Early Fertility and Labor Market Segmentation: Evidence from Madagascar

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Selected Paper prepared for presentation at the 2016 Agricultural & Applied Economics Association Annual Meeting, Boston, Massachusetts, July31-August2

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Draft May, 2016
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Abstract

Women represent the majority of informal sector workers in developing countries. This is especially true in Sub-Saharan Africa where early childbearing rates are still high. However, to date, there is little empirical evidence on the role of early fertility in female labor force participation in the informal sector. We analyze the effect of young women's timing of first birth on her entry into the labor market and selection into different types of employment. Using a panel survey in Madagascar, designed to capture the transition from adolescence to adulthood, and a multinomial approach, we estimate the effect of early childbearing on selection into four employment categories: non-participation, informal, formal, and student. Our results suggest that young mothers are more likely to work than young women without children. However, women whose first birth occurred during adolescence largely select into low-quality informal jobs. This effect is partially, but not entirely, mediated by the effect of adolescent pregnancy on schooling.

Keywords: Fertility, informal sector, adolescence, female labor force participation, Madagascar

Introduction

Female labor force participation is both an important driver and outcome of successful economic development (Verick, 2014). Policymakers have long been interested in increasing women's employment and improving their work opportunities in developing countries. Evidence suggests that women typically earn less, work in less productive jobs, and are more likely to work in unpaid or informal employment than their male counterparts (Verick 2014, World Bank 2012). In 2012, the World Bank estimated that, although women make up only approximately 40% of the total global workforce, they account for 58% of all unpaid work and 50% of informal sector employment. In Sub-Sahara Africa, these numbers are even starker where approximately 80% of the female labor force is self-employed or are unpaid family workers.

In the context of developing countries, the empirical evidence on the causal effect of fertility on women's labor supply is not conclusive. Using instrumental variables approach, some studies find that fertility has a negative causal effect on female labor force participation (Cruces and Galiani, 2007; Bloom et al; 2009 Caceres-Delpiano 2012), while others find that OLS estimates of this effect are upwardly biased and that fertility, in fact, does not have a causal effect (Agüero and Marks, 2011).[1] Nevertheless, this empirical evidence agrees on suggesting that fertility decreases the probability of women's employment in the formal sector particularly among young women (Miller, 2010; Agüero and Marks, 2011; Urdinola and Ospino, 2015). This finding is plausible because informal and/or self-employment can be more compatible with the time investments that motherhood demands. Indeed, a recent study by Heath (2016) reconciles

[1] These empirical studies have used different instruments for fertility and family size including sex composition of the first two children (Cruces and Galiani, 2007), multiple births (Caceres- Delpiano, 2012), infertility shocks (Agüero and Marks, 2011) and legal restriction to abortion (Bloom et al; 2007).Thus, the local average treatment effects in these studies are defined accordingly to the instrumental variables used.

these two streams of the empirical evidence by finding that fertility decreases the extensive margin of women's labor supply. However, for women already in the labor force, fertility increases their working hours, mainly in self-employed labor activities. Heath (2016) provides a theoretical model to explain these results in which women increase their labor supply if their returns to financial inputs in children's outcomes are sufficiently high compared to their returns in time investments.

These studies highlight the role of fertility in women's participation in informal sector employment in developing countries. The segmentation of the labor markets in these countries into distinct formal and informal sectors of employment, where job quality, job security, and earnings potential differ, motivates the need to understand not just the determinants of labor force participation in general, but the selection into different sectors. In this regard, previous research on labor market segmentation focuses on the role of education. Considerable evidence indicates that education plays a major role in increasing the likelihood of individuals being employed as formal wage earners with associated higher pay (De Beyer and Knight, 1989; Gindling, 1991; Glick and Sahn, 1997; Khandker, 1992; Vijverberg, 1986, 1993; Sahn and Villa, 2014).

This paper explores the effect of the timing of the first birth, particularly during adolescence, not only on female labor market participation but also on the selection into different types of employment among young women in Madagascar.[2] Specifically, we explore the effect of having a first child during adolescence as opposed to post-adolescence on out labor outcomes of interest. We additionally estimated the effect of delaying childbirth by one year. Finally, we investigate the extent to which the impact of early childbearing is mediated through its effect on school attainment. This paper uses a 2012 panel data survey that follows a cohort of young

[2] We define the period of adolescence as the ages between 13 and 18 years old.

women aged 21-23 years old, first interviewed in 2004 at the age of 13-16 in Madagascar, designed to capture the transition from adolescence to adulthood. We employ a multinomial logistic approach to estimate the effect of early childbearing on labor market participation as well as on selection into four employment categories: formal sector employment, informal sector employment, non-participation in the labor market and student.

To address the endogeneity between fertility and employment outcomes, we instrument the timing of the first birth with the young women's community-level access to condoms.[3]We further examine the extent to which this effect is direct, due to the demands of motherhood, and indirect, operating through reduced human capital that results from pregnancy forcing women prematurely to terminate their education (Herrera and Sahn, 2015). Clearly, schooling is also endogenous to labor market outcomes. To account for this endogeneity, we instrument individual grade attainment using information on the local primary school infrastructure when the women in our data were in early adolescence.

We find that mothers are more likely to participate in the labor market compared to those young women who do not have children yet. But the timing of motherhood matters regarding the probability of working and the sector of participation. Women who had their first child during adolescence are much more likely to be working than those who had their first child post-adolescence. However, while women who began motherhood as teenagers are more likely to be working, we find that they are predominately employed in the informal sector. After accounting for the endogeneity between fertility and labor market decisions, we find that adolescent fertility increases the likelihood of working in the informal sector by approximately 60% but does not have a statistically significant effect on the likelihood of participating in the formal sector. Labor market sectoral selection does not significantly differ between women who had their first child

[3] Our identification strategy is discussed in further detail below.

post-adolescence and those who have not yet had a child. These informal jobs, employing mothers who gave birth as teenagers, are predominately in family agricultural enterprises, presumably, allowing them to combine motherhood demands and economic activities. Our findings further suggest that school attainment is an important channel through which teen motherhood affects labor market sectoral selection. Early childbearing disrupts young women's human capital accumulation and subsequently pushes them into less economically-desirable jobs compared to their non-mother counterparts and mothers who have delayed childbirth until they passed through adolescence.

Consistent with these findings, we also find that by postponing the age of first birth by one year the young women's likelihood of working in the informal sector decreases by 8% and this effect is also mediated by school attainment. Overall, these results point out that the younger the women in our sample have their first birth the more likely they are to work in the informal sector.

Our paper contributes to the limited empirical evidence that analyzes the role of young women's fertility in determining their labor market opportunities during the transition from adolescence to adulthood. During this period young women face considerable trade-offs between schooling, becoming mothers, entering the labor force, and the type of work they want and are offered. Different from the studies mentioned above, we analyze the age first birth timing effect on labor market outcomes rather than estimating the extensive and/or intensive effect of fertility in these outcomes. We also depart from this empirical evidence in that we employ an instrumental variable approach to address that women's fertility and school attainment are endogenous to the decision to work.

We also contribute to the literature that analyses gender gaps in developing countries. In the case of Madagascar, some studies find that the average earnings gender gap is large in the informal sector, particularly in the non-farm self-employment activities. This is plausible because women self-select into industries in which they can combine market-oriented and domestic activities (Nordman, 2010; Vaillant and Norman, 2014). While examining gender gaps is beyond the scope of this paper, our findings on the role of first birth timing in selecting into the informal sector suggest this could be a possible mechanism driving these gender gaps.

The remainder of this paper is organized as follows. Section 2 describes our data and the Madagascar context. Section 3 presents our empirical model. Section 4 discusses the results while the last section concludes and discusses policy implications.

II. Data and Descriptive Statistics

This paper uses data from the *Madagascar Life Course Transitions of Young Adults Survey.* In 2011-2012, this survey re-interviewed a cohort of 1,949 young adults between the ages of 21 and 24, who were originally surveyed in 2004 when they were between 13 and 16 years old. This panel data survey was specifically designed to capture the transition from adolescence to young adulthood and thus collected detailed information on individual and household characteristics and family background. These data additionally include extensive information on schooling, fertility, marriage, labor market outcomes as well as a range of economic outcomes and life-course events going back to 2004.

In 2012 and 2004, these surveys also interviewed community leaders, teachers, and health personnel regarding community-level availability of social and economic infrastructure and services, including family planning, as well as the date these services first became available

in the community. We complement this information at the community level with the 2001 and 2007 commune censuses which include a wide range of information on basic public services and infrastructure.

Among these young adults, 859 are women, 466 of which gave birth at least once by the time of the 2012 survey. Due to missing information on certain variables, our final working sample includes 788 women, 414 of which were mothers by the time of the 2012 survey. The average age of first birth in this sample is 18 years, which is consistent with the 2009 Demographic Health Survey (DHS) national-level data

The women in our sample are young and many of them are not yet mothers, although most will be in the future since the vast majority of women in Madagascar have at least one child during their reproductive life. According to 2009 DHS, only 2.7% of women who are married or in a union between the ages of 35 and 39 are childless. This nearly universality in motherhood is consistent with the Madagascar's total fertility rate of 4.9 children per woman.

Consequently, we assume in our analysis we refer to the 374 women in our sample who have not yet begun childbearing as *not-yet mothers*, rather than non-mothers. While numerous studies are interested in the intensive and/or extensive margin of fertility on female labor outcomes, we are instead interested in the effect of the timing of a woman's first birth on her labor market participation and sectoral selection. Using information on the age of first birth, we generate a 3-category variable for *maternal status* based on fertility timing as follows: i-) *teen mothers*, whose age of first birth is 18 or less; ii-) *young mothers*, who had their first child later than age 18 but before the time of the 2012 survey, i.e., when they predominately in their early twenties, and iii-) *not-yet mothers*. *Teen mothers*, *young mothers*, and *not-yet mothers* represent 29%, 24%, and 47%, respectively, of this sample of young adults females.

<<Insert Table 1 >>

Table 1 describes the socioeconomic characteristics by maternal status. The average age *teen mothers* and *young mothers* give birth to their first child is 16.77 and 20.23, respectively. *Not-yet mothers* complete higher levels of education compared with the other two mother groups. On average, the *not-yet mothers* have 9 years of schooling while *young mothers* have 7 years and *teen mothers* 5.9 years. These differences are statistically significant. In fact, for the same sample of women, Herrera and Sahn (2015) show that early childbearing causally increases the likelihood of dropping out of school by 44% and decreases the probability of secondary school completion by 48%.

Table 2 describes the labor outcomes of the women in this sample based on the timing of their first fertility experience. Both *young* and *teen mothers* have higher labor market participation rates than their *not-yet mother* counterparts. Approximately 60% of the *not-yet-mothers* report that they are currently working in the informal or formal sectors as opposed to 83% and 89% of the *young* and *teen mothers*, respectively.

Our interest is not only in measuring the effect of fertility timing on female labor force participation but also on the quality of employment these women receive when they do work. We therefore model the selection of these women into four employment categories: formal sector, informal sector, student, and non-participation. A woman is considered to be employed in the formal sector if her main employment activity is in public administration, in a formal public or private enterprise or if she works in a nongovernmental organization (NGO). She is also considered to be employed in formal work if she works in a family enterprise or does domestic work in another household *and* earns regular wages or a salary for that work. A

woman is considered to be employed in the informal sector if her main employment activity is working in a family-owned enterprise or doing domestic work in another household *and* her remuneration status is listed as self-employed or unpaid. She is also considered to be employed in the informal sector if her main employment activity is listed as self-employment.[4]

<<Insert Table 2 >>

Looking at Table 2 we see that young Malagasy women are largely employed in the informal sector; indeed, 62% of our sample women work in informal sector while only 12% report that they are working in a formal job. While the majority of all women in Madagascar work in informal jobs, this push of women into these lower quality jobs appears exacerbated by motherhood. Almost 73% and 80% of the *young* and *teen mothers*, respectively, in our sample work in the informal sector whereas under 50% of *not-yet mothers* do.

Figure 1 elucidates further the types of jobs these women are engaged in, and shows the distribution of employment types by maternal status. We observe that approximately 10% of *young* and *not-yet mothers* are employed in public administration or a formal public or private enterprise as opposed to only 5% of *teen mothers*. *Not-yet mothers* are also much more likely to be still enrolled in school. By the time of the 2012 survey, while 27% of the *not-yet mothers* were enrolled in school, only 2% of each of the other two mother groups were still students. We further observe that the proportion of women working in self-employment or a family-owned enterprise increases the younger they are when they give birth to their first child. Approximately 16% and 31% of *not-yet mothers* are working in self-employment or a family enterprise,

[4] A handful of women in the sample claimed to be unemployed but also reported performing unpaid non-domestic work including agricultural work, fishing, preparing items for sale, domestic activities in another household, animal keeping, meal service in a restaurant, repairs, etc. Performing domestic work in their own household was not counted as participating in the labor market. We also categorized these women as working in the informal sector.

respectively. These proportions increase to 27% and 43%, respectively, for *young mothers* and 29% and 46%, respectively, for *teen mothers.*

Most of the family enterprises in this sample are in the agricultural sector. In fact, 81% of the family-owned enterprises and 65% of the self-employment occupations worked by our sample women are livestock or agriculture related. Mothers, in particular, seem to be working in family-owned enterprises related to agriculture. Only 72% of *not-yet mothers* working in family enterprises are working in agriculture. This proportion increases to 80% of *young mothers* and 92% of *teen mothers* who report their main occupation as working in a family enterprise. Thus, mothers, especially those who had children during adolescence, appear to have a higher propensity of doing agriculturally related work in a family enterprise. This trend is especially troubling because 90% of the sample women who report working in a family-owned enterprise report their remuneration status in this occupation as "unpaid". Presumably, these women receive some form of non-monetary compensation such as room, board, and help with childcare. Nonetheless, this trend points to a lack of options for women working in these low-quality informal sector jobs.

III. Empirical Methodology

The vast majority of women in Madagascar (as well as most other developing countries) will become mothers at some stage of life. And while we are interested in exploring the effect of early childbearing, on female selection into different labor market sectors, the timing of a woman's first birth is likely correlated with unobserved characteristics that are also determinants of the labor market outcomes of interest. For example, women who bear children at a very young

age may also possess characteristics that make them more likely to work in the informal than the formal labor market. Similarly, women who delay childbearing to older ages may also have preferences or other unobserved characteristics making them more likely to work in the formal sector. Indeed, women may intentionally delay childbearing to acquire the necessary skills needed for a particular type of work. Finally, women who have children at younger ages may also have lower preferences for work in general. We, therefore, use instrumental variable approach to address the endogeneity between fertility timing and labor market outcomes.

First Stage: Fertility

Following the earlier work of Herrera and Sahn (2015), we instrument for maternal status using two variables that measure access to condoms at the community level: whether or not condoms were available in the woman's 2012 community of residence, and a variable indicating a woman's community-level exposure to condoms, which we define as the number of years condoms were available in her community since the age of 15. We chose this age cut-off because the average age of first birth in our sample is 18. [5] It is worth noting here that this information is not self- reported but instead collected from community leaders surveyed for the community modules of the data.

The assumption behind this identification strategy is that access/exposure to condoms lowers fertility control costs among young women and affects their schooling and labor market decisions through a reduction of early pregnancy rather than through a direct effect. We use condom access as an instrumental variable for early fertility because they are the primary mode of contraception for women before their first birth, in contrast to other forms of contraception,

[5] We also chose this age cut-off because the average age of sexual initiation in Madagascar is 17 according to 2009 DHS. Additionally, Herrera and Sahn (2015) present sensitivity analysis that validating this age cut-off for these data as well as analysis testing the validity of this instrument.

such as pills or injectables, that are primarily used to space children within the family after the first birth. Relevant for the identification strategy, we observe in Table 2 that although there is a higher prevalence of modern contraception use among mothers, these mothers are less likely to have access to family planning services, in particular, condoms. While 84% of the *not-yet mothers* have community-level availability of condoms, only 76% and 66% of the *young* and *teen mothers*, respectively, have access to this contraception method in the community where they live in 2012. The higher prevalence of modern contraception among mothers compared to their childless counterparts is consistent with the fact that women in Madagascar use more long-term modern contraception to space children rather than to prevent the first birth.

<<Insert Table 3>>

Instrumenting for maternal status presents a couple econometric challenges. Firstly, the endogenous variable maternal status is a three-category variable: *teen mother*, *young mother* and *not-yet mother*. Therefore, we estimate the first stage by predicting maternal status as multinomial logistic function where the probability of a young woman *i* in community *j* and region *r* being in maternal status *m*, is

(1) $$P_{ijr}^{m} = \frac{e^{\alpha^{m} Z_{ijr}}}{\sum_{n=1}^{3} e^{\alpha^{n} Z_{ijr}}} \text{ where } m \in \{1,2,3\} \text{ and}$$

(2) $$\alpha^{m} Z_{ijr} = \alpha_{0}^{m} + \alpha_{2}^{m} Condom_{jr} + \alpha_{3}^{m} X_{ijr} + \alpha_{4}^{m} C_{jr} + \alpha_{5}^{m} R_{r} \nu_{ir}^{m}$$

The variable $Condom_{jr}$ is a vector of our two instruments indicating community-level access to condoms for woman *i* and X_{ijr} and C_{jr} are vectors of individual- and community-level controls, respectively, and will be discussed further below. R_r is a vector of regional dummy variables. There may be some concern over the exogeneity of access to condoms in the communities due to the possibility of non-random program placement; i.e., condom programs are potentially located in communities where teen pregnancies are the highest or where the population is more inclined to use contraception (Pörtner et al, 2012; Molyneux and Gertler, 2000; Pitt et al; 1993). To address this issue, a paper by Herrera and Sahn (2015) is focused on designing a series of economic and related robustness checks to examine the appropriateness of these instruments. These include showing that 2012 condom availability in this sample does not depend on community-level factors such as 2006 fertility variables, 2001 poverty and population measures and religion and/or ethnic composition. Likewise they perform several placebo tests, including showing that access to condoms does not have a statistically significant effect on the school outcomes of males surveyed for these data, in contrast to affecting female schooling outcomes, indicating that the mechanism through which condom exposure is affecting our outcomes of interest is indeed fertility and not some other set of community-level correlates.

We estimate the female selection into different labor market sectors using a multinomial logistic model. A traditional instrumental variable approach in which maternal status is replaced by its first-stage predicted value in the second stage will not yield a consistent estimate of our parameter of interest due to the nonlinearity of the multinomial logistic function (Terza et al. 2008). To address this concern, we employ a control function approach (also referred to as a two-stage residual inclusion method), which remains consistent in this nonlinear framework (Terza et

al. 2008). To do so, we include in the second stage two of three dummy variables, indicating observed maternal status where $m_{ijr} = (m^1_{ijr}, m^2_{ijr}, m^3_{ijr})$ and

(3) $$m^m_{ijr} = \begin{cases} 1 & if\ M_{ijr} = m \\ 0 & otherwise \end{cases},\ m \in \{1,2,3\},$$

and the superscripts 1,2, and 3, index the categories *not-yet mother*, *young mother*, and *teen mother*, respectively. $M_{ijr} \in \{1,2,3\}$ is a categorical variable indicating which maternal status category the young woman falls into. Employing the control function approach, we also include in the second stage a vector of two of three residuals from the first stage predicting mother status. Since, the first-stage is also a nonlinear multinomial model predicting the probability that each young woman is in one of the three maternal status categories, each woman in our sample has three predicted probabilities and three predicted residuals each associated with a different maternal state. Thus, the predicted maternal state first-stage residuals are $\varepsilon_{ijr} = (\varepsilon^1_{ijr}, \varepsilon^2_{ijr}, \varepsilon^3_{ijr})$ where ε^m_{ir} is the residual based on the predicted probability that woman i is in maternal status category *m*, $m \in \{1,2,3\}$ .and is calculated as follows:

(4) $$\varepsilon^m_{ijr} = m^m_{ijr}(1 - \hat{P}^m_{ijr}) + (1 - m^m_{ijr})(0 - \hat{P}^m_{ijr})\ .$$

Because M_{ijr} is comprised of three exhaustive and mutually exclusive maternal states, $\sum_{m=1}^{3} \hat{P}^m_{ijr} = 1$ and $\sum_{m=1}^{3} \hat{\varepsilon}^m_{ijr} = 0$. The observed motherhood status and predicted residual for *not-yet mothers* are excluded from the second-stage to serve as a base category.

First Stage: Education

Educational attainment is also not exogenous to selection into different labor market sectors, which is quite obvious when considering many women in our sample are still enrolled in school, and thus, being a student is a category we account for in the sectoral selection model. We address the endogeneity of school attainment by instrumenting highest grade attained in 2012 using a set of community-level school quality and access variables collected in 2004 for the period when the women in our sample were for the most part in, or had recently dropped out of primary school. Thus, the young woman's highest grade attained in 2012 is given by:

(4) $$Grade_{ijr} = \pi_0 + \pi_1' Sch_{jr} + \pi_2' X_{ijr} + \pi_3' C_{jr} + \pi_4' R_r + \vartheta_{ijr},$$

where X_i, C_i and R_r are the same household, community and regional controls included in (2) and will be described below. *Sch* is the vector of 2004 primary school characteristics and includes: the distance between the center of town and the primary school, whether or not the primary school participated in a government-sponsored nutrition program, and a school facilities quality index. The facilities quality index is constructed using factor analysis on indicators on the availability of electricity, medicine, toilets, separate toilets for boys and girls, recreation grounds, and clean water in the school. Finally, we also include whether or not there is a private school in the community. The primary schools from which these characteristics were measured are not necessarily the primary school attended by our sample women. Instead, they all pertain to the characteristics and conditions of the primary school closest to the center of town in which the women resided in 2004, so as to avoid the issue of school choice. Our exclusion restriction is based on the premise that primary school conditions in the area where the sample individuals grew up is unlikely to directly affect the labor decisions of interest but instead exerts its influence

only through the impact on education and cognitive ability. Furthermore, while communities in the sample generally have a primary school, many do not have a secondary school. Therefore, there is also a weak correlation between primary school quality and secondary school quality, strengthening the case that our instruments meet the necessary exclusion restrictions. Indeed, only 57% of our sample communities have a secondary school. First-stage results are reported in the Appendix in Table A1.

Early Fertility and Labor Market Sectoral Selection

We model the selection of these young women in Madagascar into different labor market sectors using a multinomial approach, where the indirect utility of young woman *i* residing in community *j* in region *r* and employed in sector *k*, V_{ijr}^{k}, is given by:

(5)

$$V_{ijr}^{k} = \beta_0^k + \beta_1^k M_{ijr} + \beta_2^k Grade_{ijr} + \beta_3^k{}' X_{ijr} + \beta_4^k{}' C_{jr} + \beta_5^k{}' R_r + \beta_6^k{}' \hat{\varepsilon}_{ijr}^{m} + \beta_7^k{}' \hat{\vartheta}_{ijr} + u_{ijr}^{k}$$

Where M_{ijr} is a vector of two dummy variables indicating whether the maternal state of young woman *i* in community *j* and region *r* is a *teen mother* or *young mother*. We exclude the dummy variable indicating whether she is a n*ot-yet mother* as the base category. $Grade_{ijr}$ is the young woman's highest grade attained by 2012. Again, the traditional instrumental variable approach in which maternal state probabilities and grade attainment are replaced with their first-stage predicted values will not yield consistent estimates of β_1^k and β_2^k due to the nonlinearity of the multinomial logistic model. We, therefore, employ a control function (or the two-stage residual inclusion) approach, which remains consistent in this framework. $\hat{\varepsilon}_{ijr}^{m}$ is a vector of two of the

first-stage residuals predicted in (3), $m = \{1,2\}$. We exclude the residual on the predicted probability that the young woman is a *not-yet mother* as the base category. $\hat{\vartheta}_{ijr}$ is the predicted residuals from the first stage instrumenting for school attainment. X_{ijr} is a vector of individual and household characteristics while C_{jr} include community-level controls. Under the multinomial framework, a young woman is assumed to select into employment sector *k* for which she receives the highest utility. Thus, the probability of female *i* will select into sector *k* is:

(6) $$P_{ijr}^{k} = \Pr(V_{ijr}^{k} > V_{ijr}^{l}) \;\; for\, all\, l \neq k$$

We employ (5) and (6) to run two sectoral selection models: one which assumes three labor market sectors and one which assumes four. The three sector model includes the sectors student, working, and non-participation. We employ this model for the purposes of comparison with other studies modeling female labor market participation. Generally, these models have only two categories: participation and non-participation. However, since a non-trivial portion of our sample is still enrolled in school, we must include student as its own category. The sectors of the four sector model include: formal sector employment, informal sector employment, student, and non-participation. The four sector model is designed to understand better the quality of jobs these women are selecting into and thus divides the working category of the three sector model into formal and informal sector work.

Since the formulation of (6) is a function of differences in utilities derived from choosing each sector, some normalization is required. We, therefore, use "student" as the base category of the three sector model and "working in the formal sector" as the base category in the four sector model. The estimated multinomial coefficients can, therefore, be interpreted as the effects of a

variable on the utility of being employed in sector k relative to the utility derived from working in the base category.

Individual- and household-level controls include a set of age cohort dummies, parents' education and a 2004 asset index. Community–level controls include social infrastructure variables such as the availability of community health centers, hospital, secondary school (*lycee*), availability of piped water, paved roads, electricity and markets. We also include a 2004 remoteness index which was constructed using factor analysis on information on distance to health services, banks, post offices, schools, taxis, courts, markets, inputs, extension services, veterinarians, access to national and provincial roads, utilities, media, and transportation.

Hazard Models for the Age of the First Birth

In addition to understanding the effect of beginning motherhood during adolescence as opposed to post-adolescence on female labor outcomes, it is also of interest to estimate the effect of delaying childbirth by one year. Therefore, we modified our first stage model of fertility timing by estimating a Weibull hazard model of the age of first birth instead of estimating the multinomial logit of maternal status. This hazard model corrects the right censoring issue for the *not-yet mothers* in our sample: for these women, we assume that their age at first birth is at least as high as the current age in 2012. The hazard for the age of first birth is given by:

$$h_j(t) = h_o(t)\exp\{\delta' Xi_{ij} + \beta' Condom_j + \alpha' C_{ij} + \rho' R_{ij}\}$$

Where the hazard rate $h(t)$ is the probability of having the first birth at time (or age) t conditional on not having a child until t, $Condom_{ij}$ is the young woman's community–level

access to condoms and X_j, C_j ,R_j are, respectively, the household, community and regional control variables earlier described. The term h_o is the baseline hazard assumed to follow a Weibull distribution such that: $ho(t) = pt^{p-1}$. The Weibull model allows us to calculate a predicted age of first birth (*PredAFB*) or survival time for all the women in the sample. In the second stage, in a similar fashion to equation 5, we estimate a multinomial logit model for the young women's employment categories including the predicted age of first birth. This second stage is given by:

$$V_{ijr}^{k} = \beta_0^k + \beta_1^k \Pr edAFB + \beta_2^k Grade_{ijr} + \beta_3^k{}' X_{ijr} + \beta_4^k{}' C_{jr} + \beta_5^k{}' R_r + + \beta_7^k{}' \hat{\vartheta}_{ijr} + u_{ijr}^k \quad (6)$$

Where we also include the instrumented grade attainment by adding the residuals predicted in the first stage of the education equation as well as the rest of the control variables included in equation (5).

IV. Results

Fertility Timing and Female Labor Market Participation

We begin by presenting the three-sector model of nonparticipation, working, and being a student in Table 4, which reports the estimated average marginal effects of the timing of first birth and school attainment on the likelihood participating in the labor market.[6] We report these estimated effects with and without the instrumenting for fertility as well as with and without controlling for education.

Columns 1 and 2 of Table 4 report the average marginal effects of fertility timing on labor market participation without and with instrumenting for fertility and excluding grade from

[6] Estimated coefficients for the multinomial model are not reported but can be made available upon request.

the estimation. In both specifications women who have already had their first child are significantly more likely to participate in the labor market than their *not-yet mother* counterparts. However, when we instrument for fertility the point estimates of these effects increase dramatically. This indicates that women with children by their early twenties also possess other characteristics, such as lower preferences for work, which make them less likely to work. Once we instrument for the endogeneity of fertility timing, we observe that *young mothers* are 34% and *teen mothers* are almost 60% more likely to participate in the labor market than *not-yet mothers*. These effects are statistically significant at the one percent level. They are also statistically different from each other at the five percent level, indicating that women who have their first child during adolescence are almost twice as likely to participate in the labor market as those who have their first child in young adulthood. Relatedly, *teen mothers* are 42% less likely to not participate in the labor market than *not-yet mothers*. There is no statistical difference between *young mothers* and *not-yet mothers* in the probability of non-participation.

We are also interested in how much of the effect of fertility timing on labor market participation is explained through its effect on the human capital accumulation of these women. Column 3 of Table 4 reports the average marginal effects of instrumented mother status while also controlling for instrumented grade attainment. Controlling for grade has no substantive effect on the likelihood of *young mothers'* labor market participation. However, the effect of being a *teen mother* decreases by approximately 10%. Thus, the high likelihood of *teen mother's* labor market participation is, in part, mediated through the effect of adolescent childbearing on school attainment. However, there is nonetheless a substantial direct effect in that *teen mothers* are still almost 49% more likely to be working than *not-yet mothers*, even after controlling for grade.

<<Insert Table 4 here >>

Overall, both *teen mothers* and *young mothers* are more likely to participate in the labor market than *not-yet mothers.* This contrasts with some previous work such as Agüero and Marks (2008) who find that fertility does not have a causal effect on female labor participation. Likewise, our results differ from other studies that have found a negative effect of fertility on women's labor market participation in developing countries (Caceres; 2012; Cruces and Galiani, 2007; Ardignton et al, 2015). Unlike these studies, however, we specifically look how the timing of first birth rather than overall fertility impacts labor force participation. We also focus on a group of women in their early twenties, as opposed to the overall labor force in general that includes women who were making their initial decisions regarding work 10 to 30 years ago. We find that the timing of fertility clearly matters for female labor market participation in that not only are women with children more likely to participate in the labor market than those who have not yet had a child, but that this likelihood is significantly higher for young women who bore their first child before the age of 18.

Fertility Timing and Labor Market Sectoral Selection

While early fertility appears to increase female labor market participation for this sample of young Malagasy women, the type of employment they receive matters as much as, if not more, than the question of whether or not they are working. We now turn to a more detailed look at the type of employment these young women are able to obtain when they do participate, expanding to a four sector model in which we split the "working" category into two sectors: 'informal sector employment' and 'formal sector employment'. Table 5 reports the average marginal

effects of fertility timing and school attainment on the probability of being in each of the four sectorial categories.

<< Insert Table 5 here>>

Focusing on the preferred model with grade and fertility instrumented, similar to our earlier findings, *teen mothers* are 43.7 % less likely to be unemployed than *not-yet mothers.* The effect of being a *teen mother* is statistically significantly different at the one percent level from that of being in either one of the two other mother categories. The difference between the likelihood of *young mothers* or *not-yet mothers* being unemployed is not statistically significant nor is the point estimate of this difference very large.

In Table 4 we observed that both *young* and *teen mothers* are much more likely to participate in the labor market than their *not-yet mother* counterparts. However, while both of these mother groups are more likely to be working, the difference in the timing of their first birth has differential effects on their labor market sectoral selection. In Table 5, we see that while *teen mothers* are indeed more likely to work, this probability is largely driven by the high likelihood that these young women are working in low-quality informal sector jobs. Without controlling for education, we observe in Column 2 of Table 5 that *teen mothers* are 61% more likely to be working in the informal sector than *not-yet mothers.* We find no statistical differences between *young mothers* and *not-yet mothers* in the likelihood of working in either the formal or informal sector.

Thus while having a child increases the probability that both *young* and *teen mothers* are working, the timing of their first birth matters in explaining the types of jobs they are working in.

Having her first child during adolescence strongly increases the likelihood that a woman will be employed in the informal sector in her twenties. However, if that first child is instead born in young adulthood, then her first birth appears to have no statistically significant effect on her labor market sectoral selection, even if it does increase the likelihood that she is working.

Once we control for instrumented grade attainment (column 3 of Table 6), the effect of being a *teen mother* decreases by 10% to 51%. The effect of being a *young mother* remains statistically insignificant after controlling for schooling and its point estimate remains virtually unchanged. This is intuitive in that having a child before the age of 18 is likely to have a much more disruptive effect on grade progression and subsequently completed schooling than having a child in young adulthood. Thus, like with the probability of participation, the push of *teen mothers* into low-quality informal sector jobs is in part mediated by the effect of adolescent childbearing on human capital accumulation through schooling. This indicates that childbearing during adolescence both directly and indirectly pushes these young women into informal work. It, therefore, appears that early fertility not only interrupts important human capital accumulation, as discussed in Herrera and Sahn (2015), but also this results in negative repercussions for labor market success.

While we see little to no difference in the labor market sectoral selection of *young mothers* and *not-yet mothers,* there is one difference worth noting. Table 5 reports that, even after controlling for grade attainment, *young mothers* are less likely to still be enrolled in school than *not-yet mothers.* This means that comparing a *young mother* and a *not-yet mother* with the same grade attainment, the *not-yet mother* is approximately 19% more likely to still be a student. This indicates that by being able to remain in school, *not-yet mothers* have the opportunity to ultimately complete more education before deciding to leave school and enter the labor market.

Therefore, while we see no statistical differences between *young* and *not-yet mothers* in their labor market segmentation when they are in their early 20s, this could change when looking at sectoral selection later in their life course. Indeed, in column 3 of Table 5, we see that increasing school attainment by one grade reduces that probability of informal sector employment by almost 7.5%. Given that the *not-yet mothers* are much more likely to still be a student and will therefore likely ultimately complete higher levels of education, we would expect them to have a lower probability of informal sector employment than *young* or *teen mothers* once their education is complete.

Effect of the Age of Fist Birth on Employment Outcomes

Table 6 shows the average marginal effects of the age of first birth on selection into labor market sectors. In *Panel A* of this table, without including school attainment, the age of first birth does not have a statistically significant effect on the non-participation and formal sectors. Nevertheless, by postponing the first birth by one year, the young women's probability of working in the informal sector decreases by 8.4% and this effect is statistically significant at the 5% level. This coefficient decreases 12% to 7% in *Panel B* when we include the instrumented grade attainment. These findings are consistent with our earlier results from the multinomial models: the younger the women have their first birth the more likely they are to work in the informal sector. This effect seems to be partly mediated by school attainment.

<< Insert here Table 6>>

VI. Conclusions

Policymakers have long been interested in increasing female labor participation in both developed and developing countries. However, there is an increasing interest in the quality of employment outcomes for women. This has led researchers to examine the relationship between being a mother, and fertility in general, and female labor market participation. These studies often find that fertility either has no significant effect or it reduces female labor market participation. We add to this body of literature by investigating the timing of fertility, particularly of the first birth, and its effect on both labor market participation and sectoral selection, and in doing so, we deal with the endogeneity of both the timing of first birth and schooling. Among the young women in Madagascar we study, it appears that it is indeed the timing of fertility rather than total fertility experience that matters in determining these labor outcomes of interest. After accounting for unobserved heterogeneity affecting both fertility and labor market decisions, we find no statistical differences in labor market sector selection between women who have children in young adulthood and those who will have children in later adulthood. However, women who experience their first childbirth during adolescence are much more likely to be working in the informal sector. Some of this effect appears to be driven by the negative effect teen childbearing has on human capital accumulation through schooling. However, there is also a direct effect in that these informal jobs often involve working in family-owned enterprises where these women may find more support in childcare or at least greater compatibility with their caring for their children while working. So while we find that early childbearing increases female labor market participation for young Malagasy women, they are working in lower quality, less desirable jobs.

While we do not find statistically significant differences in the employment sectors of women who have the first birth as young adults and those whose first birth will occur as older

adults, it is important to note that we are observing early career labor market selection and that differences still may emerge between these two groups later in their career paths. Indeed, we do find that the young mothers are approximately 19% less likely to still be students at the time of the survey than mothers who will experience their first birth later in adulthood. It is, therefore, plausible that these women who have yet to experience their first birth will ultimately attain higher levels of schooling than women who have children as young adults. Given that we also find that one additional year of school reduces the probability of informal work by approximately 7.5%, it is plausible that women who give birth to their first child later in adulthood will select into higher quality jobs later in their careers.

Our results suggest young mothers who experience their first birth during adolescence are more likely to work and select into low-quality informal jobs. These findings are consistent with others such as Agüero, and Marks (2008) who find that having children is a barrier to work in the paid labor sector, especially for young women and mothers in the poorest countries. Similarly, Urdinola and Ospina (2015) find that teen mothers are more likely to have lower class jobs in Colombia.

There are a number of reasons why early motherhood might push young women into less desirable jobs. These informal jobs often consist of working in agriculture or a family enterprise, which might be more compatible with the demands of motherhood. Indeed, Nordman and Vaillant (2014) show that women in Madagascar self-select into informal industries where they can combine market-oriented and domestic activities. Additionally, early fertility can interrupt important human capital accumulation by increasing the probability that these young women drop out of school prematurely. Understanding the mechanism behind this result is important in that each of these explanations has very different policy implications. The former calls for

policies that support women in caring for their children while working, thus making higher quality jobs more accessible to them. The latter calls for policies that protect young mothers schooling when they have children before completing their education.

Our findings suggest that both these direct and indirect mechanisms are important for explaining the labor market outcomes of young women. School attainment appears to be an important indirect mechanism through which adolescent childbearing affects female labor market sectoral selection. Once we control for the predicted grade attainment, the effect of teen motherhood on informal sector selection reduces by 10%, and increasing school attainment by one grade reduces the likelihood of working in the informal sector by 7.5%. Consistently, Herrera and Sahn (2015) show that, for this sample of young women in Madagascar, teenage pregnancy increases the likelihood of dropping out of school and reduces their cognitive skills, measured by Math and French test scores. Thus, our findings point out that the experience of early childbearing disrupts young women's human capital accumulation and subsequently pushes them into less economically-desirable jobs compared to those who experience their first birth later in life. Therefore, policies that aim to protect young women's human capital accumulation can also likely improve their labor outcomes. For example, programs that prevent teenage pregnancy among school girls will facilitate their school completion and subsequently decrease the likelihood of their being pushed into unpaid jobs in the informal sector.

We also find a substantial direct effect where, even after controlling for the effects of schooling, adolescent childbearing increases the likelihood of working in the informal sector by over 50%. Consequently, policies that support young mothers in caring for children while working in higher quality jobs may also improve the labor market outcomes of these young women.

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Figure 1

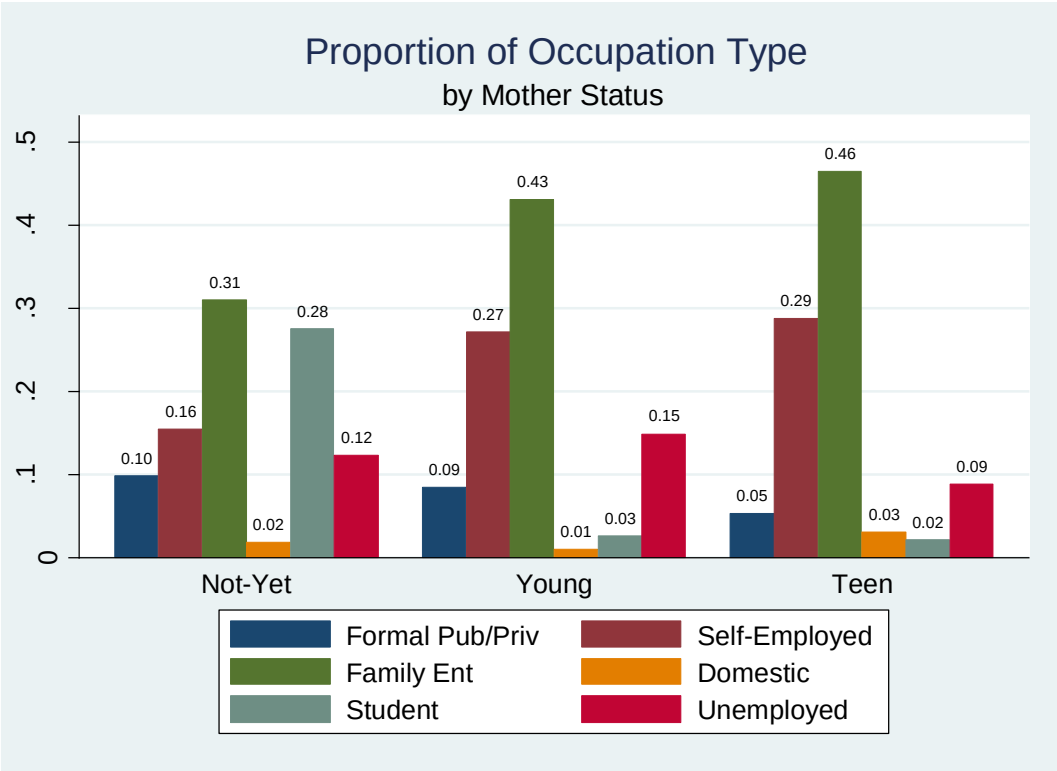
Proportion of Occupation Type
by Mother Status
0
.1
.2
.3
.4
.5
0.10
0.16
0.31
0.02
0.28
0.12
0.09
0.27
0.43
0.01
0.03
0.15
0.05
0.29
0.46
0.03
0.02
0.09
Not-Yet
Young
Teen
Formal Pub/Priv
Self-Employed
Family Ent
Domestic
Student
Unemployed

Table 1: Socioeconomic Characteristics by Age at First Birth

	Not-Yet Mothers	Young Mothers (AFB> 18)	Teen Mother (AFB <18)	Total
	N=374	N=188	N=226	N=788
Age	21.77	22.50	21.71	21.93
	(1.13)	(1.13)	(1.20)	(1.24)
Age at First Birth	--	20.23	16.77	18.34
		(1.19)	(1.26)	(2.12)
Highest Grade	9.36	7.18	5.90	7.85
	(3.71)	(3.28)	(2.77)	(3.68)
2004 Asset Index	0.26	0.03	-0.23	0.06
	(1.10)	(0.95)	(0.61)	(0.97)
Mother's Highest Grade	5.50	4.60	3.83	4.80
	(3.64)	(3.41)	(3.16)	(3.52)
Father's Highest Grade	6.20	5.48	4.23	5.46
	(3.94)	(4.17)	(3.39)	(3.93)
Access to Condoms	0.84	0.72	0.67	0.76
	(0.36)	(0.45)	(0.47)	(0.42)
Condom Exposure since Age 15	5.47	4.72	4.28	4.95
	(2.74)	(3.53)	(3.30)	(3.15)
Community Health Center Present	0.60	0.65	0.69	0.64
	(0.49)	(0.48)	(0.47)	(0.48)
Community Hospital Present	0.16	0.14	0.08	0.13
	(0.37)	(0.35)	(0.28)	(0.34)
Upper Secondary School Present	0.71	0.57	0.49	0.62
	(0.45)	(0.50)	(0.50)	(0.49)
Piped Water in Community	0.57	0.56	0.47	0.54
	(0.50)	(0.50)	(0.50)	(0.50)
Access to Weekly Market	0.69	0.55	0.54	0.61
	(0.46)	(0.50)	(0.50)	(0.49)
Access to Paved Road	0.43	0.44	0.37	0.42
	(0.50)	(0.50)	(0.48)	(0.49)
Electricity in Community	0.57	0.45	0.37	0.48
	(0.50)	(0.50)	(0.48)	(0.50)
School Facility Quality Index	0.12	-0.09	-0.11	0.00
	(0.82)	(0.71)	(0.71)	(0.77)
Distance between Town Center and Primary School	0.96	0.98	1.02	0.98
	(1.18)	(1.30)	(1.18)	(1.21)
Nutrition Program in Community Primary School	0.47	0.50	0.47	0.48
	(0.50)	(0.50)	(0.50)	(0.50)
Private School in Community	0.39	0.30	0.22	0.32
	(0.49)	(0.46)	(0.41)	(0.47)

Notes: AFB denotes Age of First Birth

Standard errors in parentheses

Table 2: Labor Market Segmentation by Age at First Birth

		Not-Yet Mothers	Young Mothers (AFB> 18)	Teen Mother (AFB <18)	Total
Non-Participation (%)		12.30%	14.89%	8.85%	11.93%
	n	46	28	20	94
Informal (%)		46.79%	72.87%	79.20%	62.31%
	n	175	137	179	491
Formal (%)		13.90%	10.11%	9.73%	11.80%
	n	52	19	22	93
Student (%)		27.01%	2.13%	2.21%	13.96%
	n	101	4	5	110
Total (%)		47.46%	23.86%	28.68%	100.00%
	n	374	188	226	788

Notes: AFB denotes Age of First Birth

Table 3: Contraception Use by Age at First Birth

	Not-Yet Mothers	Young Mothers (AFB> 18)	Teen Mother (AFB <18)	Total
Ever -Married (%)	21.6%	76.53%	77.5%	52%
Family Planning Use (%)	18.1%	36.2%	47.4%	31.2%
Access to Condoms (%)	84.5%	72.3%	66.4%	76.1%
N	N=374	N=188	N=226	N=788

Table 4: Average Marginal Effects of Fertility Timing and Education on Labor Market Participation

	Grade Excluded		Grade Included
	NO IV	Instrumented Mother Status	
	Non-Participation		
Young Mother (AFB>18)	0.038	-0.127	-0.141
	(0.031)	(0.162)	(0.219)
Teen Mother (AFB<18)	0.007	-0.420***	-0.434**
	(0.029)	(0.140)	(0.173)
Education Level			0.051
			(0.039)
	Working		
Young Mother (AFB>18)	0.167***	0.342***	0.336***
	(0.035)	(0.103)	(0.127)
Teen Mother (AFB<18)	0.186***	0.595***	0.487*
	(0.034)	(0.125)	(0.293)
Education Level			-0.036
			(0.054)
	Student		
Young Mother (AFB>18)	-0.205***	-0.215	-0.194
	(0.022)	(0.160)	(0.148)
Teen Mother (AFB<18)	-0.194***	-0.175	-0.053
	(0.024)	(0.141)	(0.292)
Education Level			-0.015
			(0.042)

Notes: AFB denotes Age of First Birth
*** p<0.01, ** p<0.05, * p<0.1. Standard errors calculated with delta method. All the models include the individual, household and community controls described in the empirical section

Table 5: Average Marginal Effects of Fertility Timing and Education on Selection into Labor Market Sectors

	Grade Excluded		Grade Included
	NO IV	Instrumented Mother Status	
	Non-Participation		
Young Mother (AFB>18)	0.037	-0.134	-0.151
	(0.031)	(0.211)	(0.170)
Teen Mother (AFB<18)	0.008	-0.421**	-0.437***
	(0.029)	(0.174)	(0.134)
Education Level			0.052
			(0.038)
	Informal		
Young Mother (AFB>18)	0.218***	0.193	0.165
	(0.040)	(0.277)	(0.265)
Teen Mother (AFB<18)	0.224***	0.613***	0.513*
	(0.038)	(0.155)	(0.284)
Education Level			-0.074+
			(0.050)
	Formal		
Young Mother (AFB>18)	-0.050*	0.154	0.172
	(0.029)	(0.293)	(0.263)
Teen Mother (AFB<18)	-0.038	-0.017	-0.014
	(0.029)	(0.069)	(0.074)
Education Level			0.038
			(0.047)
	Student		
Young Mother (AFB>18)	-0.206***	-0.213	-0.187*
	(0.022)	(0.184)	(0.102)
Teen Mother (AFB<18)	-0.193***	-0.176	-0.063
	(0.024)	(0.186)	(0.295)
Education Level			-0.015
			(0.035)

Notes: AFB denotes Age of First Birth
*** p<0.01, ** p<0.05, * p<0.1, + p<0.15 Standard errors calculated with delta method. All the models include the individual, household and community controls described in the empirical section

Table 6: Average Marginal Effects of Age of First Birth on Selection into Labor Market Sectors

	Non-Participation	Informal	Formal	Student
Panel A				
Grade Excluded				
Predicted Age of Fist Birth	0.037	-0.084**	-0.01	0.057*
	(0.029)	(0.034)	(0.023)	(0.029)
Panel B				
Predicted Age of First Birth	0.043+	-0.074**	-0.02	0.051**
Grade Instrumented	(0.03)	(0.032)	(0.023)	(0.026)
	0.053	-0.106**	0.037	0.016
	(0.038)	(0.051)	(0.041)	(0.033)

*** p<0.01, ** p<0.05, * p<0.1, + p<0.15 Standard errors calculated with delta method. All the models include the individual, household and community controls described in the empirical section

Appendix

Table A1: First-Stage Coefficients for Fertility Timing and Grade Attainment

	Fertility Timing			Education
	Not-Yet Mother	**Young Mother**	**Teen Mother**	**Grade**
Community Access to Condoms	**Base Category**	-0.3404	-0.6424	
		(0.530)	(0.525)	
Condom Exposure since Age 15		-0.0836	0.0096	
		(0.067)	(0.072)	
School Facilities Quality Index				0.0637
				(0.190)
Distance between Town Center and Primary School				0.0754
				(0.092)
Nutrition Program in School				0.0905
				(0.215)
Private School in Community				0.7123***
				(0.260)
Age Cohort 1		-1.6036***	0.1945	0.6394*
		(0.464)	(0.367)	(0.360)
Age Cohort 2		-1.5587***	-0.2343	0.6121**
		(0.287)	(0.276)	(0.283)
Age Cohort 3		-0.4834*	0.0059	0.4366
		(0.250)	(0.259)	(0.281)
Age Cohort 5		0.8363**	-0.0801	-0.1147
		(0.332)	(0.396)	(0.407)
2004 Asset Index		-0.0578	-0.3510**	0.7321***
		(0.141)	(0.150)	(0.147)
Mother's Highest Grade		-0.0620*	-0.0696**	0.2535***
		(0.034)	(0.033)	(0.034)
Father's Highest Grade		0.0335	-0.0433	0.1961***
		(0.032)	(0.029)	(0.033)
Urban		-0.9058*	-0.4625	0.3308
		(0.492)	(0.473)	(0.558)
Community Health Center (CSB2)		-0.3376	-0.0363	0.9269**
		(0.375)	(0.356)	(0.410)
Hospital		0.1709	-0.5249*	-0.0088
		(0.298)	(0.318)	(0.334)
Secondary School		-0.5906**	-0.4296	0.5169*
		(0.276)	(0.277)	(0.302)
Piped Water		0.3805	0.2805	0.7773***
		(0.239)	(0.219)	(0.251)
Weekly Market		-0.4449*	-0.2024	-0.5534**
		(0.234)	(0.227)	(0.264)
Access to Paved Road		0.3714	0.3477	-0.1422
		(0.252)	(0.238)	(0.275)
Electricity in Community		0.2659	0.0584	-0.2023
		(0.298)	(0.275)	(0.345)
2004 Remoteness ID		-0.0206	-0.0753	-0.4635***
		(0.105)	(0.098)	(0.114)
Regional Dummies	Yes	Yes	Yes	Yes
Constant		1.4934***	0.7551	5.1971***
		(0.570)	(0.535)	(0.673)
Observations	818	818	818	805

Standard Errors in Parentheses
*** p<0.01, ** p<0.05, * p<0.1