of improving access to contraceptives. In particular, DELIVER's primary goal was to improve the logistical systems by which contraceptives were made available. Though DELIVER's implementation was largely in response both to very high fertility rates and damage to the country's health systems during the genocide and civil war of the 1990's, evidence suggests that demand for contraception remained relatively constant over time. Moreover, increased access provided by DELIVER and MOH policy changes resulted from wholly external sources, unrelated to micro-level changes in preferences. I therefore treat the implementation of DELIVER as an arguably exogenous supply-

[1] Based on arguments and citations from Miller (2009).

side shift in the theoretical Rwandan contraceptive market, and analyze the ensuing short-term effects.[2]

Prior researchers have also examined the effects of changes in family planning availability on the wellbeing of women and children. Such research seems particularly relevant in developing nations like Rwanda. I am particularly interested in child health and wellbeing, investigating whether increases in contraceptive access improve newborn and infantile health. Following the example of Ananat et al. (2008), I also analyze whether such increases alter the distribution of births among mothers according to maternal characteristics. Ananat's work is based on existing research documenting that children born to women with certain characteristics are likely to be healthier and tend to attain higher socioeconomic status later in life.

Classically, economists have used per-capita income as a primary measure of quality of life. My analysis, however, looks at whether access to family planning affects quality of life in terms of health and wellbeing. While my fertility analysis serves to evaluate the short-term success of the DELIVER project as a means of reducing fertility, my health and wellbeing research helps more broadly in evaluating whether family planning programs and/or policies are effective measures for improvement of quality of life, as well. Child wellbeing is a crucial consideration in the evaluation of policies and programs as promoters of third-world development and quality of life improvement.

Overall, I find that women in areas with sharp increases in condom availability experienced reductions in short-term fertility relative to women in other regions. I also find the same areas experienced a redistribution of births, with a higher percentage of children born to educated mothers following increases in condom availability. Additionally, newborns of these

[2] I offer a more detailed explanation in Section 3.

areas experienced increases in average birth weight. Regions with dramatic increases in family planning media prominence saw decreases in the likelihood of infant health problems and a similar redistribution in births towards educated mothers, relative to other regions. Regions with increases in the discussion of family planning with women at clinic visits saw a redistribution of births in favor of married women.

The remainder of the paper is organized as follows: Section 2 provides a brief review of relevant existing literature. Section 3 briefly outlines the history of family planning and fertility in Rwanda, and Section 4 describes the data. In sections 5 and 6, I explain the theoretical framework underlying my work and my empirical methods. I present primary results in Section 7, and additional results in Section 8. I offer my conclusions in Section 9.

2. Review of Existing Literature

Prior researchers have analyzed both the demand and supply-sides of theoretical contraceptive markets in developed and developing countries. Most demand-side research identifies determinants of actual contraceptive use. Supply-side analysis addresses either the primary first-order question, whether changes in contraceptive supply actually affect fertility, or various second-order questions, essentially whether shifts in contraceptive supply affect changes in some quality of life measure, such as education-levels, employment outcomes, or health. Additionally, prior researchers have examined changes in the availability of particular methods, oral contraceptives and abortion, as well as changes in the availability of contraceptives in general. Various studies analyzing child health and fertility are also relevant to my research

Because of the wealth of literature on population control and child wellbeing, I will discuss mostly papers concerning particularly contraceptive supply changes and child-level outcomes. Of particular relevance to this study, however, is Becker and Lewis (1973), a seminar paper on child wellbeing, cited regularly by development research concerning population and child wellbeing outcomes. Becker et al. develop a theoretical budget constraint, and model a simple trade off between quantity and "quality" of children, with some extensions. Ultimately they offer a means for conceptualizing the way in which changes in fertility likely affect child wellbeing.

Miller (2009) conducts a thorough analysis of the effects of family planning on both fertility rates and other mother-level outcomes. Miller's study on Colombia is particularly relevant in its concern with socioeconomic, quality of life improvements. Moreover, he examines exogenous increases in contraceptive supply provided by a third-party aid organization, PROFAMILIA, a change very similar to that in Rwanda. Relying on data from the 1973, 1985, and 1993 Colombian censuses, he employs probit and OLS methodology and concludes that contraceptive access produced declines in lifetime fertility of 0.4 to 0.75 children per women. He also finds that women with family planning access generally obtained 0.15 more years of education, were more likely to work in the formal sector and hold a "white collar" job, and were less likely to live with male partners. Miller summarizes that "lowering the cost of postponing first births produced important socioeconomic gains" (Miller 2009).

Two major strengths of Miller's paper are (1) his use of knowledge of the age at which each woman gained contraceptive access to assert the existence of causal relationships and (2) his ability to determine lifetime effects with long-term analysis. The recent nature of DELIVER implementation (relative to that of PROFAMILIA in Colombia) prohibits me from estimating lifetime effects. I do, however, apply some of Miller's econometric methods to my own short-term analysis. Particularly, I use his primary fertility methodology, a probit estimation of the likelihood of having given birth over a specified time period.

Ananat and Hungerman (2008) analyze the effects of increased access to "the pill" provided by law changes and improved distribution in the U.S. during the 1960's and 70's. Using the 1980 census to analyze women born between 1940 and 1965 (and thus moved through their teens during the period when states decreased the legal age for pill access), they seek to determine the effects of pill access on (1) short-term fertility, and (2) characteristics of children born to young women in the short-term, in addition to other long-term outcomes, which I won't mention. Using a "difference-in-differences" analysis, Ananat et al. find that pill access bred a 10 to 20 percent reduction in short-term fertility, and that the share of children living in poverty was 2.6 percent *higher* for children born to areas with improved pill access. They rationalize this short-term redistribution of births by arguing that upon diffusion, educated and affluent women were considerably more likely to use oral contraceptives; thus the drop in fertility was greater for wealthier women, and the total number of births was reallocated with a higher percentage of births among poorer women. However, they do conclude that the marginal child (the child not born due to pill diffusion) would have been 23 to 38% less likely to live in poverty and 11 to 12 percent less likely to have a below-average birth-weight (Ananat and Hungerman 2008).[3]

Though my research focuses on a developing nation, I find that Ananat et al.'s outcomes of interest for child-cohort analysis are both relevant and adaptable for development work. I therefore adopt some of their main child-level outcomes of interest, in particular birth-weight and relevant, specific maternal characteristics (i.e. share of children born to educated mothers). Moreover, as Rwandan regions experienced significant increases in access to various contraceptive forms relative to other regions, I employ the same difference-in-differences approach to exploit regional variation in contraceptive access over time.

---

[3] Summary of short-term results only.

Pop-Eleches also analyzes the effects of a contraceptive supply shifts resulting from changes in government regulation in his 2003 and 2009 papers. His research determines the impact of drastic abortion policy changes in Romania, where liberal abortion policies were practiced prior to 1966 when family-planning services were banned, and remained so until the 1989 fall of the USSR. His 2009 paper primarily considers data from the 1993 Romanian Reproductive Health Survey to conduct a first-order analysis of a contraceptive supply-change. Pop-Eleches also uses difference-in-difference estimation to examine how a woman's education impacts her experienced changes in fertility over time. Modeling the expected number of pregnancies per woman over specified time periods, he finds a 30% reduction in short-term fertility and 25% reduction in long-term fertility following the abortion ban's 1989 repeal. He finds that changes in fertility were greater in either direction (increases following the ban or decreases following the repeal) for women with lesser education (Pop-Eleches 2009).

His 2003 paper focuses on the abortion ban's effects on child-level socioeconomic outcomes. Using data from the 1992 Romanian census, Pop-Eleches analyzes whether children born following the 1966 abortion ban achieved different socioeconomic circumstances later in life than those born prior to the ban. He exploits the large and sudden change in abortion by using a simple difference model, allowing a single "after" dummy to capture the effect of the policy change on various outcomes. He finds an increase in total fertility from 1.9 to 3.7 children per women between 1966 and 1967, and also concludes that children born following the abortion ban tended to have to higher levels of educational and labor-market attainment. He rationalizes this outcome with the explanation that prior to the ban, educated women were more likely to use abortions; thus, following the ban a greater share of total children born were born to educated mothers (Pop-Eleches 2005).[4] This finding is consistent with Ananat's discussed above; both papers indicate that in the short-term, changes ensuing from contraceptive supply shifts depend heavily on women's education and/or wealth levels. Ananat finds that in the short-term, increases in the availability of oral contraceptives actually reallocated births in favor of less-affluent women because more affluent women were more likely to use the newly available services. Pop-Eleches finds the same effect to occur in the opposite direction – in the short decreased availability of abortion reallocated births in favor of more educated/affluent women, because these women had been the primary users of abortion prior to the ban.

In that the Rwandan change in availability of family planning was not as extreme, widespread, or sudden as the decrease produced by the Romanian abortion ban, I cannot use a simple difference methodology to capture the effect of changes in contraceptive availability as Pop-Eleches does in 2003. I do, however, adopt the difference-in-differences model employed in his 2009 paper to exploit the variance in access across regions, rather than variations across education levels.

3. Family Planning and Fertility in Rwanda

Rwanda has historically experienced very high fertility rates, as high as 8.5 births per women according to a 1983 national fertility survey. This figure was exceptionally high relative not only to the worldwide fertility rate, 3.52 in 1985, but relative to the 1985 fertility rates of other East African countries: 7.1 in Uganda, 6.9 in the Democratic Republic of Congo, and 6.5 in Tanzania (World Bank). In response to the high fertility rates in the 1980's, Rwanda established a National Office of Population (ONAPO) and founded the Association Rwandaise pour le Bien-etre Familial (ARBEF), a branch of the Internal Planned Parenthood Federation. The Demographic

[4] Pop-Eleches does find that controlling for redistribution of births among mothers, children born after the abortion ban had lower levels of socioeconomic achievement.

and Health Survey found that the total fertility rate had fallen to 6.2 in 1992, and indicated a contraceptive prevalence rate of 13% (Solo 2010).[5]

The increases in contraceptive availability during the 1980's and early 1990's were provided mostly through the public health sector (DELIVER 2007). The infamous 1994 genocide, however, heavily damaged a variety of government systems, including the public health sector infrastructure. The 2000 Demographic and Health Survey indicated that the contraceptive prevalence rate had fallen to 4%, and DELIVER Project literature cites this statistic as evidence that the genocide "had a significant negative impact on family planning services" (DELIVER 2007, 3).

In 1999, the government began the creation of a community-managed health insurance system known as mutuelles, which gradually began improvements in the field of reproductive health, most notably encouraging more women to give birth under nurse supervision (McNeil 2010). Then in 2002, the DELIVER Project, a USAID program, began working in Rwanda with the primary goal of improving the logistical systems of contraceptive distribution. Most notably, DELIVER dramatically improved distribution methods and inventory systems, as well as positioned trained workers along the supply chain. Statistically, DELIVER activity dramatically reduced contraceptive "stockouts." In the project's own 2007 final report, DELIVER concluded: "The contraceptive distribution system, which used to be inefficient, is now performing well. Today, it is clearly recognized that the logistics systems has had a major role in the increase of

[5]As defined by the World Health Organization, "contraceptive prevalence rate is the percentage of women between 15-49 years who are practising, or whose sexual partners are practising, any form of contraception,"
http://www.who.int/healthinfo/statistics/indcontraceptiveprevalence/en/index.html

the CPR from 4 percent to 10.3 percent" (DELIVER 2007, 11).[6] Figure 1 shows a more thorough timeline of key events.

4. Data

4.1 Descriptive Statistics

To effectively analyze whether changes in contraceptive availability affected child health outcomes, I require measures of both parent-level family planning access and child-level outcomes from before and after DELIVER implementation. I use the individual recode (IR) sections, which provide extensive data on women ages 15-49, of the 2000 and 2005 Rwanda Demographic and Health Surveys (DHS). The surveys offer relatively thorough information on family planning and reproductive health, as well as a birth index with information on up to six children for each mother.

Table 1 offers relevant descriptive statistics at the adult woman level. In 2000, 10,384 women were surveyed, averaging about 28 years of age. 11,321 were surveyed in 2005, with an average age of about 28 again. In 2000, women had attained 3.99 years of education on average, 13% had at lease some secondary-level education, and 60% could read full sentences (literacy rate). Those in 2005 had attained an average of 3.85 years of education, 11% had secondary-level education, and 60% were literate by the same standards.

Women surveyed in 2000 on average had given birth 2.65 times and had 2.08 living children, 1.78 living at home. On average, a woman's ideal number of children was 4.82, and 29% of women indicated they wanted no more children. In 2005, women on average had given birth 2.66 times, had 2.13 living children, 1.8 living at home. The average ideal number of children was 4.25 and 33% of women wanted no more children. These two measures of fertility

[6] CPR was 10.3% according to the 2005 Demographic and Health Survey

preference were the only characteristics mentioned thus far that changed dramatically between 2000 and 2005.

Table 2 shows relevant descriptive statistics of children born within the year prior to each survey (1999-2000 and 2004-2005). In 2000, information on 1644 children under 1 year old was provided, information on 857 children in 2005. In both years, children averaged about 5.5 months in age. In each year, DHS indicated that 88% of the children were of average or above average size at birth. The mean birth weight in 2000 was 3354 grams, and 3400 grams in 2005. 62% of children had experienced a health issue (diarrhea, cough, or fever) in the past week in 2000, 47% in 2005. This drop across time is exceptionally large. While it likely captures a significant time-trend in child health improvement, it may also suggest a slight change in sample selection. In 2000, 12% of children had educated mothers and 50% had married mothers; 8% and 46% respectively in 2005. In 2000, 94% of children had mothers who received professional prenatal care, 29% had mothers who received professional birth assistance, and 12% had received a complete vaccination set; 95%, 32%, and 11% respectively in 2005.

These child-level descriptive statistics indicate, for the most part, a time-trend increase in child health – children had greater birth weights, were more likely to have been born under circumstances with professional care, and were less likely to have had recent health problems in 2005 than in 2000. Moreover, Rwanda has generally tended to have higher child wellbeing levels than other East African countries. In 2005, 6.3 percent of births were of “low” (less than 2500 grams) birth weight, compared to 14% in the Democratic Republic of Congo (DRC) and Uganda, and 9.5% in Tanzania (World Bank)

4.2 Contraceptive Statistics

Although DHS provides clear and thorough measures of contraceptive prevalence, as cited by the literature discussed earlier, it does not provide straightforward information regarding contraceptive availability. As indicated in Table 1, I ultimately create and employ three definitions of contraceptive access, each corresponding directly to a survey question. They are dummy variables equal to one if a woman indicated that she (1) could get a condom, (2) was told about family planning (FP) during a clinic visit in the past year, and (3) heard about FP in the media (print, radio, or television) in the past year. 23% of women indicated they could get a condom in 2000, 25% in 2005. 22% of women were told about FP during a clinic visit in 2000, 32% in 2005[7]; 39% heard about FP in the media in 2000, 43% in 2005.

4.3 Regions & Contraceptive Access Variation

Women surveyed cover twelve regions across Rwanda. Table 3 presents an investigation into the changes in contraceptive access over time by region. For each of the three "dummy" access definitions (condom access, told about FP at a clinic, and heard about FP in media), the table shows the percentage of women with the particular form of contraceptive access for each region in 2000, 2005, and the percentage change over time. Percentage changes greater than (+) 100% are shown in bold. Kigali, Butare, and Umutara experienced greater than 100% increases in condom availability, Gitarama, Gikorongo, Kibuye, Ruhengeri, and Bymuba in being told about FP at a clinic visit, and Butare and Kigali in FP media prevalence. For my analysis, I use these regions with greater than 100% increases in a particular access definition as the "treatment" regions for analysis of that contraceptive definition. In some cases, I use a more selective

[7] This statistic is conditional on having visited a clinic at all in the past year – this is the reason for the small number of observations indicated in Table 1.

alternate treatment area, defined as regions with 150% or greater increase in the access type of interest.

4.4 Summary

DHS survey data provides several distinct advantages. Firstly, the extensive preferential information, particular fertility and reproductive preferences, serves as a base for the construction of sound control variables and allows for fairly effective limitation of demand-side confounding of results. The inclusion of such control variables allows for considerably more confidence in attributing effects to changes in contraceptive availability. Additionally, the survey provides information on multiple ways in which a woman may have been exposed to family planning services. Rather than employing a broad "access" variable used by some prior researchers, then, I investigate changes in contraceptive availability and exposure according the particular nature and/or method of the change. The surveys do allow for a thorough analysis of a change in condom availability. Though condoms were the third most commonly used contraceptive method in Rwanda (about 9% of all contraceptive users) behind injectable and oral, I find the analysis of changes in condom availability to be particularly interesting for a few primary reasons: (1) there is not a wealth of existing research on the effects of changes in the supply of condoms, (2) condoms are among the least costly contraceptive methods to distribute and obtain, and thereby shifts in condom supply may provide the most considerable effect for young, poor, and unmarried women, and (3) because of condoms' appeal to poorer women, increases in condom availability should create changes in birth distribution different from the redistributions created by increased availability of abortions and pill (Solo 2010)

5. Theoretical Framework

5.1 Supply-Side Analysis

DELIVER Project and Intrahealth literature strongly suggest that increases in the contraceptive prevalence rate (CPR) and aid spending on contraceptives are indicative of increases in demand for family planning services. However, this is largely a misinterpretation of results and/or a negligent use of economic phrasing. The actual statistics presented do not inherently imply the demand-side changes emphasized in the project literature. I will explain this further. It *is* likely that population decimation resulting from the 1994 genocide affected some reduction in demand for contraceptive, as suggested by Intrahealth: "Beyond rebuilding the country's health system, there were also tremendous social and cultural barriers. After so much death, people wanted to bring new life. 'The government was shy to talk about family planning because so many families had lost loved ones,' as a USAID staff member explains" (Solo 2010, 4-5).

However, Intrahealth and DELIVER discuss improvements in distribution and logistics, as the creators of change in the CPR; these are *supply-side* changes. Indeed, the most notable changes in the Rwandan theoretical contraceptive market over the period 1990-2005 were supply-side shifts. The 1994 genocide, in many ways a political strife, reduced the effectiveness of the Rwandan government, especially in the public health sector (DELIVER 2007). In the 2000's, the efforts of third-party aid organizations, most notably DELIVER, coupled with the Rwandan MOH, improved distributional logistics and thereby increased contraceptive supply. The way in which the movement of the CPR, a dramatic reduction between 1992 and 2000 and an increase from 2000 to 2005, mirrored the changes in contraceptive supply suggests that demand remained relatively constant over time. In other words, changes in the CPR reflect movements along the demand curve resulting from two separate supply-shocks, genocidal destruction and family planning program implementation.

Considering this evidence, I treat the 2002 implementation of DELIVER as a somewhat exogenous shift in contraceptive supply, or a supply-shock. An advantage of this approach is the direction of its potential bias. Consider a classical supply/demand framework; I treat DELIVER project implementation as a shift in supply, reducing the theoretical costs of obtaining contraception, and analyze the effects of this cost-reduction. A coinciding increase in demand, unaccounted for by my research, would raise the cost of obtaining contraception, and my analysis would therefore *underestimate* the true effect of the supply-side change itself.

5.2 Difference-in-Differences

Contraceptive access, according to my own measures, did not increase by a significant enough margin from 2000 to 2005 over the entire sample to consider the project a nation-wide supply-shock. However, certain regions did experience dramatic increases in certain forms of access relative to other regions. I treat the 2002 DELIVER implementation as a region-specific supply-shock, then, analyzing the way in which outcomes vary in regions with increased access relative to other regions. This scenario lends itself to the "difference-in-difference" approach, which I will explain.

Consider two groups of women, for example (a) women in urban areas in year *x*, and (b) women in rural areas in year *x*. Group (a) experiences an increase in contraceptive access in year *y*, and we have group (c), women in urban areas in year *z*. We also have group (d), women in rural areas in year *z*, who have the same level of contraceptive access as in year *x*. Now consider an outcome of interest that may be affected by increases in contraceptive availability, fertility, for example. First, we take the difference in fertility between groups (a) and (c), (c-a); this is the change in fertility over time in urban areas. Next we take the difference in fertility between groups (d) and (b), (d-b); the change in fertility over time in rural areas. Finally, we take the differences between the differences: (c-a) – (d-b). This is the difference between the change in fertility over time in urban areas and the change in fertility over time in rural areas. If we assert that the change in contraceptive availability was the most significant change in urban areas relative to rural areas that might affect fertility rates, than we can attribute (c-a) – (d-b), the difference-in-differences, the degree to which fertility changes over time were greater for urban women than rural women, to the change in contraceptive supply.

Difference-in-differences is commonly used in the evaluation of a "treatment." It essentially uses one cohort, women in rural areas, for example, as a control group, and another cohort as a treatment group. The method compares the changes over time in a particular outcome for the control group to the changes over time for the treatment group. If additional and potentially confounding factors can be controlled for, the degree to which changes over time are greater for the treatment group than the control group can be attributed to the treatment.

6. Empirical Strategy

6.1 Econometric Framework

The primary empirical approach I employ is an econometric construction of the difference-in-differences framework explained above. The model is:

$$(1)\ Outcome_{it} = \alpha + \beta * Region_i + \gamma * After_t + \delta * (Region_i * After_t) + \theta * Controls_{it} + \varepsilon_{it}$$

Outcome is an outcome for a particular person (*i*) at a particular time *(t)*. Region is a dummy equal to one for women living in a particular region or regions of interest, zero otherwise. The region(s) of interest are those that, relative to other regions, experienced significant increases in contraceptive access between 2000 and 2005 – the "treatment" regions. *After* is a dummy equal to one for women surveyed in 2005, zero for women surveyed in 2000.

β captures *Region*'s effects on the outcome of interest. γ represents the time trend in *Outcome*. δ is the coefficient of interest: it represents the extent to which, over time, the change in the outcome of interest was greater for women[8] of the particular *Region* than women of other regions. In other words, δ captures the degree to which, over time, *Outcome* changed more in areas with increased contraceptive access than in regions without an increase.

6.2 Fertility

I first examine the first-order relationship between contraceptive access and short-term fertility. I consider fertility, i.e. births per woman, as a function of the woman's contraceptive access *(C)*, fertility preferences *(P)*, previous fertility *(F)*, education *(E)*, and demographic characteristics *(D)*. Note that I indicate these characteristics as X_{m} to indicate they are mother-level characteristics. This distinction will become important as I conduct child-level analysis, as well.

$$Births_m = f(C_m, P_m, F_m, E_m, D_m)$$

I adapt this conceptual framework to the "difference-in-differences" approached previously explained, and estimate equation (1) with $Pr(B_{it-1})$, the probability of having given birth over the one year prior to being surveyed, as the primary outcome of interest. I also employ $Pr(B_{it-3})$, the probability of having given birth over the three years prior to being surveyed, and $E(B_{it-3})$, the expected numbers of births over the same period, as outcomes of interest

[8] For analysis of child outcomes, "women" will be substituted with "children."

6.3 Child Health

I consider child health as function of mother's contraceptive access (C_m), mother's education (E_m), mother's health (H_m), mother's previous fertility (F_m), mother demographics (D_m), and child demographics (D_c).

$$Health_{child} = f(C_m, E_m, H_m, F_m, D_m, D_c)$$

The outcomes of interest here are formulations of $E(H_{child})$. In particular, I estimate a continuous measure, $E(BW_{ct})$, a child's expected birth weight, and two binary measures, $Pr(\mu_{ct})$, the probability the child was of average of above average size at birth, and $Pr(HP_{it-1wk})$, the probability that the child experienced a health problem in the week prior to the survey. To ensure sound construction of control variables, I restrict the sample in child-level regressions to children under one year of age at the time of the survey.

6.4 Child Wellbeing & Maternal Characteristics

Following the example of previous literature, I also examine whether increases in contraceptive access caused a redistribution of births among mothers with certain characteristics. The outcome of interest is $Pr([m_\eta]_{it-1})$. This is the probability that a child (*i*) born over the given period (*t-1*) has a mother with characteristic η. The two particular characteristics of interest are a mother's (1) marital status and (2) education.

7. Results

7.1 Fertility Results

Table 4 presents estimates of the effect of changes in condom availability between in 2000 and 2005 on fertility. Condom Region is a dummy variable equal to one for the regions City of Kigale, Butare, and Umutara, each of which experienced an increase in condom access of over 100% from 2000 to 2005. As described earlier, the coefficient of interest is the interaction between the "after" variable, year 2005, and the treatment region; this is the difference-in-differences. Columns 1 and 2 offer probit estimates of the marginal effects of the independent variables at their means on the binary dependent variable of interest. Across the entire sample, the probability of a woman having given birth in the past year was about 18 percent. Over, the years prior to the sample, the probability of a woman having given birth was about 40 percent, and women on average had given birth 0.46 times over that period. Column 1 indicates that women in the treatment region experienced a 3 percentage-point reduction over time in the likelihood of having given birth in the past year, compared to women in other regions. Column 2 indicates that women of the same treatment region experience a 6 percentage-point decrease in the probability of having given birth in past three years, relative to other women.

Column 3 provides an OLS estimate of the expected number of children born to a respective woman in the past three years. Women of the treatment region experienced an over-time reduction in the expected number of births over the period of 0.6, relative to other women.

Columns 4, 5, and 6 present identical estimates to those in Columns 1, 2, and 3 with an added dummy variable equal to one for women who indicated that they had discussed FP with their partners. For all three estimates, the "Talk FP with Partner" variable yields very large positive and highly significant coefficients. Women who had discussed FP with their partners were 21 percentage-points more likely to have given birth in the past year, 40 percentage-points more likely to have given birth in the past three years, and were expected to have given birth 0.5 more times in the past three years. Moreover, the inclusion of the discussion variable removes significance from the difference-in-differences coefficient for estimates of the probability of having given birth in the past year (see Column 4), and reduces the significance and size of the difference-in-differences coefficients for the three-year estimates (see Columns 5-6). Some previous research conducted in Nigeria indicates that women who discussed family planning with their partner were significantly *less* likely to use contraceptives.[9] This is consistent with the fact that adding the discussion variable makes the difference-in-differences coefficient a smaller, negative number.

Table 5 presents an identical set of estimates, except with regions that experienced increases of over 150% in having been told about FP at clinic visits as the treatment region. Since five regions experienced 100% (or greater) increases, I choose to employ only those with greater than 150% increases, Gikorongo and Kibuye, as the regions of interest. I indicate this choice by denoting the treatment region variable as the alternative (alt) clinic region. The results shown indicate that women of the treatment region did not experience over-time fertility changes that differed significantly from women of other regions. However, the signs of the difference-in-differences coefficients are negative, and the size of their robust standard errors seem to indicate p-values approaching significance. As with condom-region estimates, the inclusion of the discussion dummy variable reduces the size of the interaction coefficients and increases their standard errors, thus reducing their significance.

Table 6 again offers the same set of estimates, with the sole region that experienced greater than a 100% increase in FP prevalence in the media, Butare, as the treatment region. Again, none of the difference-in-difference coefficients are significant, indicating that women in Butare did not experience over-time fertility changes that differed significantly from women in other regions. The inclusion of the discussion dummy variable reduces the coefficient size and significance.

[9] See Oyedokun (2007), "Determinants of Contraceptive Usage: Lessons from Women in Osun State, Nigeria"

7.2 Child Health Results

Tables 7, 8, and 9 show similarly structured difference-in-difference estimates conducted at the child level. The outcomes of interest are two binary variables, (1) whether the child experienced a health problem (cough, diarrhea, or fever) in the past week, and (2) whether the child was of average or above average size at birth, and a continuous variable, (3) birth weight in grams. I restrict the sample to children born within the year prior to the survey. Across all children considered, the probability of having experienced a health issue was about 56 percent. 88 percent of children were above average size at birth, and the average birth weight was about 3370 grams.

Table 7 shows estimates using regions with large increases in condom availability as the regions of interest. Estimates using the original three regions with 100% or greater increases in condom availability yield no significant difference-in-difference coefficients (results not shown). However, once I restrict the treatment area to the only region with a greater than 150% increase in condom availability, the City of Kigali, I find that the average increase in birth weight between newborns in 1999-2000 and newborns in 2004-2005 was about 299 grams greater for children in Kigali than children in other regions, as indicated in Column 3.

Estimates using the previously employed treatment region of regions with 150% or greater increases in having been told about FP at a clinic did not show significant difference-in-differences. However, changing the restriction and using all five regions with 100% or greater increases in the same measure does yield a significant interaction term coefficient. Table 8, Column 1 shows that children born in Gitarama, Gikorongo, Kibuye, Ruhengeri, or Byumba experienced an over-time reduction in the likelihood of having had a recent health issue of 11 percentage points, relative to children in other regions. However, this particular definition of contraceptive access also encapsulates whether women had visited health clinics at all, and possibly how frequently they had done so. This aspect of the definition may drive the effect then, as any health clinic visits, or more frequent visits, would likely result in healthier children. Therefore, I don't find this result especially meaningful.

Table 9, Column 1 shows that newborns in regions with large increases in FP media prevalence experienced a 12 percentage-point reduction over time in the likelihood of having had a recent health issue, relative to newborns of other regions.

7.3 Birth Distribution Results

As discussed earlier, previous research indicates that children born to mothers with certain characteristics tend to be healthier and attain higher-level socioeconomic outcomes later in life. I therefore model the effect of dramatic regional increases in contraceptive access on the distribution of births to mothers who are married and mothers with secondary education or higher, two characteristics generally associated with better child outcomes. As I explained earlier, I do so with probit models, and the models can therefore best be conceptualized: for a child born in the past year, what was the probability of having a mother with characteristic *n*? Overall, about 49 percent of children had married mothers, and about 11 percent had educated mothers. Again, I restrict the sample to children born in the year prior to each survey.

Table 10 shows estimates of the marginal effects at the means of the independent variables on the likelihood of a child born in the year prior to the survey having a married or educated mother. Although using the broader treatment region (>100% increases) did not yield significant results, employing the alternate treatment region as regions with a 150% or greater increase in condom access (Kigali) did. Column 2 indicates that women in the treatment experienced a 38 percentage-point increase in the likelihood of having an educated mother over time, compared to women in other regions. This is an exceptionally large coefficient, large enough that it possibly encapsulates another, unmeasured effect unique to the treatment region, and I may not be able to attribute the full 38 percentage-point change to increases in contraceptive access. Having said that, it is likely that increased condom availability was a major contributing factor to this effect, as increased availability of condoms would better allow younger, less affluent, and less educated women to avoid unwanted pregnancies.

Table 11 provides the same set of estimates, with regions experiencing increases of 150% or greater in having been told about FP at clinic visits as the regions of interest. Column 1 shows that children in the treatment area experienced an 18 percentage-point increase in the probability of having a married mother over time, relative to women in other regions. This possibly suggests that unmarried (and likely younger) women who were told about family planning at health clinics were better able to avoid unwanted pregnancies. Column 2, however, illustrates that children of the same treatment region experienced a 6 percentage-point decrease over time in the likelihood of having an educated mother, compared to children of other regions.

Table 12 shows that children of the treatment region, regions with 100% or greater increases in family planning media prevalence, experienced a 26 percentage-point increase in the probability of having an educated mother over time, relative to other regions. The size of this coefficient, however, suggests the presence of a fairly obvious bias: presumably, educated women were more likely to access the media, and therefore more likely to indicate they had heard about FP in the media.

8. Additional Results

8.1 Alternate Fertility Specifications

Appendix 1 shows difference-in-difference OLS estimates of the age at first birth for women who gave their first birth in the three years prior to being surveyed (either 1997-2000 or 2002-

2005). Column 1 shows estimates with condom-increased regions as the treatment area, 2 with clinic-increased regions, and 3 with media-increased regions. The 2005 dummy variable is large and significant in each estimate, indicating that women giving their first birth between 2002 and 2005 were likely to do so between 0.56 and 0.59 years later than those first giving birth between 1997 and 2000. However, the estimates indicate that women of the respective treatment regions did not experience over-time changes in age at first birth that differed significantly from those of women in other regions. This seems to indicate that increases in average age at first birth result more from a national time-trend than region-specific increases in contraceptive availability.

8.2 Mother and Child Care Specifications

Appendices 2, 3, and 4 present estimates very similar to those in Tables 7-12 – they are estimates, conducted at the child-level, of the marginal effects of the independent variables at their respective means on binary outcomes. The outcomes of interest are (1) whether a child's mother received professional prenatal care, (2) whether a child's mother received professional birth assistance, and (3) whether the child had been fully vaccinated at the time of the survey. I do not include these specifications in my primary analysis because of the large degree of endogeneity in these particular outcomes; the most significant determinant of these outcomes is was presumably the decision-making of the surveyed mothers. As with all child-level estimates, the sample for appendices 2-4 is children born within the year prior to the survey.

Results for these specifications are very scattered, with difference-in-difference coefficients varying heavily not only in significance, but in sign and magnitude as well. Were there some consistency in these results, I might attribute some of the discovered changes in these outcomes to increased contraceptive access despite their inherent endogeneity. However, the scattered and inconsistent nature of the results lead me to conclude that the endogenous force, maternal decision-making, was the primary factor effecting these mother and child care outcomes. Full regression results can be viewed in appendices 2-4.

8.3 Validity and Robustness

As shown in Table 3, there were not significant nationwide increases in contraceptive availability from 2000 to 2005 in Rwanda. While some regions, those used as treatment regions for each respective contraceptive definition, experienced large increases in access over time, others experienced decreases. Comparing the treatment region to regions with over-time decreases in contraceptive availability, rather than regions where access remained constant, could overestimate the effect. As a robustness check, I re-conduct estimates with significant difference-in-differences, omitting regions with decreases in contraceptive availability. Since condom increase is the only treatment yielding expected, significant results for at least one outcome in each field (fertility, child health, and birth distribution), I focus on analyzing the robustness of those estimates.

Appendix 5 presents the same set of fertility estimates as Table 4, excluding women from regions experiencing 50% or greater decreases in condom access, Kibuye and Ruhengeri. When such regions are omitted, the difference-in-differences for the one-year fertility estimate shown in Column 1 no long yields a significant coefficient. The coefficient remains negative, however, and its standard error suggests a p-value just above 10% significance. Columns 2 and 3 convey that the difference-in-differences for three-year fertility estimates retain both significance and negative signs. The magnitude of each coefficient falls slightly, about 1 to 1.5 percentage-points in each case, with the omission of the regions with significant decreases in condom access. This particular robustness check does suggest that by including regions with large decreases in condom availability, the original estimates overstate the over-time fertility effect of an increase in condom access. However, as the three-year period fertility difference-in-differences estimates retain their significance, I still assert that women of the treatment region experienced over-time reductions in fertility significantly greater than women in regions with small changes in condom availability.

Appendix 6, Column 1 presents an estimate of the marginal effects of the independent variables, at their means, on the likelihood of a child having an educated mother. While Table 10 indicated that children of the condom-treatment region experienced significantly greater over-time increases in the probability of having an educated mother than children of other regions, Appendix 6 shows that once regions with stark condom decreases are omitted, the difference-in-differences coefficient loses significance. Similarly, Column 2 denotes that when the 2 regions with decreased condom access are omitted, the difference-in-differences coefficient loses its significance, whereas in Table 7, Column 3, children of the treatment region experienced over-time increases in birth weight significantly greater than children in other regions. This may suggest that the coefficients shown in Tables 7 and 10 mostly capture the differences between regions with large increases and regions with large decreases in condom availability, and that children of the treatment regions did not experience changes over time relative to children of regions with small changes in condom access. Even so, the measured effects in each case imply that contraceptive access changes were a factor in determining birth distributions.

9. Conclusion

9.1 Potential Shortcomings

The primary shortcomings of my analysis stem from various inadequacies in the employed data. Both the DELIVER literature and the DHS surveys appear to be focused mostly on the contraceptive prevalence rate, or contraceptive use. I find this to be a particularly unsound aspect of DELIVER's self-analysis; while the project's primary goal was to improve various aspects of the contraceptive supply chain, their literature focuses almost exclusively on contraceptive use, a demand-side factor. In simple economic terms, their activity resulted in a shift in supply, but their analysis seeks less to determine the effects of the shift and more to determine whether the shift was accompanied by a shift in demand. DHS offers very specific information regarding contraceptive usage by method, but notably unspecific information on contraceptive access by method. For instance, the surveys do not offer information as to whether Rwandan women were able to obtain injectable contraceptives, the nation's most commonly used method (DELIVER 2007). Information about contraceptive availability comparably specific to that provided about contraceptive use would allow for a much sounder and more thorough supply-side analysis than I've conducted thus far. More thorough information, moreover, would allow more confidence in attributing changes to DELIVER, and would thereby promote a more rigorous analysis of the project. Perhaps future DHS surveys will offer more specific information on access.

The employed data also has shortcomings concerning timing. The surveys do not provide information about when women first received contraceptive access. This is problematic especially for my research as an evaluation of DELIVER, as uncertainty about the time at which a woman gained access to some extent inhibits me from assigning gains related to contraceptive access to DELIVER activity. The lack of such information also inhibits me from limiting my analysis to women who gained access prior enough to the survey to have experienced any effect from such access.

Along similar lines, data from 2005 provides information only three years following DELIVER implementation. Presumably, the full effects of an exogenous increase in contraceptive supply did not occur in three years. The short-term analysis I am forced to conduct by the timing of the "after" data, then, does not capture the full effect of the project on child outcomes. This problem is slightly compounded by the fact that the DELIVER-induced supply change was in some sense a gradual one. Although my analysis of the 2005 survey and DELIVER documentation suggest some significant changes in contraceptive access by 2005, even the full increase in supply likely had not ensued by 2005. This is not to say that the DELIVER-induced exogenous increase in supply does not offer a legitimate circumstance for analysis of the effects of family-planning on second-order outcomes; rather I am suggesting the more gradual nature of the supply change is not as ideal for short-term evaluation as more immediate shock.[10] Moreover, I have no real basis for claiming that the discovered short-term changes will persist in the future. An advantage of my short-term analysis is, however, is that my analysis most likely underestimates the true and long-term effects of changes provided by DELIVER project implementation. Finally, the two DHS surveys do not provide a panel.[11] A panel, information on the same woman during two time periods, would provide an opportunity for analysis of woman-by-woman changes.

A final potential shortcoming lies in my econometric foundation. As discussed at length in earlier sections, the primary strength of the difference-in-differences framework I employ is its establishment of theoretical control and treatment groups and the methodology's ensuing ability to control for time trends in the outcomes of interest. However, the use of a region as an instrument for the treatment itself allows for the possibility that changes in the outcomes of

[10] The abortion ban considered by Pop-Eleches (2003 & 2009), for instance.
[11] There were 37 women surveyed in both 2000 and 2005. These observations were dropped to ease the restructuring of the data for child-level analysis.

interest have resulted from a coinciding and unmeasured change over time specific to the treatment regions, rather than the treatment itself.

In spite of these considered shortcomings, however, I find many of the results presented earlier to be meaningful, significant, and most importantly, economically and econometrically sound. My selective standard for a “treatment” region, 100% or greater increases in contraceptive availability, as well as the inclusion of various control variables in the econometric models, improves the probability that the found effects resulted from changes in contraceptive access. Moreover, I have not found other, unmeasured changes unique to the employed treatment regions that may have caused the measured effects.

9.2 Summary of Results, Conclusions, and Suggestions for Future Research

As discussed above, I do not find evidence suggesting that increases in levels of family planning discussion during health clinic visits or family planning prevalence in the media affected short-term fertility outcomes for women in Rwanda. I do find some evidence that increases in health clinics’ discussion of family planning with women reduced incidences of child health problems and reallocated a greater percentage of births to married women. As previously mentioned, I do not find the increase’s measured effect on child health issues to be particularly sound, as it likely captures the effect of regular health clinic visits on child health.

However, evidence of birth redistribution in favor of married women possibly indicates that availability of family planning allowed more unmarried (and likely young) women to avoid unwanted births, even if it did not decrease regional fertility rates. As shown in Table 11, children born in regions with increases in discussion of FP during health clinic visits saw an over-time increases in the likelihood of being born to a married women of 18 percentage-points greater than children of other regions. Previous literature suggests that children born to married women generally tend to have fewer health issues and higher levels of socioeconomic attainment, and thereby increased discussion of FP at health clinics may have significant, positive effects on child wellbeing. Increasing levels of family planning discussion at health clinics, however, was not a cornerstone of DELIVER activity; rather, I presume it stems from slight policy changes and alterations in national attitudes, and therefore do not necessarily attribute resulting improvements in child wellbeing directly to DELIVER programs.

Some evidence also suggests that increases in prominence of family planning materials in the media resulted in over-time reductions in incidences of health issues for infants and an increase in the percentage of births to educated women. As I discussed earlier, there are likely other effects driving these results. Women indicating that they've heard about FP in the media must be accessing the media, and therefore this measure of access is biased in favor of more educated and affluent women. Moreover, I do not attribute this particular access change and its ensuing effects to DELIVER activity.

As I have discussed, the analysis of changes in condom availability is perhaps my best measure of contraceptive access in that it does not suffer from the endogeneity problems inherent in my other measures. Whether a woman indicated that she could obtain a condom is not subject to the sample selection issues inherent in my other measures – whether she had heard about FP at a clinic visit or in the media. These latter definitions depend on whether a woman was visiting or clinics or was able to access the media. On the other hand, changes in condom availability resulted from improvements from the contraceptive supply chain, and therefore changes ensuing from increased in condom availability can be attributed to the implementation of the DELIVER project. One potential issue with the analysis of condom access is the fact that unlike some other contraceptive methods, condom use absolutely depends on the man's consenting to wear the condom during success. The consent of the man is an endogenous, unmeasured factor that may have affected the extent to which increased condom availability impacted fertility.

Even with this in mind, the fact that increased condom access had such strong effects on child and mother-level outcomes is particularly interesting for a number of reasons, from a policy standpoint. Though only the third most commonly used contraceptive method, it is the least costly to distribute and obtain. Its unregimented, encounter-by-encounter use pattern implies that it is likely more popular among the younger, poorer, and unmarried. The effects of contraceptive availability on such women are perhaps the most important, as they would carry the most drastic improvements in child wellbeing. As children born to less affluent, less educated, and unmarried women tend to have worse health levels and lower socioeconomic attainment, the avoidance of births for these women in particular would result in higher wellbeing levels for the newborn population as a whole.

I find evidence suggesting that increases in the availability of condoms significantly reduced short-term fertility. Women of regions with dramatic increases in condom access experienced over-time reductions in the probability of having given birth in the past year 3 percentage-points greater than women of other regions. Similar, they experienced reductions in the probability of having given birth in the previous three years 6 percentage points greater than other women, and reductions in their expected number of births over the same period 0.6 children greater.

The same regions also saw an over-time increase in average birth weight of 298 grams more than other regions, and a 38 percentage-point reallocation of births to mothers with secondary education. These figures suggest not only that children born in areas with higher levels of condom supply are healthier at birth, but that they are more likely to be better cared-for and have higher levels of socioeconomic attainment later in life, as shown by previous research indicating that children of educated mothers tend towards more positive health and socioeconomic outcomes.

In spite of various shortcomings, then, I find the effects of increases in the availability of condoms, reductions in short-term fertility, increases in average birth weights, and a reallocation of a higher percentage of births to educated mothers, to be both relevant and significant. I attribute at least some of these changes to family planning program implementation in Rwanda, suggesting that the DELIVER project's improvements in contraceptive supply helped to reduce births, improve newborn health and redistribute births towards mothers associated with positive future outcomes for children.

More analysis should be conducted in the future to determine whether fertility changes persist in the long-term, and whether the effects on contraceptive supply changes on child wellbeing become larger and more apparent. It is presumable that the effects, especially second-order ones, of contraceptive access were not fully realized during the period 2002 to 2005. Additionally, some DELIVER and MOH activity continued after 2002. Therefore a similar study completed using later data could draw stronger conclusions. Hopefully future investigation will be aided by more thorough method-by-method information regarding changes in contraceptive access. I also suggest that similar studies be conducted in other areas, as previous research suggests that contraceptive supply's effects on fertility vary significantly by country. As fertility rates, birth distributions, and child health are crucial considerations in evaluating quality of life, such research is highly relevant in the field of economic development. Moreover, such studies rigorously analyze the actual impact, rather than purely theoretical population effects, of family planning programs, as well as help to determine the most efficient and effective procedures for these programs in pursuit of fertility reduction and quality of life improvement.

Works Cited

Ananat, E. & Hungerman, D. (2008). The Power of the Pill for the Marginal Child: Oral Contraception's Effects on Fertility, Abortion, and Maternal & Child Characteristics. *NBER Working Paper*. 1-36.

Becker, G. & Lewis, H. (1973). On the Interaction between the Quantity and Quality of Children. *The Journal of Political Economy*. 81(2), 279-288.

CIA World Factbook: Rwanda. (n.d.) Accessed from the CIA website on May 1, 2010: https://www.cia.gov/library/publications/the-world-factbook/geos/rw.html

DELIVER (2007). Rwanda: Final Country Report. Arlington, VA: DELIVER, for the U.S. Agency for International Development.

McNeil, Donald G. Jr. (2010, June 14). A Dirt-Poor Nation, With a Health Plan. *The New York Times*. Retrieved from http://www.nytimes.com/2010/06/15/health/policy/15rwanda.html?hp

Miller, Grant (2009). Contraception as Development? New Evidence from Family Planning in Colombia. *The Economic Journal*. August 25, 2009. 1-35.

Oyedokun, Amos (2007). Determinants of Contraceptive Usage: Lessons from Women in Osun State, Nigeria. *Journal of Humanities and Social Sciences.* 1(2), 1-13.

Pop-Eleches, Christian (2009). The Supply of Birth Control Methods, Education and Fertility: Evidence from Romania. *Columbia University*. 1-22.

Pop-Eleches, Christian (2009). The Supply of Birth Control Methods, Education and Fertility: Evidence from Romania. *Columbia University*. 1-22.

Rwanda MeasureDHS 2000 Data Set. Accessed via permission granted from DHS website on Feb 3, 2010: http://www.measuredhs.com/countries/metadata.cfm?surv_id=252&ctry_id=35&SrvyTp=ctry&cn=Rwanda

Rwanda MeasureDHS 2005 Data Set. Accessed via permission granted from DHS website on Feb 3, 2010: http://www.measuredhs.com/countries/metadata.cfm?surv_id=252&ctry_id=35&SrvyTp=ctry&cn=Rwanda

Rwanda MeasureDHS 2005 Final Report: Summary. Accessed from DHS website on Fed 3, 2010: http://www.measuredhs.com/pubs/pub_details.cfm?id=594

Solo, Julie (2010). Family Planning in Rwanda: How a Taboo Topic Became Priority Number One. Intrahealth International.

World Bank Public Data provided by Google. Accesed via Google Public Data, Aug. 10, 2010: http://www.google.com/publicdata

Figure 1: Rwanda Family Fanning Timeline

Rwanda Family Planning Timeline

Year	Events/Activities	Indicators
1962	• First family planning (FP) program offering modern contraception established	
1970	• Fertility Survey conducted	TFR: 7.7
1977	• FP goals included for first time in five-year plan (1977-1981)	
1981	• National Office of Population (ONAPO) established to implement population programs and begin program to integrate FP services into all health facilities	
1983	• Fertility Survey conducted	TFR: 8.5
1986	• ARBEF founded as local International Planned Parenthood Federation (IPPF) affiliate	
1990	• National Population Policy and plan of action adopted, goals of reducing TFR from 8.6 to 4.0 and increasing CPR from 2 to 48% by 2000	
1992	• DHS conducted	TFR: 6.2 CPR: 13%
1994	• Genocide	
1995	• Government issues policy to guide reconstruction of the health system	
1997	• ONAPO conducts study on attitudes and strategies for population in Rwanda	
1999	• The Rwandan government begins to encourage the creation of community-managed mutual health organizations, or *mutuelles*.	
2000	• DHS conducted • PRIME II begins assistance to Ministry of Health (MOH) to build capacity of primary providers	TFR: 5.8 CPR: 4%
2002	• Qualitative assessment of FP in Rwanda conducted • DELIVER begins project to improve contraceptive logistics (JSI prime contractor) • Rwandan Parliamentarians' Network for Population and Development (RPRPD) formed	
2003	• July: First National Reproductive Health Policy signed by minister of health • ONAPO closed	
2004	• PEPFAR funding begins in Rwanda	
2005	• DHS conducted • Twubakane Program launched in 12 districts (IntraHealth prime contractor), including support to FP/reproductive health (RH) service delivery • PSI begins family planning program, working with private sector and community-based distribution • May: RAPID model presented to parliamentarians • Sept: HIV/Performance-Based Financing (PBF) project begins (Management Sciences for Health—MSH—prime contractor)	TFR: 6.1 CPR: 10%
2006	• Jan: draft of Quality Assurance Policy (which includes PAQs—community-provider partnerships) • Jan: new districts created • Mar: National FP Policy and its five-year strategies (2006-2010) produced by MOH • April: performance-based contracts introduced with district mayors • May: Capacity Project begins support for FP service delivery in 11 districts (IntraHealth prime contractor)	

Source: Solo (2010), p. 10

Table 1: Descriptive Statistics (Women)

	2000		2005	
Variable	**Observations**	**Mean**	**Observations**	**Mean**
Age	10384	27.87	11321	28.31
Urban (%)	10384	25.97	11321	23.11
Education (Yrs)	10373	3.99	11314	3.85
Secondary Education (%)	10384	13.42	11321	10.79
Literacy (%)	10384	60.30	11321	60.26
Reads Regularly (%)	10384	7.20	11321	8.72
Employed (%)	10384	75.16	11321	64.17
Total Births	10384	2.65	11321	2.66
Living Children	10384	2.08	11321	2.13
Number of Ideal Children	10065	4.82	10937	4.25
Children at Home	10384	1.78	11321	1.80
Wants No More Births (%)	10384	28.95	11321	32.64
Given Birth Past Yr (%)	10384	18.25	11321	17.30
Given Birth Past 3 Yrs (%)	10384	37.67	11321	40.12
Births Past 3 Yrs	10384	0.45	11321	0.49
Could Get a Condom (%)	10384	22.88	11321	24.54
Told About FP at Clinic (%)	2967	21.60	3314	31.59
Heard About FP in Media (%)	10384	39.23	11321	42.59
Intends to Use FP (%)	10384	41.43	11321	44.32
Discussed FP w/ Partner (%)	10384	4.53	11321	7.79

Table 2: Descriptive Statistics (Children)

	b. 1999-2000		b. 2004-2005	
Variable	**Obs**	**Mean**	**Obs**	**Mean**
Age (Months)	1644	5.87	857	5.49
Birthweight (g)	475	3353.78	277	3399.68
Avg. Size (or Greater) (%)	1638	88.22	854	88.06
Health Problem (Last Week) (%)	1642	62.06	855	46.55
Mother Married (%)	1644	5.00	857	0.46
Mother Has Secondary Ed. (%)	1644	11.92	857	8.28
Pro. Prenatal Care (%)	1607	93.59	851	95.06
Pro. Birth Assistance (%)	1643	29.21	856	31.78
Full Vaccinations (%)	1630	12.21	851	11.40

Table 3: Regional Variation in Contraceptive Availability by Conraceptive Access Definition

	Could Get a Condom		
	2000	**2005**	**% Change**
City of Kigali	18.42	49.90	**170.83**
Kigali Ngali	22.91	18.14	-20.84
Gitarama	14.84	0.26	72.61
Butare	12.39	29.20	**135.58**
Gikongoro	14.50	13.25	-8.58
Cyangugu	24.12	18.15	-24.75
Kibuye	21.70	9.87	-54.50
Gisenyi	6.09	11.76	92.98
Ruhengeri	48.49	19.61	-59.56
Byumba	26.65	26.93	0.01
Umutara	12.68	31.10	**145.35**
Kibungo	14.99	28.31	88.88

	Told About FP at Clinic			Heard About FP in Media		
	2000	**2005**	**% Change**	**2000**	**2005**	**% Change**
City of Kigali	25.59	18.24	-28.74	33.56	66.64	**98.58**
Kigali Ngali	22.17	21.88	-1.33	38.41	21.47	-44.11
Gitarama	16.17	34.88	**115.70**	28.50	32.92	15.50
Butare	23.67	25.76	8.84	19.37	41.20	**112.64**
Gikongoro	10.47	41.62	**297.72**	26.06	40.90	56.96
Cyangugu	34.57	37.08	7.24	43.03	36.98	-14.06
Kibuye	14.52	62.39	**329.63**	39.72	32.81	-17.40
Gisenyi	20.11	20.26	0.72	21.61	28.29	30.95
Ruhengeri	16.83	35.41	**110.41**	70.06	52.52	-25.04
Byumba	20.77	48.24	**132.29**	46.12	49.78	7.94
Umutara	31.82	28.03	-11.91	23.00	44.17	92.02
Kibungo	30.83	17.68	-42.65	39.84	50.39	26.49

Table 4: Estimates of the Effects of Increases in Condom Access on Fertility Outcomes

VARIABLES	(1) Pr[birth 1yr]	(2) Pr[birth 3yr]	(3) E[births 3yr]	(4) Pr[birth 1yr]	(5) Pr[birth 3yr]	(6) E[births 3yr]
Condom Region	0.0217**	0.00463	-0.00294	0.0197**	0.00162	-0.00661
	(0.00969)	(0.0121)	(0.0153)	(0.00962)	(0.0122)	(0.0151)
yr2005	-0.00413	0.0299***	0.0450***	-0.0140**	0.0118	0.0221**
	(0.00676)	(0.00854)	(0.0110)	(0.00679)	(0.00869)	(0.0109)
Region x 2005	**-0.0306****	**-0.0633*****	**-0.0645*****	-0.0185	**-0.0410****	**-0.0349***
	(0.0120)	(0.0161)	(0.0213)	(0.0124)	(0.0165)	(0.0211)
Age	0.00159***	0.00864***	0.0130***	0.00190***	0.00887***	0.0131***
	(0.000435)	(0.000627)	(0.000842)	(0.000435)	(0.000632)	(0.000828)
Education Years	0.000816	0.00377***	0.00508***	-0.000764	0.000849	0.00142
	(0.000919)	(0.00116)	(0.00153)	(0.000922)	(0.00119)	(0.00152)
Previous Kids (1yr)	0.00155			-0.00243		
	(0.00202)			(0.00205)		
Ideal Kids	0.00580***	0.00664***	0.0145***	0.00690***	0.00862***	0.0165***
	(0.00161)	(0.00212)	(0.00275)	(0.00161)	(0.00214)	(0.00272)
Previous Kids (3yr)		-0.00142	-0.0220***		-0.00709**	-0.0288***
		(0.00288)	(0.00404)		(0.00294)	(0.00403)
Talk FP w/ Partner				0.212***	0.397***	0.490***
				(0.0149)	(0.0134)	(0.0191)
Constant			0.0493*			0.0409*
			(0.0252)			(0.0247)
Observations	20984	20984	20984	20984	20984	20984
R-squared			0.023			0.058

Robust standard errors in parentheses

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

Table 5: Estimates of the Effects of Increases in Being Told about FP at Health Clinc Visits on Fertility Outcomes

VARIABLES	(1) Pr[birth 1yr]	(2) Pr[birth 3yr]	(3) E[births 3yr]	(4) Pr[birth 1yr]	(5) Pr[birth 3yr]	(6) E[births 3yr]
Clinic Region (Alt)	0.0138	0.0527***	0.0496***	0.0113	0.0493***	0.0441**
	(0.0119)	(0.0151)	(0.0189)	(0.0118)	(0.0152)	(0.0186)
yr2005	-0.00822	0.0228***	0.0386***	-0.0158**	0.00871	0.0209**
	(0.00631)	(0.00801)	(0.0103)	(0.00632)	(0.00813)	(0.0102)
Region x 2005	-0.0222	-0.0277	-0.0354	-0.0183	-0.0212	-0.0269
	(0.0145)	(0.0194)	(0.0254)	(0.0147)	(0.0197)	(0.0249)
Age	0.00160***	0.00856***	0.0129***	0.00194***	0.00882***	0.0130***
	(0.000434)	(0.000627)	(0.000841)	(0.000434)	(0.000631)	(0.000827)
Education Years	0.000644	0.00334***	0.00459***	-0.000847	0.000579	0.00114
	(0.000913)	(0.00115)	(0.00153)	(0.000916)	(0.00118)	(0.00151)
Previous Kids (1yr)	0.00153			-0.00255		
	(0.00202)			(0.00205)		
Ideal Kids	0.00596***	0.00666***	0.0146***	0.00699***	0.00850***	0.0165***
	(0.00160)	(0.00212)	(0.00274)	(0.00160)	(0.00214)	(0.00271)
Previous Kids (3yr)		-0.00101	-0.0215***		-0.00684**	-0.0285***
		(0.00288)	(0.00404)		(0.00294)	(0.00403)
Talk FP w/ Partner				0.212***	0.399***	0.493***
				(0.0148)	(0.0133)	(0.0190)
Constant			0.0418*			0.0329
			(0.0252)			(0.0247)
Observations	20984	20984	20984	20984	20984	20984
R-squared			0.023			0.058

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6: Estimates of the Effects of Increases in FP Prevalence in the Media on Fertility Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Pr[birth 1yr]	Pr[birth 3yr]	E[births 3yr]	Pr[birth 1yr]	Pr[birth 3yr]	E[births 3yr]
Media Region (Alt)	0.0153	-0.00398	-0.0219	0.0172	0.000407	-0.0168
	(0.0157)	(0.0198)	(0.0243)	(0.0157)	(0.0199)	(0.0240)
yr2005	-0.0105*	0.0195**	0.0343***	-0.0182***	0.00513	0.0163*
	(0.00610)	(0.00770)	(0.00995)	(0.00611)	(0.00783)	(0.00980)
Region x 2005	-0.0206	-0.0394	-0.0288	-0.0136	-0.0268	-0.0121
	(0.0192)	(0.0258)	(0.0332)	(0.0195)	(0.0262)	(0.0329)
Age	0.00160***	0.00864***	0.0130***	0.00192***	0.00887***	0.0131***
	(0.000435)	(0.000627)	(0.000841)	(0.000435)	(0.000632)	(0.000828)
Education Years	0.000682	0.00325***	0.00447***	-0.000805	0.000508	0.00104
	(0.000915)	(0.00116)	(0.00153)	(0.000918)	(0.00118)	(0.00152)
Previous Kids (1yr)	0.00151			-0.00249		
	(0.00202)			(0.00206)		
Ideal Kids	0.00595***	0.00710***	0.0150***	0.00697***	0.00892***	0.0168***
	(0.00161)	(0.00212)	(0.00275)	(0.00161)	(0.00213)	(0.00272)
Previous Kids (3yr)		-0.00142	-0.0220***		-0.00709**	-0.0288***
		(0.00288)	(0.00404)		(0.00295)	(0.00403)
Talk FP w/ Partner				0.213***	0.399***	0.493***
Region x 2005				(0.0149)	(0.0133)	(0.0190)
			0.0494**			0.0401
			(0.0250)			(0.0246)
Observations	20984	20984	20984	20984	20984	20984
R-squared			0.022			0.057

Robust standard errors in parentheses

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

Table 7: Estimates of the Effects of Increases in Condom Access on Chld Health Outcomes

	(1)	(2)	(3)
VARIABLES	Pr[healthproblem]	Pr[avg size]	E[birthweight]
Condom Region (Alt)	0.169***	-0.0307	-154.8
	(0.0488)	(0.0362)	(127.4)
yr2005	-0.161***	-0.00892	42.15
	(0.0237)	(0.0154)	(61.10)
Region x 2005	-0.0437	0.0106	**298.7***
	(0.0911)	(0.0493)	(170.1)
Age	0.000921	-0.00195	-15.79***
	(0.00259)	(0.00160)	(5.858)
Education Years	-0.00744**	0.000513	12.84
	(0.00351)	(0.00217)	(8.044)
Married	0.0136	0.00986	36.11
	(0.0227)	(0.0143)	(57.76)
Ideal Kids	-0.00319	-0.00314	-0.223
	(0.00634)	(0.00400)	(18.54)
Siblings (1yr)	-0.0161*	0.0106*	92.83***
	(0.00883)	(0.00581)	(19.90)
Constant			3,537***
			(160.5)
Observations	2439	2435	733
R-squared			0.043

Robust standard errors in parentheses

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

Table 8: Estimates of the Effects of Increases in Being Told about FP at Clinic Visits on Child Health Outcomes

	(1)	(2)	(3)
VARIABLES	Pr[healthproblem]	Pr[avg size]	E[birthweight]
Clinic Region	0.0486*	0.0219	94.17
	(0.0276)	(0.0169)	(70.54)
yr2005	-0.121***	-0.00560	130.6*
	(0.0295)	(0.0186)	(72.23)
Region x 2005	**-0.107****	-0.00447	-118.2
	(0.0470)	(0.0300)	(115.2)
Age	0.00177	-0.00195	-15.73***
	(0.00259)	(0.00159)	(5.718)
Education Years	-0.00732**	0.000127	12.70
	(0.00351)	(0.00216)	(7.918)
Married	0.0153	0.0106	39.03
	(0.0228)	(0.0143)	(57.79)
Ideal Kids	-0.00414	-0.00335	-2.235
	(0.00635)	(0.00401)	(18.57)
Siblings (1yr)	-0.0189**	0.0109*	93.88***
	(0.00883)	(0.00578)	(19.63)
Constant			3,480***
			(163.5)
Observations	2439	2435	733
R-squared			0.042

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9: Estimates of the Effects of Increases in FP Prevalence in the Media on Child Health Outcomes

	(1)	(2)	(3)
VARIABLES	Pr[healthproblem]	Pr[avg size]	E[birthweight]
Media Region	0.136***	-0.0585**	-209.7*
	(0.0358)	(0.0268)	(108.7)
yr2005	-0.151***	-0.0120	56.08
	(0.0248)	(0.0163)	(63.90)
Region x 2005	**-0.120***	0.0292	197.3
	(0.0631)	(0.0310)	(143.9)
Age	0.000967	-0.00180	-15.39***
	(0.00259)	(0.00161)	(5.843)
Education Years	-0.00647*	0.000338	14.25*
	(0.00349)	(0.00216)	(8.002)
Married	0.0133	0.00906	31.33
	(0.0227)	(0.0143)	(57.89)
Ideal Kids	-0.00396	-0.00302	-0.282
	(0.00634)	(0.00401)	(18.57)
Siblings (1yr)	-0.0166*	0.0101*	91.73***
	(0.00881)	(0.00583)	(19.84)
Constant			3,530***
			(160.2)
Observations	2439	2435	733
R-squared			0.044

Robust standard errors in parentheses

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

Table 10: Estimates of the Effects of Increases in Condom Access on Birth Disribution by Mother Characteristics

VARIABLES	(1) Pr[married]	(2) Pr[seconded]
Condom Region (Alt)	-0.0622	-0.0290
	(0.0522)	(0.0213)
yr2005	-0.0397*	-0.0417***
	(0.0237)	(0.0120)
Region (Alt) x 2005	-0.0711	**0.383*****
	(0.0825)	(0.1000)
Age	0.00742***	0.00202
	(0.00257)	(0.00131)
Education Years	0.0334***	
	(0.00352)	
Siblings (1yr)	0.0384***	-0.0154***
	(0.00904)	(0.00502)
Observations	2499	2499

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 11: Estimates of the Effects of Increases in Being Told About FP at Health Clinic Visits on Birth Distribution by Mother Characteristics

VARIABLES	(1) Pr[married]	(2) Pr[seconded]
Clinic Region (Alt)	-0.119***	0.0339
	(0.0380)	(0.0232)
yr2005	-0.0747***	-0.0121
	(0.0244)	(0.0128)
Region (Alt) x 2005	**0.178*****	-0.0573***
	(0.0570)	(0.0185)
Age	0.00679***	0.00225*
	(0.00259)	(0.00129)
Education Years	0.0329***	
	(0.00348)	
Siblings (1yr)	0.0400***	-0.0167***
	(0.00899)	(0.00495)
Observations	2499	2501

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 12: Estimates of the Effects of Increases in FP Prevalence in the Media on Birth Distribution by Mother Characteristics

VARIABLES	(1) Pr[married]	(2) Pr[seconded]
Media Region	-0.0487	-0.0535***
	(0.0373)	(0.0145)
yr2005	-0.0368	-0.0473***
	(0.0249)	(0.0124)
Region x 2005	-0.0331	**0.266*****
	(0.0629)	(0.0733)
Age	0.00747***	0.00210
	(0.00257)	(0.00130)
Education Years	0.0329***	
	(0.00350)	
Siblings (1yr)	0.0382***	-0.0157***
	(0.00903)	(0.00493)
Observations	2499	2501

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix 1: Estimates of the Effects of Increases in Condom Access on Age at 1st Birth for Women 1st Giving Birth 1997-2000 2002-2005

VARIABLES	(1) E[age at 1stbirth]	(2) E[age at 1stbirth]	(3) E[age at 1stbirth]
yr2005	0.559**	0.587***	0.557***
	(0.219)	(0.208)	(0.201)
Condom Region	-0.0356		
	(0.328)		
Condom Region x 2005	0.306		
	(0.428)		
Clinic Region (Alt)		-0.319	
		(0.369)	
Clinic Region (Alt) x 2005		0.122	
		(0.474)	
Media Region (Alt)			-0.491
			(0.513)
Media Region (Alt) x 2005			1.000
			(0.635)
Education Years	0.283***	0.283***	0.285***
	(0.0328)	(0.0326)	(0.0325)
Ideal Kids	-0.0239	-0.0167	-0.0265
	(0.0578)	(0.0582)	(0.0579)
Constant	20.30***	20.33***	20.32***
	(0.389)	(0.387)	(0.384)
Observations	1540	1540	1540
R-squared	0.075	0.075	0.076

Robust standard errors in parentheses

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

Appendix 2: Estimates of the Effects of Increases in Condom Access on Child/Mother Care Outcomes

	(1)	(2)	(3)
VARIABLES	Pr[proprenatalcare]	Pr[proassisted]	Pr[vaccinatedfull]
Condom Region	0.0167*	-0.0280	0.0552***
	(0.0102)	(0.0265)	(0.0208)
yr2005	0.0288***	0.00422	0.0258
	(0.00977)	(0.0236)	(0.0179)
Region x 2005	-0.0830**	**0.137*****	-0.0736***
	(0.0404)	(0.0524)	(0.0188)
Age	-0.000559	0.00110	0.000380
	(0.00103)	(0.00239)	(0.00165)
Education Years	0.00519***	0.0337***	0.00139
	(0.00143)	(0.00294)	(0.00216)
Married	0.0160*	0.0423**	0.0608***
	(0.00933)	(0.0198)	(0.0148)
Ideal Kids	-0.00250	-0.0235***	2.61e-05
	(0.00247)	(0.00636)	(0.00443)
Siblings (1yr)	-0.00155	-0.0322***	-0.00590
	(0.00322)	(0.00853)	(0.00582)
Observations	2401	2441	2424

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix 3: Estimates of the Effects of Increases in Being Told About FP at Health Clinic Visits on Child/Mother Care Outcomes

VARIABLES	(1) Pr[proprenatalcare]	(2) Pr[proassisted]	(3) Pr[vaccinatedfull]
Clinic Region	-0.0157	0.0585**	-0.0136
	(0.0109)	(0.0247)	(0.0171)
yr2005	-0.00515	0.0487*	-0.0237
	(0.0117)	(0.0269)	(0.0190)
Region x 2005	**0.0422*** **	-0.0259	**0.0656***
	(0.00854)	(0.0384)	(0.0381)
Age	-0.000640	0.00146	0.000324
	(0.00102)	(0.00238)	(0.00166)
Education Years	0.00518***	0.0333***	0.00111
	(0.00142)	(0.00294)	(0.00217)
Married	0.0138	0.0420**	0.0589***
	(0.00897)	(0.0198)	(0.0149)
Ideal Kids	-0.00213	-0.0251***	0.000617
	(0.00242)	(0.00636)	(0.00437)
Siblings (1yr)	-0.00112	-0.0332***	-0.00532
	(0.00318)	(0.00849)	(0.00589)
Observations	2401	2441	2424

Robust standard errors in parentheses

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

Appendix 4: Estimates of the Effects of Increases in FP Prevalence in the Media on Child/Mother Care Outcomes

VARIABLES	(1) Pr[proprenatalcare]	(2) Pr[proassisted]	(3) Pr[vaccinatedfull]
Media Region	-0.0196	-0.0768**	0.0452*
	(0.0168)	(0.0304)	(0.0263)
yr2005	0.0173*	0.00957	0.0114
	(0.00960)	(0.0220)	(0.0164)
Region x 2005	-0.00934	**0.203*****	-0.0620**
	(0.0273)	(0.0670)	(0.0246)
Age	-0.000429	0.00130	0.000272
	(0.00105)	(0.00239)	(0.00165)
Education Years	0.00513***	0.0336***	0.00111
	(0.00146)	(0.00294)	(0.00218)
Married	0.0161*	0.0405**	0.0607***
	(0.00939)	(0.0198)	(0.0148)
Ideal Kids	-0.00241	-0.0237***	0.000492
	(0.00253)	(0.00635)	(0.00439)
Siblings (1yr)	-0.00194	-0.0328***	-0.00523
	(0.00327)	(0.00854)	(0.00584)
Observations	2401	2441	2424

Robust standard errors in parentheses

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

Appendix 5: Estimates of the Effects of Increases in Condom Access on Fertility Outcomes, Reduced Sample

VARIABLES	(1) Pr[birth 1yr]	(2) Pr[birth 3yr]	(3) E[births 3yr]
Condom Region	0.0146	-0.00216	-0.0124
	(0.00993)	(0.0126)	(0.0160)
yr2005	-0.0157**	0.0191**	0.0267**
	(0.00772)	(0.00973)	(0.0126)
Region x 2005	-0.0210	**-0.0544*** **	**-0.0489** **
	(0.0129)	(0.0168)	(0.0221)
Age	0.00151***	0.00862***	0.0130***
	(0.000477)	(0.000684)	(0.000916)
Education Years	0.00117	0.00428***	0.00587***
	(0.00102)	(0.00129)	(0.00170)
Previous Kids (1yr)	0.00156		
	(0.00221)		
Ideal Kids	0.00530***	0.00598***	0.0132***
	(0.00177)	(0.00232)	(0.00298)
Previous Kids (3yr)		-0.00169	-0.0230***
		(0.00313)	(0.00439)
Constant			0.0632**
			(0.0276)
Observations	16850	16850	16850
R-squared			0.022

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix 6: Estimates of the Effects of Increases in Condom Access on Select Child-Level Outcomes, Reduced Sample

	(1)	(2)
VARIABLES	Pr[seconded]	E[birthweight]
Condom Region (Alt)	-7.59e-08	-91.60
	(1.83e-07)	(121.7)
yr2005	2.71e-08	74.63
	(1.22e-07)	(65.82)
Region x 2005	1.35e-06	254.0
	(4.27e-06)	(164.5)
Age	-4.14e-08	-21.01***
	(8.64e-08)	(6.334)
Education Years	5.44e-07	7.808
	(1.19e-06)	(8.567)
Married		59.60
		(59.74)
Ideal Kids		1.660
		(20.78)
Siblings (1yr)	2.70e-08	96.60***
	(6.92e-08)	(21.05)
Constant		3,655***
		(175.6)
Observations	2027	521
R-squared		0.048

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1