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ABSTRACT

Teen Fertility and Labor Market Segmentation: Evidence from Madagascar*

Women represent the majority of informal sector workers in developing countries, especially in Sub-Saharan Africa where adolescent pregnancy rates are high. Little empirical evidence exists concerning the relationship between teen fertility and the likelihood that a woman will be employed in the informal sector. Using a panel survey in Madagascar designed to capture the transition from adolescence to adulthood, we estimate a multinomial logit model to capture the effect of the timing of first birth on female selection into four categories: non-participation, informal, formal, and student. To address the endogeneity of fertility and labor market outcomes, we instrument the timing of first birth using young women's community-level access, and duration of exposure to family planning. Our results suggest that motherhood increases the probability of employment for young women and that women whose first birth occurs during adolescence largely select into low-quality informal jobs. This effect is partially, but not entirely, mediated by the effect of teen pregnancy on schooling.

JEL Classification: J13, J24, O1

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

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Introduction

Women's economic opportunities are both an important outcome and driver of successful economic development (Duflo, 2012). Recent decades simultaneously witnessed increasing rates of female participation in the labor market and declining fertility across the globe (Heath and Jayachandran, 2016). Despite increasing rates of women entering the labor force, evidence suggests that they typically earn less, work in less productive jobs, and are more likely to work in unpaid or informal employment than their male counterparts. Although women only represent approximately 40% of the total global workforce, they account for 58% of all unpaid work and 50% of informal sector employment (World Bank, 2012). Fertility rates are often cited as an important determinant of female employment outcomes (Verick, 2014). Thus women might be in an equilibrium of low human capital, restricted access to labor markets and limited control over their fertility decisions. Adolescence may represent a critical window for intervening to influence the economic opportunities of women (Bandiera, et al.2015), as early childbearing and marriage can interrupt human capital accumulation (Fields and Ambrus, 2008; Baird et al. 2011; Herrera and Sahn 2015). Understanding the trade-offs between becoming a mothers and labor market opportunities is essential to designing effective policies aimed at improving women's long-term economic welfare, as well as that of their children. However, while adolescent pregnancy rates are quite high throughout the developing world, empirical evidence documenting its effects on female labor outcomes is scarce.

Using a unique panel data set from Madagascar that was specifically designed to capture the transition of a cohort of young women (and men) from adolescence to adulthood, this paper explores the effects of teenage pregnancy[1] on young women's labor force participation and sector of employment. We examine this issue for a cohort of young women who were between the ages of 21 and 23 years old at the time of the survey. This question is particularly salient in Madagascar where one in three girls between the ages of 15 and 19 have a child or are pregnant for the first time (Demographic Health Survey, 2009). In our examination of labor market participation, we distinguish between formal and informal sector employment. Evidence indicates that job quality, job security, and earnings potential differ between these sectors. We further explore the extent to which the effect of early childbearing on labor market outcomes is direct, due to the demands of motherhood, and indirect, operating through reduced human capital as a consequence of pregnancy forcing women to prematurely terminate their education (Herrera and Sahn, 2015). Understanding the role teenage pregnancy plays in female employment and sector selection is especially pertinent in the context of Madagascar and in sub-Saharan Africa more generally, where childbearing during adolescence is common and approximately 80% of the female labor force is self-employed or unpaid family workers.

Our paper fits within a larger body of evidence that attempts to examine the causal relationship between fertility and labor outcomes in developing countries. Some studies find that fertility has a negative effect on overall female labor force participation (Cruces and Galiani, 2007; Bloom et al; 2009 Caceres-Delpiano 2012), whereas others find no causal effect (Agüero and Marks, 2011).[2] Nevertheless, these studies agree that fertility decreases the probability of women's employment in the formal sector, particularly among young women (Miller, 2010; Agüero and Marks, 2011). Heath (2016) finds that fertility decreases the extensive margin of

[1] We use the terms adolescent pregnancy and teenage pregnancy interchangeably hereafter.
[2] These empirical studies use 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 restrictions on abortion (Bloom et al; 2007).

women's labor supply. However, for women already in the labor force, she finds that fertility increases the number of working hours, mainly in self-employed labor activities, due to greater compatibility between this type of employment and the time demands of motherhood.

While these studies are informative, they all examine the effect of either the total number of children or of having any children as opposed to having none. This paper adopts an alternative approach: rather than examining the effect of fertility at the intensive or extensive margin, we investigate the effect of the timing of first birth, with an emphasis on the period of adolescence. The effects of teenage pregnancy on labor market outcomes have been extensively studied in the United States (Hotz; 2005; Feltcher and Wolfe, 2009; Keplinger et al, 1999); however, empirical evidence on the causal effect of adolescent childbearing on young women's labor market outcomes in developing countries is scarce. The little existing evidence is largely from Latin America and is mixed regarding the effect of teenage pregnancy on female labor outcomes. Arceo et al. (2014) demonstrate that teenage pregnancy in Mexico reduces the number of hours that women work. Azevedo et al. (2012), however, find that women who give birth during adolescence are more likely to be employed than those who do not. Finally, Urdinola and Ospino (2015) report that women in Colombia who give birth at ages 18 or 19 are more likely to have a low-quality job than those who give birth at 20 or 21 years of age. Our paper on Madagascar adds to the sparse literature on the causal impact of teenage pregnancy on labor market outcomes in developing countries.

We address the endogeneity between fertility and employment outcomes by instrumenting the timing of the first birth with community-level data on access and exposure to condoms since the women were aged 15. We then estimate a multinomial logistic (MNL) model of female labor market participation and sector selection for our cohort of 21 to 24 year old women, distinguishing between those who are engaged in the formal sector, the informal sector, not working, and currently enrolled in school. Given that the instruments used to identify age at first birth, the availability of contraception and the duration of exposure to contraception at the community level, are potentially non-randomly placed, we present evidence that our instruments satisfy the necessary exclusion restriction through a series of robustness checks. We also note that school attainment, another key covariate in our model of sectoral choice, is potentially endogenous as well. Thus, we instrument individual grade attainment using eight-year lagged (2004) community-level information on primary school infrastructure to investigate the extent to which the impact of early childbearing is mediated through its effect on school attainment. Finally, our empirical approach to instrumenting both fertility timing and grade attainment uses a control function approach, which remains consistent in the non-linear framework of our MNL labor market models (Terza et al. 2008).

Unlike previous work in this literature, we find that among our cohort of young women, between 21 and 24 years of age, those who had their first child during and post-adolescence are more likely to participate in the labor market than those who do not yet have children. However, the timing of motherhood matters in determining the labor sector in which these women are employed. Women who had their first child as teenagers are 55% more likely to be working in the informal sector than those who had their first child post-adolescence. There is no statistically significant difference between women who had their first child after adolescence and those who have not yet had a child in terms of their sector of employment. Consistent with these findings, we estimate a Weibull hazard model as a complement to our MNL modeling strategy and find that delaying the age at first birth by one year decreases a young woman's likelihood of working in the informal sector by 7.2%.

Our findings further suggest that school attainment is an important channel through which teen motherhood affects labor market sector selection. Teenage pregnancy disrupts young women's human capital accumulation and subsequently pushes them into jobs that are less economically desirable than those obtained by their non-mother counterparts and mothers who have delayed childbirth until post-adolescence. This result is consistent with previous findings on labor market segmentation indicating that education is an important predictor of being employed as a formal wage earner with associated higher pay (Gindling, 1991; Glick and Sahn, 1997; Vijverberg, 1993; Sahn and Villa, 2015). Although we do not analyze the mechanism underlying our observation that teenage pregnancy leads to a higher probability of working in the informal sector, we conjecture that such jobs, which are predominately in agricultural family enterprises, presumably enable young women to combine the demands of motherhood with making an economic contribution to the household.

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, and 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 1,749 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 survey was specifically designed to capture the transition from adolescence to young adulthood and thus collected detailed information on individual and household characteristics as well as family background. These data additionally include extensive information on schooling, fertility, marriage, and 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 the community-level availability of social and economic infrastructure and services, including family planning, and the date these services first became available in the community. We complement this information at the community level with the 2001 and 2007 national commune census data, which include a broad range of information on basic public services and infrastructure.

Of the young adults surveyed, 859 are women, 466 of whom gave birth at least once by the time of the 2012 survey. Due to missing information for certain variables, our final working sample includes 788 women, 414 of whom were mothers by 2012. The average age at 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. However, nearly all of them will be mothers in the future since the vast majority of women in Madagascar have at least one child during their reproductive life.[3] Consequently, we refer to the 374 women in our sample who have not yet begun childbearing as *not-yet mothers* rather than non-mothers. Using information on the age at first birth, we generate a 3-category variable based on *fertility timing*: *teen mothers* whose age at first birth is 18 or less, *young mothers* who had their first child later than age 18 but before the time of the 2012 survey, i.e., when they were predominately in

[3] According to the 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 universal experience of motherhood is consistent with Madagascar's total fertility rate of 4.9 children per woman (DHS, 2009).

their early twenties, and *not-yet mothers*. *Teen mothers*, *young mothers,* and *not-yet mothers* represent 29%, 24%, and 47%, respectively, of this sample of young adult females. Defining fertility timing in this manner allows us to first, compare the labor outcomes of mothers and not yet mothers, and second, to estimate the effect of having a first child during adolescence versus post-adolescence.

<<Insert Table 1 >>

Table 1 describes the socioeconomic characteristics of the women in our sample by maternal status. The average age that *teen mothers* and *young mothers* gave birth to their first child is 16.77 and 20.23, respectively. *Not-yet mothers* completed higher levels of education than the other two mother groups, with differences in the average educational attainment of each fertility timing category being statistically significant. On average, *not-yet mothers* have 9 years of schooling, whereas *young mothers* have 7 years, and *teen mothers* have 5.9 years. Indeed, for this same sample of women, Herrera and Sahn (2015) demonstrate 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 birth. 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 compared to 83% and 89% of the *young* and *teen mothers*, respectively.

Our interest lies not only in measuring the effect of fertility timing on female labor force participation but also in the quality of employment these women obtain when they do work. We therefore model the selection of these women into four categories: formal sector employment, informal sector employment, student, and non-participation. We classify a woman as 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 categorized as employed in formal work if she works in a family enterprise or performs domestic work in another household *and* earns regular wages or a salary for that work. We classify a woman as employed in the informal sector if her main employment activity is working in a family-owned enterprise or performing 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 >>

Table 2 illustrates that young Malagasy women are largely employed in the informal sector; indeed, 62% of our sample women work in the informal sector and only 12% work in a formal job. While the majority of all women in Madagascar work in informal jobs, the likelihood of women working in lower-quality jobs appears to be exacerbated by motherhood. Nearly 73% and 80% of the *young* and *teen mothers,* respectively, in our sample work in the informal sector, compared to less than 50% of *not-yet mothers*.

III. Empirical Methodology

[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, and repairs, among others. We categorize these women as working in the informal sector. Performing domestic work in one's own household was not considered participation in the labor market.

The timing of a woman's first birth and her education are 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 render them more likely to work in the informal rather than the formal labor sector. Women may also intentionally delay childbearing to acquire the necessary skills needed for a particular type of work. Women who have children at younger ages may also have lower preferences for work in general. We therefore use an instrumental variable approach to address the endogeneity between fertility timing, schooling, 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: a variable indicating whether or not condoms were available in a 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 have been available in her community since she was 15 years old. We selected this age cut-off because the average age at first birth in our sample is 18.[5] It is worth noting that this information is not self-reported but instead collected from community leaders surveyed for the community module. We use condom access as our instrument for the timing of first birth because women in the sample area typically use condoms to delay their first birth and use other forms of contraception, such as pills or injectables, to space children within the family after their first birth (DHS, 2009). This behavior is illustrated in Table 3, which reports that although there is a higher prevalence of modern contraception use among mothers, they are less

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

likely to have access to family planning services, particularly condoms. In 2012 84% of the *not-yet mothers* have community-level availability of condoms, but this applies to only 76% and 66% of the *young* and *teen mothers*, respectively. We further see that while *teen* and *young mothers* have the lowest level of access to condoms, they have the highest use of family planning services. Approximately 47% and 36% of *teen* and *young mothers*, respectively, report using family planning, whereas only 18% of *not-yet mothers* do. The higher prevalence of modern contraception among mothers compared to their childless counterparts is consistent with the fact that women in Madagascar are more likely to use long-term modern contraception methods to space children than to prevent the first birth. It is worth noting that our surveys lack information regarding the exact source and channels of condom distribution within each commune. We do know that the United Nations Population Fund, the United States Agency for International Development and the Global Fund lead condom procurement at the national level in Madagascar. These organizations, however, do not coordinate their efforts to distribute condoms and do not have individually or collectively any explicit criteria that governs the choice of the selection of communities for condom distribution. This is visually demonstrated in Figure A.1 in the Appendix which shows no clear pattern in access and length of exposure to condoms across the communities in our sample. We further address below, and address in more detail elsewhere, the potential endogeneity of program placement by controlling for an extensive set of community-level social and economic characteristics, both current and lagged over the past decade (Herrera and Sahn, 2015).

<<Insert Table 3>>

Instrumenting for maternal status presents a couple of econometric challenges. First, the endogenous fertility timing state variable consists of three categories: *teen mother*, *young mother* and *not-yet mother*. Therefore, we estimate the first stage by predicting fertility timing using a multinomial logistic function in which the probability of a young woman *i* in community *j* and region *r* being in fertility state *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 and exposure to condoms, 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.

Second, we also use a MNL model to estimate female selection into different labor market sectors. A traditional instrumental variable approach in which fertility timing is replaced by its first-stage predicted value in the second stage will not necessarily yield a consistent estimate of our parameter of interest due to the nonlinearity of the MNL function. 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 non-linear framework (Terza et al. 2008). To do so, we include in the second stage two of the three dummy variables, indicating the observed fertility state where $m_{ijr} = (m_{ijr}^1, m_{ijr}^2, m_{ijr}^3)$ and

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

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 into which fertility timing category the young woman falls. 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 MNL model predicting the probability of being in each of the three fertility states, each woman in our sample has three predicted probabilities and three predicted residuals, each associated with a different fertility timing state. Thus, the predicted fertility 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 fertility timing 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} comprises three exhaustive and mutually exclusive fertility states, $\sum_{m=1}^{3} \hat{P}^m_{ijr} = 1$ and $\sum_{m=1}^{3} \hat{\varepsilon}^m_{ijr} = 0$, the observed fertility state and associated 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 clear when considering that many women in our sample are still enrolled in school; thus, we account for being a student as a category in the sectoral selection model. We instrument the 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, a young woman's highest grade attained in 2012 is given by

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

where X_i, C_i and R_r are the same individual, 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. Following Glick et al. (2011), we construct the facilities quality index using factor analysis on indicators of the availability of electricity, medicine, toilets, separate toilets for boys and girls, recreation grounds, and clean water in the school. Finally, we also include an indicator of whether or not there is a private school in the community.

Validity of Instruments

A valid instrument must satisfy two requirements: the relevance condition (i.e., that the instrument is sufficiently correlated with the endogenous variables of interest) and the exclusion restriction (i.e., the instrument is not correlated with omitted factors affecting our labor outcomes of interest). First-stage results predicting fertility timing and school attainment are reported in Table A.1 in the Appendix. Tests on the joint significance of our instruments indicate that the fertility and schooling instruments are jointly significant at the one and five percent levels, respectively.[6] This suggests that the instruments are a valid source of variation in predicting fertility timing and grade attainment and thus satisfy the relevance condition.

Turning to the exclusion restriction requirement, the potential sources of statistical endogeneity are reverse causality and unobserved heterogeneity. Reverse causality poses a problem if the fertility and educational decisions of the women in our sample are determined to some degree by their labor decisions. This can happen, for example, if the women achieve a level of schooling or delay childbearing in order to pursue a specific type of occupation. Given that our instruments rely on community-level variation, they are unlikely to correlate with this individual-level heterogeneity. That is, the primary school data that serve as our instruments are not necessarily the primary schools attended by our sample women. Instead, they reflect the characteristics and conditions of the primary school closest to the center of the women's 2004 community of residence. This helps to avoid the issue of school choice, especially since the parents of the cohort members were responsible for making decisions related to the members' schooling in 2004. However, it remains possible that households select into particular communities based on available resources and social infrastructure. We think this is very unlikely evidenced by the fact that nearly 90% of our sample women's parents report living in their 2004 community of residence since birth.

We still need to be concerned about unobserved heterogeneity that will result in statistical endogeneity if omitted variables such as preferences over schooling, fertility and labor simultaneously determine each of our outcomes of interest. The biggest concern in this regard is that family planning services are non-randomly placed and are correlated with local labor market

[6] Test statistics on the joint significance of the fertility and schooling instruments are $\chi^2(4) = 12.48$ and $F(4,762) = 1.98$, respectively.

conditions, or that school quality is similarly correlated with these characteristics. For example, condom programs may be located in communities where teen pregnancies are high 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 concern, we include an extensive set of community controls, including lagged information from other community-level data sources spanning more than a decade, in both our instrumenting equations and our labor model. These controls include a remoteness index and variables capturing a community's health and physical infrastructure. The specific community controls we employ are discussed below. Furthermore, using these same data, Herrera and Sahn (2015) demonstrate that 2012 condom availability in this sample does not depend on community-level factors such as 2006 fertility variables, 2001 poverty and population measures, or religion and/or ethnic composition. In addition, Herrera and Sahn (2015) present numerous robustness and statistical tests, as well as qualitative evidence from field work, that support the exclusion restriction. Additionally, as mentioned earlier, Figure A.1 in the Appendix displays no clear geographic pattern regarding the availability and timing of condom programs across the communes in our sample.

Early Fertility and Labor Market Sectoral Selection

We model the selection of young women in Madagascar into different labor market sectors using a multinomial logic models 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

$$(5) \qquad V_{ijr}^{k} = \beta_0^k + \beta_1^k M_{ijr} + \beta_2^k Grade_{ijr} + \beta_3^k{}' X_{ijr} + \beta_4^k{}' C_{jr} + \beta_5^k{}' R_r + \beta_6^k{}' \hat{\varepsilon}_{ijr}^{m} + \beta_7^k{}' \hat{\vartheta}_{ijr} + u_{ijr}^{k},$$

where M_{ijr} is a vector of two dummy variables indicating whether the fertility timing 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 *not-yet mother* as the base category. $Grade_{ijr}$ is the young woman's highest grade attained by 2012. As mentioned previously, the traditional instrumental variable approach in which fertility 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 MNL 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, and C_{jr} includes community-level controls. Under the MNL framework, a young woman is assumed to select into employment sector k for which she receives the highest utility. Thus, the probability that 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 estimate two sectoral selection models: one that assumes three labor market sectors and one that 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 include student as a separate category. The categories of the four-sector model are formal sector employment, informal sector employment, student, and non-participation. The four-sector model is designed to better understand the quality of the jobs into which these women are selecting 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 in the three-sector model and "working in the formal sector" as the base category in the four-sector model. The estimated MNL 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 indicating the availability of community health centers, hospitals, upper-secondary school (*lycee*), piped water, paved roads, electricity and markets. We also include a 2001 remoteness index that was constructed using factor analysis on information related to distance to health services, banks, post offices, schools, taxis, courts, markets, inputs, extension services, and veterinarians and access to national and provincial roads, utilities, media, and transportation.

Hazard Models for the Age at First Birth

In addition to understanding the effect of beginning motherhood during adolescence compared to post-adolescence on female labor outcomes, estimating the effect of delaying age at first birth by one year is also of interest. Therefore, we estimate a Weibull hazard model of the age at first birth. This hazard model corrects for the fact that the age at first birth of the *not-yet mothers* in our sample is right-censored. The hazard for age at first birth is given by

$$(7) \qquad h_{ij}(t) = h_0(t)\exp\{\delta_0' Condom_{jr} + \delta_1' X_{ijr} + \delta_2' C_{jr} + \delta_3' R_r\},$$

where $h(t)$ represents the hazard that woman *i* experiences her first birth at time (or age) *t*, conditional on not having a child prior to age *t*. $Condom_{ij}$ is the young woman's community-level access and exposure to condoms, and X_j, C_j and R_j are the individual, household, community and regional controls, respectively, described earlier. The term h_0 is the baseline hazard that is assumed to follow a Weibull distribution such that $h_0(t) = \rho t^{\rho-1}$. The Weibull model allows us to calculate the mean predicted age at first birth (*AFB)* or survival time for each of the young women included in the estimation sample.[7] Similar to the MNL model for maternal status, we use access/exposure to condoms as exogenous variation to identify age at first birth. The joint significance of the condom access and exposure variables is statistically significant at 1% ($\chi^2(2) = 9.44$; p-value=0.0089) in the Weibull hazard model. Figure 1 plots the predicted hazard function (i.e., risk of having a first child at age *t*) across different levels of young women's condom exposure since the age of 15. In this graph, we observe that young women who live in communities with no access to condoms experience a higher risk of becoming a mother at a younger age than their female counterparts who have had access to condoms for six and eight years. In fact, the longer the women are exposed to condoms since age 15, the lower their risk of becoming a mother after controlling for the individual, household and community characteristics described earlier.

[7] We find nearly identical results in the second stage when we use median predicted age at first birth. These results are not reported but are available upon request.

<<Insert Figure 1 >>

In the second stage, similar to equation (5), we estimate an MNL model for the young women's labor market sectoral selection. However, rather than including instrumented fertility timing categories, we instead include the age at first birth (*AFB)* as predicted by the hazard model. This second stage is given by

$$(8) \qquad V_{ijr}^{k} = \gamma_0^k + \gamma_1^k AFB_{ijr} + \gamma_2^k Grade_{ijr} + \gamma_3^k{}' X_{ijr} + \gamma_4^k{}' C_{jr} + \gamma_5^k{}' R_r + \gamma_6^k \hat{\vartheta}_{ijr} + u_{ijr}^k,$$

where we also include instrumented grade attainment by adding the residuals predicted in the first stage of the education equation and the rest of the control variables included in equation (5). Because a model with a first-stage hazard model and second-stage MNL model will not necessarily yield consistent estimates of our parameter of interest, the point estimate of γ_2^k cannot be interpreted causally. We therefore simply use the results obtained from (8) to complement our primary results estimated in equations (1) – (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 of participating in the labor market.[8] Columns 1 and 2 show the results without and with instrumenting the timing of the first birth, respectively, and excluding grade. In both specifications, women who have already had their first child are

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

significantly more likely to participate in the labor market than their *not-yet mother* counterparts. The IV point estimates (Column 2), which are much larger than the non-instrumented results, indicate that *young mothers* are 35% and *teen mothers* are 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 significantly 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 their early twenties. The much larger IV estimates in column 2 than column 1 also indicate that women who have children by their early twenties possess other characteristics, one possible example being lower preferences for work, which simultaneously make them less likely to select into the labor market.

We are also interested in how much of the effect of fertility timing on labor market participation is explained through its effect on human capital accumulation. Columns 3 and 4 of Table 4 add grade attainment to the IV estimates in Column 2, the difference being that in Column 3 education is not instrumented and in Column 4 it is.[9] Controlling for grade attainment has no substantive effect on the likelihood of *young mothers'* labor market participation; however, the effect of being a *teen mother* decreases by almost 10%. This suggests that the high likelihood of *teen mothers'* labor market participation is, in part, mediated through the effect of adolescent childbearing on school attainment. There is nonetheless a substantial direct effect in that *teen mothers* are still 52% more likely to be working than *not-yet mothers*, even after controlling for grade attainment.

<<Insert Table 4 here >>

[9] It is worth noting that whether we instrument for grade attainment has little to no effect on our point estimates of the fertility timing effects.

Our findings that *teen mothers* and *young mothers* are more likely to participate in the labor market than *not-yet mothers* 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. Similarly, our results differ from other studies that find a negative effect of fertility on women's labor market participation in developing countries (Caceres; 2012; Cruces and Galiani, 2007;). One important consideration in how our results differ, however, is that unlike the other literature cited that looks at the broader issue of fertility impact, we focus on the effect of the timing of first birth among young women on labor force participation.

Fertility Timing and Labor Market Sectoral Selection

While early fertility appears to increase female labor market participation for young Malagasy women, the type of employment they obtain matters as much as, if not more than, whether they are working. Table 5 reports the average marginal effects of fertility timing and school attainment on the probability of being in each of the four sectors of the sector selection model.

<< Insert Table 5 here>>

Focusing on the preferred model with grade and fertility instrumented, we observe that, similar to our earlier findings (Column 4 of Table 4), *teen mothers* are 46% less likely to be unemployed than *not-yet mothers.* The effect of being a *teen mother* is significantly different at the one percent level from that of being in either of the other two 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 large.

While Table 4 indicated that both *young* and *teen mothers* are more likely to participate in the labor market than their *not-yet mother* counterparts, Table 5 shows that in the case of teen mothers, this is largely driven by their working in low-quality informal sector jobs. Without controlling for education, we observe in Column 2 of Table 5 that *teen mothers* are 62% more likely to be working in the informal sector than *not-yet mothers.* We find no significant differences between *young mothers* and *not-yet mothers* in terms of 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 in which they are working. 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 4 of Table 5), the effect of being a *teen mother* decreases by approximately 8%, to 54.5%. The effect of being a *young mother* remains statistically insignificant after controlling for schooling, and the 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 subsequent completed schooling than having a child in young adulthood. Thus, as with the probability of participation, the push of *teen mothers* into low-quality informal sector jobs is partially 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.

Delaying First Birth and Labor Market Sectoral Selection

Table 6 shows the average marginal effects of delaying the age at first birth by one year on selection into labor market sectors. Again, these estimated parameters are not guaranteed to be consistent; nonetheless, they broadly support the narrative of our primary results. In *Panel A* of this table, without including school attainment, age at first birth does not have a statistically significant effect on selection into the non-participation and formal sectors.

<< Insert Table 6 here>>

Nevertheless, by postponing the first birth by one year, a young women's probability of working in the informal sector decreases by 7.2%, and this effect is statistically significant at the 10% level (p-value=0.077). In *Panel C*, when we include instrumented grade attainment, this coefficient decreases by 16% to 6%, and it is statistically significant at the 5% level. Consistent with the MNL models, the effect of early childbearing on selection into the informal sector is partially mediated by school attainment.

Using the specification of *Panel C,* Figure 2 plots the predicted probability of working in the informal sector for different values of predicted age at first birth. We observe that the younger women are when they have their first child, the more likely they are to work in the informal sector. These findings support our earlier results: early childbearing takes a higher toll on the labor opportunities of women whose first birth occurs during adolescence.

<<Insert Figure 2>>

Robustness Checks

While we control for an extensive set of individual- and community-level controls in each of our instrumenting equations and labor models, our community-level fertility instruments may nonetheless be correlated with some unobserved aspect of local labor market conditions. If this is the case, our estimates of the effect of fertility timing on labor outcomes are biased. To further investigate whether our fertility instruments are exogenous, we estimate a placebo test by examining whether the instruments significantly predict the labor outcomes of the parents of the sample women. Specifically, we estimate an MNL model of the industry of main occupation for mothers and fathers separately on our fertility instruments as well as our individual- and community-level controls. The industrial categories we examine are agriculture and livestock, manual labor and low skill, and service and high skill.[10] We also include homemaker as a fourth category for the sample women's mothers to account for those who stay at home. If the instruments, conditional on our controls, are correlated with local labor market conditions, then they should be able to predict the labor outcomes of the parents of our sample women.

<<Insert Table 7 here>>

Table 7 reports the average marginal effect of the fertility instruments on the likelihood of each parent working in each of the industry categories. Table 7 also reports the Chi-squared statistic for the test of the joint significance of the instruments in predicting the mothers' and

[10] While it would be ideal to estimate selection into the same labor market sectors for the parents that we use for our sample women, we do not have enough information to do so. Whether the sample women are categorized as working in the formal or informal sector depends partly on how they are compensated for their labor. Unfortunately, we do not have information on the remuneration status of their parents and therefore cannot classify their parents' occupations as formal or informal employment.

fathers’ industry of main occupation. Each of the Chi-squared test statistics is highly insignificant, with p-values of 0.37 and 0.74 for mothers and fathers, respectively.

<<Insert Table 8 here>>

As a point of comparison, Table 8 reports the reduced form estimates of the marginal effect of the fertility instruments on the labor market sectoral selection of the young women in our sample. In other words, we regress the MNL model of labor market sectoral selection directly on the fertility instruments, excluding the fertility timing categories. Here, we observe that the instruments significantly predict these women’s sector of employment. The Chi-squared statistic on their joint significance is statistically significant at the five percent level. The placebo test results suggest that our instruments do not correlate with local labor market conditions. It is possible that these instruments may still be capturing some unobserved community labor characteristics. However, given the reduced form results reported in Table 8, these characteristics would have to be unique to our sample women and unrelated to the labor outcomes of their parents.

VI. Conclusions

Policymakers have long been interested in increasing female labor participation in both developed and developing countries, as well as the role that childbearing plays in labor market opportunities and decisions. There is also increasing interest in the quality of employment outcomes for women, which has focused our attention on not just the relationship between women’s fertility experiences and female labor market participation, but the type and quality of work as well. While the literature has largely been limited to look at the general role of fertility on work, we instead are concerned with a more specific question that revolves around the timing of first birth, and more specifically teenage births, on both labor market participation and sectoral selection among young women in Madagascar. In doing so, we deal with the endogeneity of both the timing of first birth and schooling.

Our findings indicate that while motherhood in general increases the likelihood of working, the timing of fertility influences the magnitude of this effect and the type of work in which young women are employed. We find no statistically significant differences in labor market sector selection between women who have children in young adulthood (i.e., after their teenage years through their early 20s) and those who will have children in later adulthood. Teen mothers, however, are much more likely to be working in the informal sector. This result is partially explained by the negative effect of adolescent childbearing on school attainment. However, there is also a direct effect of teenage birth on the probability of working in the informal sector, which presumably reflects both the reluctance of formal sector employers to hire a teenage mother as well as the compatibility between working in family-owned enterprises and childcare. The larger concern, however, is that not only does early childbearing increase female labor market participation in lower-quality, less desirable jobs, but that such a finding will have deleterious consequences for a women's work opportunities across their life-course. The push of these young women into informal jobs is especially troubling given that 90% of our sample women who report working in a family-owned enterprise report their remuneration status as "unpaid." These women presumably receive non-monetary compensation as a member of the household, and this may include assistance with childcare. Nonetheless, the much higher probability of teenage mothers working as informal, unpaid family workers highlights the lack of options available to women who give birth as teenagers. Our results, therefore, highlight the importance of preventing teenage pregnancy as an effective modality for improving the human capital and labor outcomes of young women in developing countries.

One final note is that we are observing labor market outcomes of women in their early twenties, and differences may emerge later in their life course. For example, it is reasonable to expect that women who have yet to experience their first birth in the early twenties will ultimately attain higher levels of schooling than women who have children as young adults, and that these women may consequently have different work profiles later in life. In fact, given that we also find that one additional year of school reduces the probability of informal work by approximately 7.8%, 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 are broadly consistent with others such as Agüero, and Marks (2008), who find that having children is a barrier to work in the paid labor sector, and Urdinola and Ospina (2015), who find that teen mothers in Colombia are more likely to have lower-quality jobs. These findings thus focus attention on policies that prevent teenage pregnancy to facilitate higher school attainment and thereby reduce the likelihood of young women being driven into low-quality jobs in the informal sector. Additionally, the fact that we also find a substantial direct, non-school mediated, effect of adolescent childbearing on working in the informal sector, highlights the importance of policies, such as access to child-care, that support young mothers in caring for their children while working in higher-quality jobs.

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Figure 1

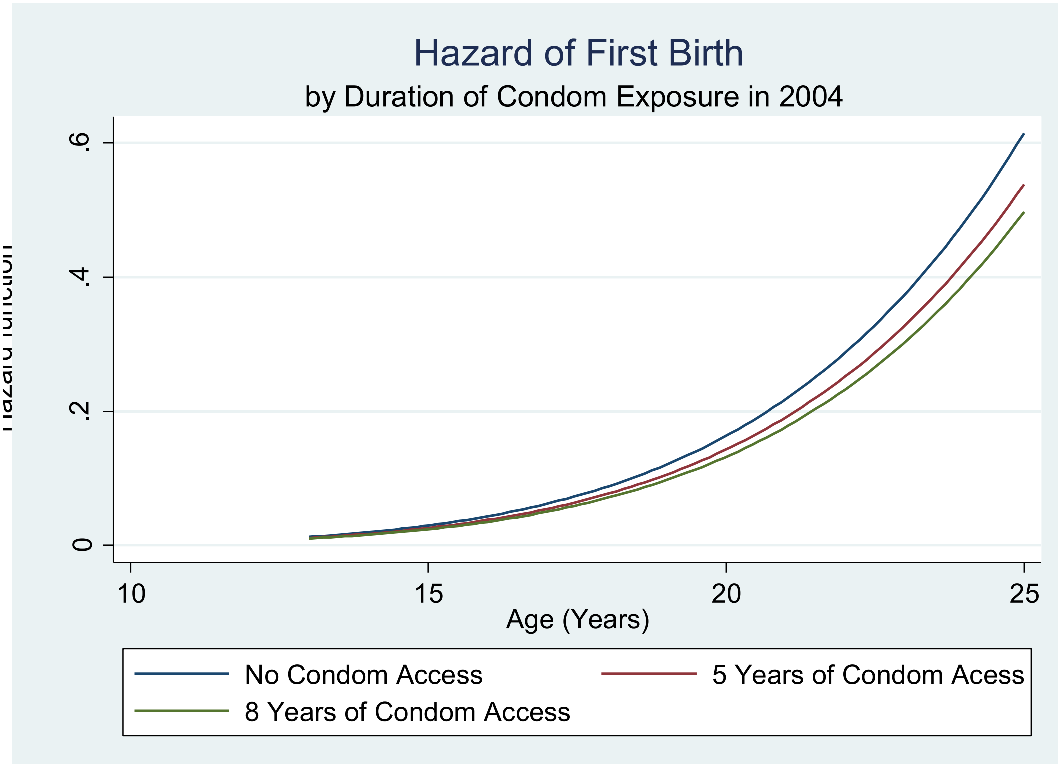

Figure 2

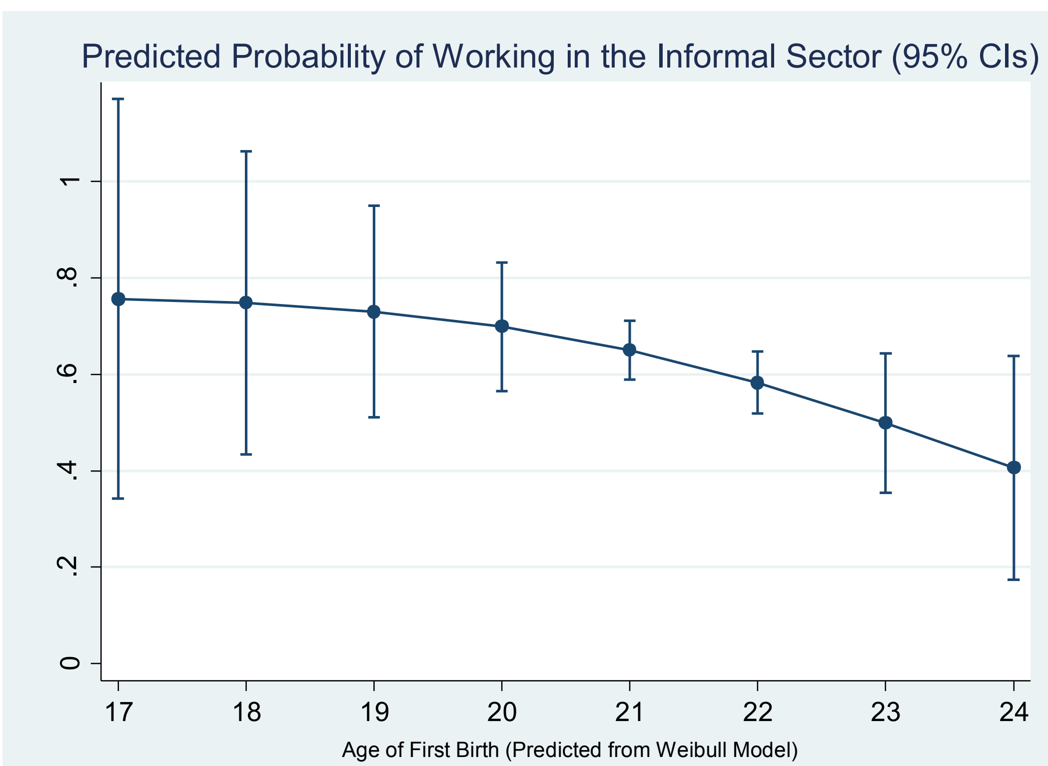

Table 1: Socioeconomic Characteristics by Age at First Birth

	Not-Yet Mothers	Young Mothers (AFB>18)	Teen Mothers (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 at first birth.

Standard errors in parentheses.

Table 2: Labor Market Segmentation by Age at First Birth

	Not-Yet Mothers	Young Mothers (AFB>18)	Teen Mothers (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 at first birth.

Table 3: Contraception Use by Age at First Birth

	Not-Yet Mothers	Young Mothers (AFB>18)	Teen Mothers (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	Instrumented Grade Included
	NO IV	Instrumented Mother Status		
	(1)	(2)	(3)	(4)
	Non-Participation			
Young Mother (AFB>18)	0.041	-0.160	-0.178	-0.168
	(0.032)	(0.180)	(0.187)	(0.154)
Teen Mother (AFB≤18)	0.002	-0.447***	-0.465***	-0.458***
	(0.029)	(0.156)	(0.150)	(0.132)
Education Level			0.000	0.055
			(0.005)	(0.038)
	Working			
Young Mother (AFB>18)	0.168***	0.354***	0.345***	0.343***
	(0.036)	(0.086)	(0.131)	(0.113)
Teen Mother (AFB≤18)	0.195***	0.602***	0.500*	0.522*
	(0.034)	(0.121)	(0.293)	(0.270)
Education Level			-0.038***	-0.038
			(0.006)	(0.046)
	Student			
Young Mother (AFB>18)	-0.209***	-0.194	-0.167+	-0.175+
	(0.022)	(0.138)	(0.112)	(0.112)
Teen Mother (AFB≤18)	-0.197***	-0.155	-0.036	-0.064
	(0.024)	(0.176)	(0.285)	(0.289)
Education Level			0.038***	-0.018
			(0.006)	(0.036)

Notes: AFB denotes age at first birth.
*** p<0.01, ** p<0.05, * p<0.1, + p<0.15. Bootstrapped standard errors calculated using the 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	Instrumented Grade Included
	NO IV	Instrumented Mother Status		
	(1)	(2)	(3)	(4)
	Non-Participation			
Young Mother (AFB>18)	0.040	-0.169	-0.187	-0.179
	(0.032)	(0.148)	(0.170)	(0.173)
Teen Mother (AFB≤18)	0.003	-0.449***	-0.468***	-0.462***
	(0.029)	(0.122)	(0.138)	(0.135)
Education Level			-0.001	0.056+
			(0.005)	(0.038)
	Informal			
Young Mother (AFB>18)	0.219***	0.213	0.164	0.159
	(0.041)	(0.269)	(0.222)	(0.259)
Teen Mother (AFB≤18)	0.229***	0.620***	0.522**	0.545**
	(0.039)	(0.137)	(0.262)	(0.251)
Education Level			-0.049***	-0.078*
			(0.006)	(0.046)
	Formal			
Young Mother (AFB>18)	-0.050*	0.147	0.184	0.187
	(0.029)	(0.259)	(0.186)	(0.298)
Teen Mother (AFB≤18)	-0.035	-0.015	-0.012	-0.011
	(0.030)	(0.061)	(0.083)	(0.079)
Education Level			0.012**	0.040
			(0.005)	(0.045)
	Student			
Young Mother (AFB>18)	-0.209***	-0.191*	-0.161*	-0.167*
	(0.022)	(0.106)	(0.089)	(0.098)
Teen Mother (AFB≤18)	-0.197***	-0.156	-0.043	-0.071
	(0.024)	(0.1640)	(0.296)	(0.233)
Education Level			0.038***	-0.018
			(0.007)	(0.039)

Notes: AFB denotes age at first birth.
*** p<0.01, ** p<0.05, * p<0.1, + p<0.15. Bootstrapped standard errors calculated using the delta method. All the models include the individual, household and community controls described in the empirical section.

Table 6: Marginal Effect of Delaying Age at First Birth by One Year on Selection into Labor Market Sectors

	Non-Participation	Informal Sector	Formal Sector	Student
Panel A				
Predicted Age at First Birth	0.041	-0.072*	-0.018	0.049*
	(0.03)	(0.042)	(0.027)	(0.028)
Panel B				
Predicted Age at First Birth	0.041	-0.058	-0.026	0.043+
	(0.033)	(0.041)	(0.031)	(0.029)
Education Level	-0.003	-0.058***	0.012**	0.049***
	(0.004)	(0.005)	(0.005)	(0.006)
Panel C				
Predicted Age at First Birth	0.043	-0.060**	-0.026	0.043+
	(0.035)	(0.029)	(0.027)	(0.026)
Education Level Instrumented	0.045	-0.076*	0.031	-0.000
	(0.037)	(0.046)	(0.040)	(0.041)

Notes: N=788. *** p<0.01, ** p<0.05, * p<0.1, + p<0.15. Bootstrapped standard errors calculated using the delta method. All the models include the individual, household and community controls described in the empirical section.

Table 7: Average Marginal Effects of Fertility Instruments on the Likelihood of Parents' Industry of Occupation

	Fertility Instruments			
	Mother		Father	
	Condom Access	Condom Exposure	Condom Access	Condom Exposure
	(1)	(2)	(3)	(4)
Agriculture/Livestock	0.038	-0.009	0.063	-0.005
	(0.085)	(0.011)	(0.081)	(0.010)
Manual Labor/Low Skill	0.094	-0.009	0.044	-0.004
	(0.058)	(0.007)	(0.077)	(0.009)
Service/High Skill	-0.058	0.001	-0.107	0.010
	(0.078)	(0.010)	(0.079)	(0.010)
Homemaker	-0.074	0.017		
	(0.079)	(0.011)		
Chi-Square Statistic	6.49		1.96	
P-value	0.37		0.74	

*** p<0.01, ** p<0.05, * p<0.1, + p<0.15. Standard errors in parentheses.
Includes all the individual, household and community controls described in the empirical section.

Table 8: Average Marginal Effects of Fertility Instruments on Young Women's Selection into Labor Market Sectors

	Condom Access	Condom Exposure
Non-participation	0.025	0.006
	(0.062)	(0.009)
Informal	-0.190**	0.012
	(0.079)	(0.011)
Formal	0.056	-0.011
	(0.052)	(0.008)
Student	0.108***	-0.007
	(0.039)	(0.007)
Chi-Square Statistic	12.27	
P-value	0.05	

*** p<0.01, ** p<0.05, * p<0.1, + p<0.15. Standard errors in parentheses.
Includes all the individual, household and community controls described in the empirical section.

Appendix

Table A.1: First-Stage Coefficients for Fertility Timing and Grade Attainment

	Fertility Timing			Education
	Not-Yet Mother	Young Mother	Teen Mother	Grade
Community Access to Condoms		-0.1730	-0.6392	
		(0.551)	(0.534)	
Condom Exposure since Age 15		-0.0990	0.0142	
		(0.070)	(0.074)	
School Facilities Quality Index				0.0654
				(0.192)
Distance between Town Center and Primary School				0.0803
				(0.093)
Nutrition Program in School				0.0554
				(0.217)
Private School in Community				0.6794**
				(0.265)
Age Cohort 1		-1.7963***	0.3102	0.5464
		(0.501)	(0.378)	(0.371)
Age Cohort 2		-1.5819***	-0.1868	0.5661**
		(0.297)	(0.283)	(0.287)
Age Cohort 3		-0.5043*	0.0193	0.4307
		(0.258)	(0.265)	(0.284)
Age Cohort 5		0.8447**	-0.0851	-0.1971
		(0.338)	(0.403)	(0.411)
2004 Asset Index		-0.0616	-0.3451**	0.7951***
		(0.148)	(0.150)	(0.149)
Mother's Highest Grade		-0.0782**	-0.0604*	0.2477***
		(0.034)	(0.034)	(0.035)
Father's Highest Grade		0.0378	-0.0537*	0.1935***
		(0.034)	(0.030)	(0.033)
Urban		-0.8458*	-0.4668	0.3114
		(0.505)	(0.473)	(0.566)
Community Health Center		-0.2593	-0.0343	0.9268**
		(0.381)	(0.353)	(0.414)
Hospital		0.2150	-0.5819*	-0.0121
		(0.303)	(0.324)	(0.335)
Secondary School		-0.6971**	-0.4636	0.4842
		(0.288)	(0.289)	(0.307)
Piped Water		0.4491*	0.2626	0.8598***
		(0.250)	(0.225)	(0.253)
Weekly Market		-0.4911**	-0.1191	-0.5912**
		(0.240)	(0.232)	(0.269)
Access to Paved Road		0.4149	0.3433	-0.1635
		(0.261)	(0.246)	(0.277)
Electricity in Community		0.2068	-0.0027	-0.2462
		(0.311)	(0.282)	(0.349)
2001 Remoteness Index		-0.0333	-0.0926	-0.4768***
		(0.109)	(0.101)	(0.117)
Regional Dummies	Yes	Yes	Yes	Yes
Constant		1.4556**	0.7309	5.3474***
		(0.584)	(0.546)	(0.680)
Observations	788	788	788	788

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

**Figure A.1: Access to Condoms Among Young Women's Communes of Residence
2011-12 Madagascar Life Course Transition of Young Adults Survey**