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Christoph Strupat

# Does Timing of Health and Family Planning Services Matter?

## Age at First Birth and Educational Attainment in Indonesia

Ruhr Graduate School in Economics
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Technische Universität Dortmund, Department of Economic and Social Sciences
Vogelpothsweg 87, 44227 Dortmund, Germany

Universität Duisburg-Essen, Department of Economics
Universitätsstr. 12, 45117 Essen, Germany

Rheinisch-Westfälisches Institut für Wirtschaftsforschung (RWI)
Hohenzollernstr. 1-3, 45128 Essen, Germany

## Editors

Prof. Dr. Thomas K. Bauer
RUB, Department of Economics, Empirical Economics
Phone: +49 (0) 234/3 22 83 41, e-mail: thomas.bauer@rub.de

Prof. Dr. Wolfgang Leininger
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Economics – Microeconomics
Phone: +49 (0) 231/7 55-3297, e-mail: W.Leininger@wiso.uni-dortmund.de

Prof. Dr. Volker Clausen
University of Duisburg-Essen, Department of Economics
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Phone: +49 (0) 201/1 83-3655, e-mail: vclausen@vwl.uni-due.de

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RWI, Phone: +49 (0) 201/81 49-213, e-mail: presse@rwi-essen.de

## Editorial Office

Sabine Weiler
RWI, Phone: +49 (0) 201/81 49-213, e-mail: sabine.weiler@rwi-essen.de

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Christoph Strupat[1]

# Does Timing of Health and Family Planning Services Matter?

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## Abstract

*This paper examines empirically whether midwifes, as an integral part of the health and family planning programs in Indonesia, are effective in advising young women to delay their first birth and also influence the decision on post-primary school attendance. Using the Indonesian Family Life Survey, I investigate the extent to which the exogenous expansion of a midwife program affects the age at first birth and the number of school years of women. My findings suggest that women who were exposed to a midwife when they have to decide on further school attendance (age 13-20) delay their first birth and also stay longer in post-primary school. According to the average returns of education in Indonesia, I conclude that family planning services provided by midwifes can generate large socioeconomic benefits by allowing young women to postpone their first birth.*

*JEL Classification: J13, I12; O12*

*Keywords: Family planning; midwifes; fertility; education*

*August 2014*

*1 Christoph Strupat, University Duisburg-Essen and RGS Econ.* *– The author would like to thank Martin Fischer, Sarah Okoampah, Florian Klohn, Matthias Busse, Martin Karlsson and Christoph M. Schmidt for helpful comments.* *– All correspondence to: Christoph Strupat, University Duisburg-Essen, Schützenbahn 70, 45127 Essen, Germany, e-mail: christoph.strupat@uni-due.de*

## 1. Introduction

Steadily increasing birth rates in developing countries (UNITED NATIONS 2011) bear the consequences of lower economic growth and high youth un-employment rates. In order to overcome cycles of high fertility and economic stagnation many development interventions improve the access to modern contraceptives and information on family planning. Especially the last measure can theoretically influence women's knowledge on the benefits of smaller families, convince them to have a lower number of births and encourage them to invest more in their educational and professional career over the life cycle (GOLDIN AND KATZ 2002, ANGELES ET AL. 2004). Furthermore, an improved access to contraceptives may reduce the economic and psychological costs of fertility control for women (ASHRAF ET AL. 2010). However, empirical evidence on the effectiveness of family planning interventions in developing countries is rather mixed. While some studies find a significant increase of contraceptive usage and a decline in fertility rates (e.g. ANGELES ET AL. 1998, SINHA 2005, PHILIPS ET AL. 2006), other studies do not find any impact of family planning programs (e.g. GERTLER AND MOLYNEAUX 1994, DESAI AND TAROZZI 2011).

One problem potentially responsible for this mixed evidence is the difficult evaluation of those programs, as placement and utilization of family planning are generally targeted to areas with a high demand for children (SCHULTZ 1994, 2005). Another problem is that many studies entirely focus on fertility or contraceptive usage and neglect the timing of births as another important output of reproductive behavior that also can affect the human capital accumulation of women (MILLER 2010). While a large number of studies have investigated empirically the effect of modern contraceptives and family planning on the timing of births, human capital accumulation and labor market outcomes for developed countries (ANGRIST AND EVANS 1998, RIBAR 1999, BAILEY 2006, BAILEY ET AL. 2012, ANANAT AND HUNGERMAN 2012) similar work for developing countries remains scarce.

In this paper I examine how a large-scale Indonesian midwife program, as an integral part of the Indonesian family planning and health program, affects the timing of first birth and the educational attainment of women as an indicator for human capital accumulation. The midwife program dispatched trained midwives to over 50,000 communities in the early- to mid-1990s. As the midwifes' responsibilities were not restricted to improve infant and maternal health but also included the provision of modern contraceptives and information on family planning, the program bore potential for convincing and allowing women to postpone their first birth and, thereby, might affect their decision to stay longer in school. At the time of the program family planning activities aimed at advising young women to have their first child after they had reached an age of 20. In addition, midwifes were supposed to advise women beyond the age of 30 and those with three or more children not to have any more children.

The empirical analysis is based on data from the last wave of the Indonesian Family Life Survey (IFLS) which was conducted in 2007. The IFLS provides information on individual socio-economic variables like pregnancy and education histories. In addition, detailed information on 311 communities from the 1993, 1997 and 2000 IFLS waves are used that documents the major expansion in midwife services and the economic development during that time. While in 1993 only 10% of IFLS communities had a village midwife, the share had increased to 50 percent by 1997. I employ a difference-in-difference approach and calculate the difference in means between midwife and non-midwife communities as well as the difference between birth cohorts that are differently exposed to the midwife treatment.

To the best of my knowledge, no comprehensive analysis of family planning services, timing of first birth and educational attainment for women has yet been conducted for Indonesia. Furthermore, few empirical studies on the relationship between family planning services and human capital accumulation of women exist for other developing countries. MILLER (2010) provides evidence that women postpone their first birth and increase their participation in the formal labor market, using a country-wide roll-out of family planning services in Colombia. He shows that especially young women (age 15-19) delay their first birth when family planning services are available, but cannot exactly determine the postponement in terms of age. FRANCAVILLA AND GIANELLI (2011) show that family planning workers who are sent to visit women in certain areas in India are effective in increasing the probability of women's employment. SCHULTZ (2012) investigates the long-run consequences of the famous Matlab family planning experiment from Bangladesh and finds that the program contributed to investments in the human capital of women. He finds that women from the program regions earn higher wages than non-participating women.

Two empirical studies on impacts of the Indonesian family planning program are partly related to this paper. ANGELES ET AL. (2005) use data from the 1993 IFLS wave to show that available family planning services increase school attendance of women in Indonesia, but do not investigate whether the timing of first birth also is affected. KIM (2010) uses the same data in order to examine the relationship between education and timing of birth by using a duration model. He finds that family planning services negatively affect the hazard to experience a second birth, but do not study impacts on the timing of first birth and education.

This study contributes to the literature in three ways. Firstly, while most studies cannot investigate the timing of first birth due to data limitations, I use information on the age at first birth, which allows me to examine whether family planning services affect the date of first birth. Secondly, as most studies on this topic do focus on labor market outcomes (e.g. wages) as an indicator for human capital accumulation, I can investigate directly if the number of school years of women is influenced by the timing of birth, which can trigger outcomes such as wages or formal labor market participation. Thirdly, I am able to evaluate whether a combination of the provision of modern contraceptives and information on family planning is effective in changing reproductive behavior and human capital accumulation.

My results indicate that women who were exposed to a midwife when they also make their school attendance decision (age 13-20) delay their first birth by about one year. Furthermore, those women also stay 0.70 years longer in school which indicates that the midwife treatment works beyond the postponement of first birth and leads to a significant increase of school years. In addition, the presence of a midwife results in a higher probability of receiving first birth after the age of 20.

The rest of this paper is organized as follows. Section 2 describes the midwife program and the educational system of Indonesia. Section 3 introduces the dataset and presents the econometric model. Section 4 shows the estimation results before section 5 concludes.

## 2. The Community Midwife Program and the educational system in Indonesia

### 2.1 The Midwife Program

The Indonesian midwife program (*bidan di desa*) was initiated by the Indonesian government and international donors in 1989 and dispatched 52,000 midwifes to over 50,000 communities until the late 1990s (WORLD BANK 1991). Due to the major expansion of the program between 1993 and 1997, midwife density increased from 0.2 per 10,000 inhabitants in 1986 to 2.6 in 1996 (MINISTRY OF HEALTH, 1997, 2000). The main aim of the program was the reduction of maternal and infant mortality, especially in poor and remote communities that underutilize health services. The program recruited nursing academy graduates to one-year midwifery trainings, subsequently placing them into different communities.

Midwifes were trained to conduct a wide range of health services such as skilled birth delivery, injections and administration of nutritional supplements particularly for women in their reproductive age (14-49). They served as health resources in the community and actively seek for patients and visited them in their homes (FRANKENBERG AND THOMAS 2001). In order to guarantee that midwifes were able to offer their services for reduced prices or free of charge, the government paid them a salary in the first three to six years after they had started their work. In addition, they were also allowed to practice privately after regular office hours, as it was expected that midwifes lived in or nearby the selected communities. Various studies show that the presence of midwifes increased in particular the use of antenatal care and women's intake of iron tablets and improved a variety of health outcomes of mothers and young children including the body mass index of women, birth weight and height-for-age of their children (FRANKENBERG ET AL. 2009, FRANKENBERG ET AL. 2005). Additionally, midwifes also lower neonatal mortality (SHRESTHA 2010).

Besides the health services of midwifes, their responsibilities also included the provision of modern and long-lasting contraceptives like oral and injectable contraceptives or implants (WORLD BANK 1991). Midwifes were an integral part of the country-wide family planning program. This program was started by the New Order regime of President Suharto in 1970 and was implemented by the National Family Planning Coordinating Board (BKKBN), with branch offices in each of the country's 33 provinces (MCDONALD ET AL. 2009). Cornerstones of the program were community health meetings in villages and community family planning facilities run by BKKBN assistants that distribute contraceptives in the communities. The main strategy of this program during that time included advising women to have their first child after they had reached an age of 20 (BPS & MACRO INTERNATIONAL 1991). Furthermore, women over 30 and those with three or more children were to be advised not to have any more children. In accordance to this strategy, midwifes served as an additional access point for modern contraceptives and information on family planning that could change reproductive behavior of women who were under 20 (over 30) or had three or more children.

A recent study by WEAVER ET AL. (2013) shows that midwifes enhanced the supply of modern contraceptives and influenced women's contraceptive method choice, but does not find a significant increase of contraceptive usage for women that were older than 30 or had more than three children. The study did not investigate whether midwifes influence contraceptive usage of women under 20 and affect the timing of first birth.

## 2.2 The Indonesian educational system

The Indonesian educational system includes six years of primary education which is compulsory for all children (age 6-12) and two phases of post-primary education (see Table 1). Both, the junior secondary school (age 13-15) and the senior secondary school (age 16-18) take three years to complete. Furthermore, both are neither mandatory nor subject to payments of school fees. In addition, at the end of junior secondary education there is a national examination and entry into senior secondary school is based on the results of the exam. Senior secondary education can be completed attending either vocational or general schools. After graduating from senior secondary school, adolescents can attend university courses, which take four years for an under-graduate degree (age 19-22) and two years (age 23-24) for a graduate degree. Finally, doctoral students are intended to need three years (age 25-27) for their doctoral thesis.

As Indonesia has made great progress in its school system over the last three decades in terms of providing basic education for all, the net enrollment rates at primary school level increased from 79 percent in 1983 to 92 percent in 2012. In addition, the net enrollment rate at junior secondary schools raised from 17 percent in 1973 to 71 percent in 2012, while senior secondary school attendance increased from 9 to 39 percent (ACEDO ET AL. 2002, MILLER ET AL. 2013). This development is a consequence of the nation-wide expansion of school education which included the construction of new school buildings, hiring of new teachers, improved teacher training and changes of the curriculum.

**Table 1: Educational system of Indonesia**

| Educational stage | Year | Age | Level |
|---|---|---|---|
| Primary school | 1 | 7 | Primary education |
| | 2 | 8 | |
| | 3 | 9 | |
| | 4 | 10 | |
| | 5 | 11 | |
| | 6 | 12 | |
| Junior Secondary school | 7 | 13 | Post-primary education |
| | 8 | 14 | |
| | 9 | 15 | |
| Senior Secondary school | 10 | 16 | |
| | 11 | 17 | |
| | 12 | 18 | |
| Under Graduate | 13 | 19 | Higher education |
| | 14 | 20 | |
| | 15 | 21 | |
| | 16 | 22 | |
| Post Graduate | 17 | 23 | |
| | 18 | 24 | |
| Doctorate | 19 | 25 | |
| | 20 | 26 | |
| | 21 | 27 | |

Source: Southeast Asian Ministry of Education Organization and Acedo et al. (2002)

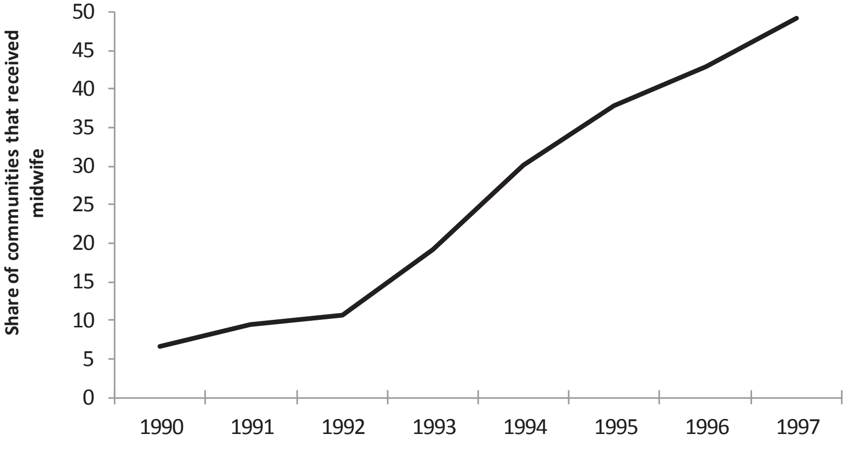
## 3. Data and identification strategy

### 3.1 Data description

For my empirical analysis I use data from the 2007 wave of the Indonesian Family Life Survey (IFLS), which contains socio-economic variables including information on the age at first birth and individual education histories. The survey was conducted in 311 communities in 13 of the Indonesia's 27 provinces offering information on the physical and social environment in the communities. In addition, I use data from the three other IFLS waves conducted in 1993, 1997 and 2000 that include information on community characteristics such as number of schools and health posts, road status and availability of electricity. Most importantly the presence of a program midwife and the timing of the midwife's arrival in the community are also documented. Figure 1 shows that about 5 percent of the IFLS communities had received program midwives in 1992, while the share increased to about 50 percent until 1997 indicating the rapid expansion of the program between 1993 and 1997. Therefore, I define a binary indicator representing the presence of a village midwife in an individual's community between 1993 and 1997 as the treatment variable.

Furthermore, I define three outcome variables. First, I use information from pregnancy histories to calculate the age at first birth. Second, I define a dummy variable that indicates whether a woman receives her first child after the age of 20. As only three percent of the women's sample defined below (all women between age 27 and 49) had not give birth, both outcomes do not induce a sample selection problem. I exclude women that had not give birth from the sample (3%). For robustness checks I also conduct the analysis by including them and results did not change. Finally, I use detailed information on the education history, including the time of graduation, grade repetition and school drop-outs in order to calculate the total number of school years.

**Figure 1: Expansion of the midwife program**




Source: Own calculation using IFLS

As shown in Table 1, the education career in Indonesian is regularly completed by the age of 27 (ACEDO ET AL. 2002), thus I will include all women who are of age 27 or older in the sample. I further restrict the sample to women who do not exceed age 49 as information on the age at first birth is available until that age.[2] As I do not have information on the individual exposure to a midwife, I further restrict the sample to all women who did not move to other communities between 1993 and 2007. Thus, my sample consists of 2,384 women that provide information on all variables I use in the empirical analysis.

[2] As I will exploit the variation in the midwife treatment across women of different age for identification, I check my findings against the possibility of comparing mothers with their daughters, which would potentially violate the stable unit treatment assumption. Thus, I gradually reduce the maximum age from 49 to 44 which did not change the results.

### 3.2 Identification strategy

The Indonesian family planning program strategy included advising women to have their first child after they had reached an age of 20 years. Thus, midwifes as an integral part of the family planning program are supposed to provide modern contraceptives and information on family planning to women who were in the relevant age group during the program expansion between 1993 and 1997. For instance, women born between 1977 and 1980 belonged to the age groups 13-16 in 1993 and 17-20 in 1997 and could be influenced by midwifes in their decision on delaying first birth beyond age 20. As during the same age span decisions on post- primary education attendance (see Table 1) also had to be made by the women or their parents, it is possible to investigate if the midwife program also affected the number of school years through the delay of first births. Contrarily, women who were 25 years or older in 1997 (born before 1972) already had made their decisions on post-primary school attendance in the past and were not exposed to a midwife during the relevant age (13-20). I exploit this variation in treatment exposure in order to identify the causal effect of the midwife program employing a difference-in-difference framework. In particular, I calculate the difference between midwife and non-midwife communities as well as the difference between birth cohorts that are differently exposed to the midwife treatment.

Table 2 shows the means of the three outcome variables for the different groups of birth cohorts. Women who were fully exposed to the community midwife in terms of the decisions on first birth and post-primary education were in the age group of 13-16 in 1993 and 17-20 in 1997 (born between 1977-1980). Partly exposed women are 17-20 and 21-24 years old in 1993 and 1997, as only some of them are under age 20 during the expansion of the midwife program and many probably have completed post-primary education. The control group is defined by all women aged 25 or older in 1997 (born before 1972) that are not affected by the midwife in their decisions on the timing of first birth before age 20 and post-primary education.

The difference-in-difference between the birth cohorts fully exposed to the midwife and the control group reveal an increase in the age at first birth of 0.67 years. The double difference also shows that midwife communities exhibit a higher likelihood of having their first birth after reaching age 20 of 6 percentage points and stay in school for an additional year. Under the assumption that in absence of the midwife program the increase in outcomes between midwife and non-midwife communities has not been systematically differed, these results can be interpreted as the causal effects of the program.

However, earlier studies have shown that the midwife program was targeted to communities with poorer infrastructure, lower welfare and health status (FRANKENBERG AND THOMAS 2001, FRANKENBERG ET AL 2005). In addition, midwifes should visit especially women from uneducated, low-income families that underutilize family planning services (WEAVER AND FRANKENBERG 2012).

**Table 2: Means of the outcome variables by birth cohort and midwife presence**

| | Fully exposed | | | Partly exposed | | | Control group | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | | 3 | 4 | | 5 | 6 |
| | Has Village Midwife | No Village Midwife | Double diff. (1-2) – (5-6) | Has Village Midwife | No Village Midwife | Double diff. (3-4) – (5-6) | Has Village Midwife | No Village Midwife |
| **Dep. var** | | | | | | | | |
| Age of first birth | 21.63 | 21.57 | 0.67 | 21.24 | 22.47 | -0.62 | 20.97 | 21.58 |
| | (0.23) | (0.21) | (0.43) | (0.20) | (0.24) | (0.40) | (0.18) | (0.17) |
| Age of first birth >20 | 0.69 | 0.69 | 0.06 | 0.70 | 0.74 | 0.02 | 0.58 | 0.64 |
| | (0.03) | (0.03) | (0.06) | (0.03) | (0.02) | (0.04) | (0.02) | (0.02) |
| # of school years | 8.73 | 9.32 | 0.95 | 7.89 | 9.73 | -0.18 | 6.46 | 8.12 |
| | (0.29) | (0.25) | (0.45) | (0.20) | (0.26) | (0.43) | (0.18) | (0.18) |
| N | 451 | | | 566 | | | 1,331 | |

*Notes:* Standard errors are in parenthesis.

This non-random placement of midwifes makes it likely that young birth cohorts from midwife communities with lower initial developmental levels had benefited differently from changes in the economic situation than non-midwife communities. For instance, economic growth in the 1990s may have especially increased the possibility for low-income families in initially underdeveloped communities to pay school fees and have allowed those to send more children to secondary schools. As post-primary education ranges from age 13 to 19, women in this age group living in midwife communities were fully exposed to the treatment and, thus, might have been particularly affected by this development. In that case higher outcomes of these birth cohorts might be fully attributed to the presence of the midwife program although in reality a part of the correlation might be due to the lower initial developmental level and different socioeconomic dynamics in midwife communities.

In order to overcome this problem I estimate average midwife effects at the community level by specifying three linear regression models. The first specification includes 310 community dummies ($Community_c$), in order to account for the different development levels between midwife and non-midwife communities:

$$y_{ikc} = \beta_0 + \left(M_c \cdot Cohort_i^{full}\right)\beta_1 + \left(M_c \cdot Cohort_i^{part}\right)\beta_2 + \sum_{k=1}^{5} \theta_k \left(Cohort_{ik}\right) + \sum_{c=1}^{310} \mu_c \left(Community_c\right) + \epsilon_{ikc} \quad (1)$$

The dependent variable $y_{ikc}$ indicates the number of school years of woman $i$ that is born in year $k$ and lives in community $c$.[3] This variable is regressed on the interactions between the binary treatment variable $M_c$ which takes the value 1 if the woman lives in a midwife community between 1993- 1997 and the two groups of birth year cohorts that indicates if the woman was born between 1977-1980 ($Cohort_{ik}^{full}$) and 1973-1976 ($Cohort_{ik}^{part}$).[4] The remaining three groups of birth year cohorts consist of women born between 1969-1972, 1965-1968 and 1961-1964. The coefficients of interest are $\beta_1$ and $\beta_2$, which represent the difference-in-difference estimates that measure the effect of the midwife presence on the outcome variables. They show the difference between midwife and non-midwife communities relative to the remaining birth year cohorts.

In order to consider the fact that midwifes should visit women from uneducated, low-income families, I include in the second specification a range of parental background variables, $X_i$, such as education, occupation and religion of the parents.[5] Furthermore, $Age_i$ includes women's age and a

[3] I also use this regression model for the age at first birth as dependent variable. For the binary dependent variable indicating if the woman receives her first birth after reaching age 20, I estimate a linear probability model (LPM) using the same specification as in equation (1). Standard errors are clustered at the community level and are robust against heteroscedasticity.

[4] The reference cohorts are women born between 1957 and 1960.

[5] Table A1 in the Appendix displays the descriptive statistics of the variables used in the regression model, distinguished by midwife exposure.

variable that shows the age at the first menstruation in order to approximate for delayed fecundity due to a low health status during adolescence:

$$y_{ikc} = \beta_0 + \left(M_c \cdot Cohort_i^{full}\right)\beta_1 + \left(M_c \cdot Cohort_i^{part}\right)\beta_2 + \sum_{k=1}^{5} \theta_k \left(Cohort_{ik}\right) + \sum_{c=1}^{310} \mu_c \left(Community_c\right) + \gamma' \mathrm{X}_i + \tau' Age_i + \epsilon_{ikc} \qquad (2)$$

As changes in the economic situation and targeted policy interventions such as the extension of junior high schools or family planning facilities affect especially young birth cohorts and may not occur in the same pace in midwife and non-midwife communities, I include interaction terms between the treatment birth cohorts and a range of community variables from 1993 and 1997, $V_c$, into the specification. I consider changes in the economic situation of communities by including the primary income source of the community, road status, availability of electricity and tap water. Furthermore, I consider the number of health facilities, family planning assistants and post-primary schools, in order to account for policy changes that also may influence the age at first birth or then number of school years.

$$y_{ikc} = \beta_0 + \left(M_c \cdot Cohort_i^{full}\right)\beta_1 + \left(M_c \cdot Cohort_i^{part}\right)\beta_2 + \sum_{k=1}^{5} \theta_k \left(Cohort_{ik}\right) + \sum_{c=1}^{310} \mu_c \left(Community_c\right) + \gamma' \mathrm{X}_i + \tau' Age_i + \left(V_c \cdot Cohort_i^{full}\right)\vartheta_1 + \left(V_c \cdot Cohort_i^{part}\right)\vartheta_2 + \epsilon_{ikc} \qquad (3)$$

The difference-in-difference estimates have a causal interpretation, if the included family background characteristics and the community fixed effects capture the differences in the initial developmental levels between midwife and non-midwife communities. Additionally, the included interaction terms between the birth cohorts and past community characteristics have to capture the diverging developments between young and old birth cohorts that may not be equally distributed across midwife and non-midwife communities. If both holds the difference-in-difference estimates represent intention-to-treat effects (ITT) i.e. the effects of an offer to follow the family planning advice of midwifes on the age at first birth, which are of particular interest from a policy perspective, as it captures the effects of the type of changes that the government can carry out.

However, omitted changes in the community characteristics that only affect women from young birth cohorts in midwife communities still might confound the difference-in-difference estimates. Thus, the validity of the identification hinges on the assumption that no unobserved or omitted interactions between the midwife community and the birth year cohorts influence the outcome variables except for the effect of the midwife presence. This assumption is more likely to be satisfied when fewer cohorts are used, as this increases the homogeneity of the exposure and control groups in terms of observable characteristics such as parental or family background variables (see Table A2 of the Appendix) and could also raise the similarity in unobserved characteristics. I therefore present regression results using all women aged 25-28 years old in 1997 as the control group, which results in a restricted sample of women born between 1969 and 1980.

## 4. Results

Table 3 reports the estimation results from the three econometric specifications for age at first birth as dependent variable (see Table A3 of the Appendix for full results). The first column shows the two difference-in-difference estimates without the inclusion of individual control variables and the past community characteristics. Especially, women who were under 20 years during the main expansion of the midwife program and lived in a participating community delayed their first birth by 0.76 years. Contrarily, partly exposed women exhibit a negative but statistically insignificant effect of midwife exposure. Including individual control variables does change the coefficients remarkably. The effect for women that were fully exposed to a midwife increases, which is in line with the fact that midwifes visited primarily uneducated and low-income families that possibly underutilize family planning services. The included parental background variables capture the family characteristics that lead to a midwife visit, which not controlled for downward bias the difference-in-difference estimates. When I include the interaction terms between the past community characteristics and birth cohorts the size of the coefficients increases slightly. This suggests that changes in the infrastructure or certain policy interventions lead to lower socioeconomic dynamics for the treatment birth cohorts in midwife communities than in non-midwife communities.

**Table 3: Effects of the midwife exposure on the age at first birth**

| **Dep. Variable: Age at first birth** | **1** | **2** | **3** |
|---|---|---|---|
| Midwife * Birth cohorts 1977-1980 (Full) | 0.76* | 0.92** | 1.00** |
| | (0.44) | (0.44) | (0.46) |
| Midwife * Birth cohorts 1973-1976 (Part) | -0.47 | -0.48 | -0.19 |
| | (0.39) | (0.38) | (0.46) |
| N | 2,348 | 2,348 | 2,348 |
| adj. R-sq | 0.02 | 0.04 | 0.06 |
| Individual variables | No | Yes | Yes |
| Community variables (1993-1997) * Birth cohorts | No | No | Yes |

Community and birth cohort dummies are included; Standard errors (in parenthesis) are clustered at the community level, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In order to further illustrate the effects of midwife exposure, Table 4 shows the estimation results of the linear probability model for the binary dependent variable indicating if a woman receives her first birth after the age of 20.[6] Women who were fully exposed to a midwife during their teens exhibit a 10 percentage point higher probability to receive their first birth reaching age 20.

[6] I also provide estimates by using a non-linear model (probit) and results do not change.

Thus midwifes do actually affect the timing of birth according to the country-wide family program strategy, which aims at advising women to have their first child only after their 20th birthday. Women who were partly exposed by the midwife, as they were older than 20 years old during the main expansion of the midwife program do not show statistically significant effects.

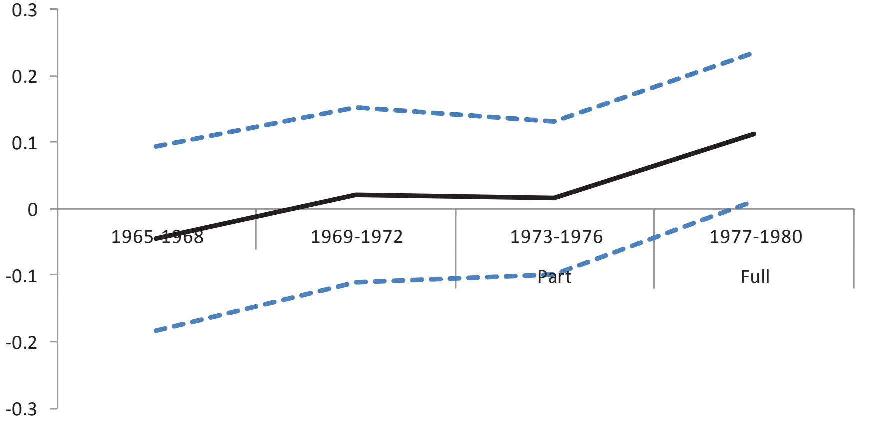
**Table 4: Effects of the midwife exposure on the prob. to receive first birth after 20**

| Dep. Variable: Age at first birth > 20 (0/1) | 1 | 2 | 3 |
|---|---|---|---|
| Midwife * Birth cohorts 1977-1980 (Full) | 0.09 | 0.11* | 0.10* |
| | (0.057) | (0.057) | (0.056) |
| Midwife * Birth cohorts 1973-1976 (Part) | 0.03 | 0.02 | 0.01 |
| | (0.05) | (0.05) | (0.05) |
| N | 2,348 | 2,348 | 2,348 |
| adj. R-sq | 0.02 | 0.05 | 0.07 |
| Individual variables | No | Yes | Yes |
| Community variables (1993-1997) * Birth cohorts | No | No | Yes |

Community and birth cohort dummies are included; Standard errors (in parenthesis) are clustered at the community level, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In Figure 2 I present all coefficients of the interaction terms between the midwife dummy and the birth year cohorts. The reference cohorts are women born between 1960 and 1964. The dashed lines show the 0.95 confidence intervals. The absence of meaningful coefficients among women that were above age 20 (born between 1965 and 1972) during the expansion of the midwife program is in line with the family planning strategy to advise women under age 20 to receive first birth after their 20th birthday. Women born between 1977-1980 exhibit positive coefficients, which suggests that at the time when the midwife program was expanded (between 1993 and 1997) a significant change in timing of first birth can be found for these birth cohorts.

**Figure 2: Coefficients of the interaction term between midwife availability in the community by 1997 and birth year cohorts (Dep. variable: Age at first birth > 20 (0/1))**




Community and birth cohort dummies are included in the estimation model. Standard errors are clustered at the community level.

In Table 5 I present the regression results for the number of school years as dependent variable. According to the previous results, the coefficients of the difference-in-difference estimates show the same pattern across the first two specifications. The inclusion of individual control variables changes the coefficients to a significant extent. Women who were under 20 and, thus, still had to make their decision on post-primary education stay 1 year longer in school if a midwife was available in their community. However, the inclusion of the interaction terms between the past community characteristics and birth cohorts decrease the size of the coefficients, which suggests that changes in the economic situation or certain policy interventions are partly responsible for changes in the number of school years in midwife communities. Nevertheless, the presence of a midwife seems to work beyond the postponement of first birth and leads on average to 0.70 additional years of schooling. From a base of roughly 9 years of schooling, this is an increase of 8%.

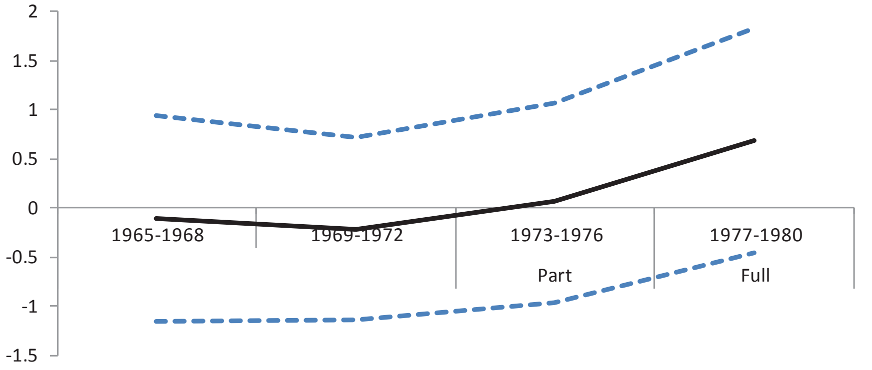
**Table 5: Effects of the midwife exposure on the number of school years**

| Dep. Variable: Number of school years | 1 | 2 | 3 |
|---|---|---|---|
| Midwife * Birth cohorts 1977-1980 (Full) | 0.67* | 1.00** | 0.70* |
| | (0.40) | (0.39) | (0.40) |
| Midwife * Birth cohorts 1973-1976 (Part) | -0.07 | 0.12 | 0.09 |
| | (0.38) | (0.36) | (0.41) |
| N | 2,348 | 2,348 | 2,348 |
| adj. R-sq | 0.10 | 0.25 | 0.25 |
| Individual variables | No | Yes | Yes |
| Community variables (1993-1997) * Birth cohorts | No | No | Yes |

Community and birth cohort dummies are included; Standard errors (in parenthesis) are clustered at the community level, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 3 illustrates how the coefficients from the difference-in-difference estimates vary across the birth year cohorts. The reference cohorts are women born between 1960 and 1964. The estimates are close to zero for women that were out of school during the expansion of the midwife program (born between 1965 and 1972), which is consistent with the expectation that family planning services of midwifes do not affect education beyond school age. Contrarily, the estimates for women in schooling age who were born between 1973 and 1976 slightly increase, while women born between 1977 and 1980 exhibit the highest effect.

**Figure 3: Coefficients of the interaction term between midwife availability in the community by 1997 and birth year cohorts (Dep. variable: Number of school years)**




Community and birth cohort dummies are included in the estimation model. Standard errors are clustered at the community level.

Table 6 shows the regression results for the restricted sample for the three outcome variables. The effects for the three former outcome variables remain similar compared to the findings using the full sample, which suggests that the findings are not driven by heterogeneity between the treatment groups and the control group. However, the difference-in-difference coefficients indicating the probability to have the first birth after reaching age 20 do not retain their statistically significance.

**Table 6: Effects of midwife exposure on the outcome variables (restricted sample – all women born between 1969-1980)**

| Dependent variables: | Age at first birth | First birth >20 | # of school years |
|---|---|---|---|
| Midwife * Birth cohorts 1977-1980 (Full) | 1.12** | 0.09 | 1.10** |
| | (0.51) | (0.06) | (0.48) |
| Midwife * Birth cohorts 1973-1976 (Part) | -0.28 | 0.03 | 0.23 |
| | (0.52) | (0.06) | (0.42) |
| N | 1,569 | 1,569 | 1,569 |
| adj. R-sq | 0.05 | 0.05 | 0.17 |

Community and birth cohort dummies are included. Standard errors (in parenthesis) are clustered at the community level, * $p<0.10$, ** $p<0.05$, *** $p<0.01$

## 5. Conclusion

As many studies on family planning programs in developing countries do not investigate the timing of first birth as an important output of reproductive behavior, this paper examines empirically whether midwifes, as an integral part of the family planning program in Indonesia, are effective in advising young women to delay their first birth and also influence the decision on post-primary school attendance.

Given that midwife's responsibilities include the provision of modern contraceptives and information on family planning, the empirical approach exploits the variation between midwife and non-midwife communities and between birth cohorts that were differently exposed to the presence of a midwife during the main expansion of the program between 1993 and 1997. To address the non-random placement of the midwife I control for community fixed effects and family background variables and test for the robustness of results against the inclusion of a broad set of past community characteristics. I also examine the relationship between the midwife program and the outcome variables by restricting the sample in order to increase the homogeneity with respect to observable and unobservable characteristics.

I find that women who were fully exposed to a midwife during their teens postpone their first birth by one year and exhibit a 10 percentage points higher probability of receiving first birth after the age of 20. Furthermore, the results suggest that midwifes work beyond the postponement of first birth and also cause women to stay longer in school. The number of school years for young women who were exposed to a midwife increases of 0.70 or roughly 8%.

As women's average returns of post-primary education were around 6 percent of the monthly earnings in 2007 (MILLER ET AL. 2013), these results indicate that family planning can generate substantial economic benefits by allowing young women to postpone their first birth. This is in line with the sparse literature for developing countries on this topic. MILLER (2010), for instance, also provides empirical evidence that young women (age 15-19) delay their first birth when family planning services are available, but cannot exactly determine the postponement in terms of age. Furthermore, he shows that the number of school years and formal labor market participation increased for those women by 1% and 7%. However, the Colombian family planning program is not directly comparable to the targeted midwife program in Indonesia that combines the provision of modern contraceptives and information on family planning.

The gain in education attributable to the midwife program can also be compared with other development interventions such as the famous INPRES school construction program in Indonesia. Between 1973 and 1974, this program was responsible for the construction of 61,807 primary schools, which makes it the fastest primary school construction program ever undertaken in the world (World Bank, 1990). DUFLO (2001) shows that the INPRES program was also very effective in increasing the number of primary school years. She finds on average an increase of 0.25 to 0.40 years in primary education, which is half of the effect size of the midwife program. Thus, the family planning counseling of midwifes seems to be an effective way to improve educational attainment in Indonesia.

As this study shows striking evidence for the relationship between family planning, age at first birth and educational attainment, promising avenue for future research would therefore be to elicit more detailed data on the timing of birth during and after the implementation of family planning programs in other developing countries. Especially collecting information on women's knowledge about the benefits of delaying first birth and having smaller families could probe more deeply into the role of family planning services in changing fertility preferences and how this mediates the impact on human capital accumulation. Furthermore, it would be of interest to study intergenerational effects of family planning services in order shed light on the relationship between higher educational attainment of women as a result of family planning and school attendance of their children.

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## Appendix

**Table A1: Means of the explanatory variables by birth cohort and midwife presence (full sample)**

| | Fully exposed | | Partly exposed | | Control group | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Has Village Midwife | No Village Midwife | Has Village Midwife | No Village Midwife | Has Village Midwife | No Village Midwife | Has Village Midwife | No Village Midwife |
| **Individual variables** | | | | | | | | |
| Muslim (father) | 0.91 | 0.91 | 0.91 | 0.89 | 0.90 | 0.89 | 0.91 | 0.90 |
| Primary education father | 0.67 | 0.57 | 0.65 | 0.64 | 0.61 | 0.66 | 0.63 | 0.64 |
| Post-primary education father | 0.20 | 0.42 | 0.19 | 0.33 | 0.14 | 0.24 | 0.16 | 0.30 |
| Primary education mother | 0.62 | 0.58 | 0.58 | 0.66 | 0.49 | 0.59 | 0.53 | 0.60 |
| Post-primary education mother | 0.14 | 0.27 | 0.10 | 0.24 | 0.09 | 0.17 | 0.10 | 0.21 |
| Age at first menstruation | 13.39 | 13.38 | 13.26 | 13.20 | 13.20 | 13.26 | 13.25 | 13.27 |
| Parents work in agric. sector | 0.57 | 0.43 | 0.69 | 0.51 | 0.72 | 0.55 | 0.69 | 0.52 |
| Age | 28.52 | 28.53 | 32.91 | 32.86 | 42.30 | 42.35 | 37.36 | 37.43 |
| **Community variables 1993** | | | | | | | | |
| Manufact. primary income source | 0.02 | 0.03 | 0.01 | 0.04 | 0.03 | 0.04 | 0.02 | 0.04 |
| Availability of electricity | 0.71 | 0.74 | 0.67 | 0.73 | 0.68 | 0.74 | 0.68 | 0.75 |
| Piped main drinking water | 0.14 | 0.32 | 0.11 | 0.34 | 0.10 | 0.32 | 0.11 | 0.33 |
| Main road asphalt | 0.64 | 0.68 | 0.60 | 0.72 | 0.58 | 0.73 | 0.60 | 0.72 |
| Number of Health facilities (Posyandu) | 5.78 | 7.03 | 5.61 | 7.44 | 5.79 | 8.27 | 5.74 | 7.83 |
| Number of Family planning assistants | 3.15 | 4.53 | 3.18 | 4.64 | 3.40 | 4.94 | 3.30 | 4.79 |
| Number of Jun. Sec. schools | 2.68 | 2.32 | 2.69 | 2.25 | 2.67 | 2.31 | 2.67 | 2.30 |
| Number of Sec. schools | 1.56 | 1.60 | 1.60 | 1.60 | 1.55 | 1.66 | 1.56 | 1.63 |
| **Community variables 1997** | | | | | | | | |
| Manufact. primary income source | 0.02 | 0.10 | 0.01 | 0.10 | 0.01 | 0.08 | 0.01 | 0.09 |
| Availability of electricity | 0.74 | 0.78 | 0.75 | 0.79 | 0.75 | 0.78 | 0.75 | 0.78 |
| Piped main drinking water | 0.15 | 0.34 | 0.10 | 0.36 | 0.12 | 0.40 | 0.12 | 0.38 |
| Main road asphalt | 0.67 | 0.77 | 0.67 | 0.75 | 0.67 | 0.79 | 0.68 | 0.78 |
| Number of Health facilities (Posyandu) | 6.35 | 7.39 | 5.90 | 7.56 | 6.14 | 8.44 | 6.11 | 8.03 |
| Number of Family planning assistants | 5.40 | 6.88 | 5.81 | 6.36 | 6.21 | 7.13 | 5.96 | 6.91 |
| Number of Jun. Sec. schools | 5.09 | 5.66 | 4.89 | 5.94 | 5.05 | 5.96 | 5.02 | 5.90 |
| Number of Sec. schools | 4.49 | 5.74 | 4.44 | 5.64 | 4.41 | 5.81 | 4.43 | 5.76 |
| N | 204 | 247 | 292 | 274 | 629 | 702 | 1,125 | 1,223 |

**Table A2: Means of the explanatory variables by birth cohort and midwife presence (restricted sample)**

| | Fully exposed | | Partly exposed | | Control group | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Has Village Midwife | No Village Midwife | Has Village Midwife | No Village Midwife | Has Village Midwife | No Village Midwife | Has Village Midwife | No Village Midwife |
| **Individual variables** | | | | | | | | |
| Muslim (father) | 0.91 | 0.90 | 0.91 | 0.88 | 0.90 | 0.90 | 0.91 | 0.90 |
| Primary education father | 0.66 | 0.56 | 0.64 | 0.63 | 0.64 | 0.61 | 0.65 | 0.60 |
| Post-primary education father | 0.21 | 0.42 | 0.20 | 0.35 | 0.14 | 0.27 | 0.19 | 0.35 |
| Primary education mother | 0.62 | 0.57 | 0.57 | 0.64 | 0.56 | 0.58 | 0.58 | 0.60 |
| Post-primary education mother | 0.14 | 0.28 | 0.10 | 0.26 | 0.10 | 0.22 | 0.11 | 0.25 |
| Age at first menstruation | 13.38 | 13.28 | 13.27 | 13.18 | 13.01 | 13.05 | 13.22 | 13.20 |
| Parents work in agric. sector | 0.58 | 0.41 | 0.69 | 0.49 | 0.73 | 0.55 | 0.67 | 0.48 |
| Age | 28.52 | 28.52 | 32.93 | 32.89 | 37.45 | 37.71 | 32.92 | 32.91 |
| **Community variables 1993** | | | | | | | | |
| Manufact. primary income source | 0.02 | 0.04 | 0.01 | 0.05 | 0.03 | 0.06 | 0.02 | 0.05 |
| Availability of electricity | 0.71 | 0.74 | 0.67 | 0.73 | 0.69 | 0.74 | 0.69 | 0.74 |
| Piped main drinking water | 0.13 | 0.35 | 0.11 | 0.36 | 0.11 | 0.36 | 0.12 | 0.36 |
| Main road asphalt | 0.65 | 0.71 | 0.60 | 0.75 | 0.55 | 0.75 | 0.60 | 0.74 |
| Number of Health Posts | 6.01 | 7.08 | 5.79 | 7.48 | 5.97 | 8.01 | 5.91 | 7.54 |
| Number of Jun. Sec. schools | 2.65 | 2.31 | 2.69 | 2.25 | 2.68 | 2.25 | 2.67 | 2.27 |
| Number of Sec. schools | 1.59 | 1.64 | 1.60 | 1.63 | 1.42 | 1.66 | 1.54 | 1.64 |
| **Community variables 1997** | | | | | | | | |
| Manufact. primary income source | 0.01 | 0.09 | 0.01 | 0.11 | 0.01 | 0.12 | 0.01 | 0.11 |
| Availability of electricity | 0.74 | 0.78 | 0.75 | 0.79 | 0.76 | 0.78 | 0.75 | 0.78 |
| Piped main drinking water | 0.14 | 0.37 | 0.10 | 0.36 | 0.09 | 0.39 | 0.11 | 0.37 |
| Main road asphalt | 0.67 | 0.79 | 0.68 | 0.78 | 0.67 | 0.81 | 0.68 | 0.80 |
| Number of Health Posts | 6.35 | 7.42 | 5.91 | 7.66 | 6.35 | 8.29 | 6.14 | 8.79 |
| Number of Jun. Sec. schools | 5.06 | 5.94 | 4.87 | 6.22 | 4.95 | 5.95 | 4.95 | 5.99 |
| Number of Sec. schools | 4.54 | 5.91 | 4.49 | 5.94 | 4.35 | 5.77 | 4.45 | 5.83 |
| N | 207 | 273 | 299 | 306 | 227 | 257 | 733 | 836 |

**Table A3: Regression results on the age at first birth**

| Dep. Variable: Age at first birth | 1 | 2 | 3 |
|---|---|---|---|
| Midwife * Birth cohorts 1977-1980 (Full) | 0.761* | 0.925** | 1.003** |
| | (0.437) | (0.442) | (0.456) |
| Midwife * Birth cohorts 1973-1976 (Part) | -0.474 | -0.480 | -0.193 |
| | (0.389) | (0.383) | (0.429) |
| Muslim (father) | | -1.665*** | -1.798*** |
| | | (0.566) | (0.595) |
| Primary education father | | -0.176 | -0.066 |
| | | (0.207) | (0.212) |
| Post-primary education father | | 0.674*** | 0.772*** |
| | | (0.246) | (0.254) |
| Primary education mother | | -0.055 | -0.099 |
| | | (0.212) | (0.218) |
| Post-primary education mother | | 0.706** | 0.680** |
| | | (0.282) | (0.282) |
| Farming primary income source | | 0.135 | 0.141 |
| | | (0.204) | (0.209) |
| Age at first menstruation | | 0.303*** | 0.288*** |
| | | (0.0602) | (0.063) |
| Age | | 0.073 | 0.068 |
| | | (0.067) | (0.067) |
| N | 2,348 | 2,348 | 2,348 |
| adj. R-sq | 0.016 | 0.044 | 0.058 |
| Individual variables | No | Yes | Yes |
| Community variables (1993-2000) * Birth cohorts | No | No | Yes |

Community and birth cohort dummies are included. Standard errors (in parenthesis) are clustered at the community level, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

**Table A4: Regression results on the probability to receive first birth after the age of 20**

| Dep. Variable: Age of first birth > 20 (0/1) | 1 | 2 | 3 |
|---|---|---|---|
| Midwife * Birth cohorts 1977-1980 (Full) | 0.0923 | 0.108* | 0.0966* |
| | (0.0568) | (0.0556) | (0.0562) |
| Midwife * Birth cohorts 1973-1976 (Part) | 0.0261 | 0.0213 | 0.0144 |
| | (0.0471) | (0.0460) | (0.0524) |
| Muslim (father) | | -0.200*** | -0.200*** |
| | | (0.0538) | (0.0624) |
| Primary education father | | 0.0408* | 0.0574** |
| | | (0.0245) | (0.0241) |
| Post-primary education father | | 0.135*** | 0.145*** |
| | | (0.0316) | (0.0317) |
| Primary education mother | | -0.0218 | -0.0268 |
| | | (0.0247) | (0.0246) |
| Post-primary education mother | | 0.00589 | 0.00240 |
| | | (0.0305) | (0.0311) |
| Farming primary income source | | 0.00414 | -0.00527 |
| | | (0.0236) | (0.0250) |
| Age at first menstruation | | 0.0425*** | 0.0417*** |
| | | (0.00704) | (0.00721) |
| Age | | -0.00249 | -0.00227 |
| | | (0.00794) | (0.00787) |
| N | 2,348 | 2,348 | 2,348 |
| adj. R-sq | 0.022 | 0.053 | 0.071 |
| Individual variables | No | Yes | Yes |
| Community variables (1993-2000) * Birth cohorts | No | No | Yes |

Community and birth cohort dummies are included. Standard errors (in parenthesis) are clustered at the community level, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

**Table A5: Regression results on the number of school years**

| Dep. Variable: Number of school years | 1 | 2 | 3 |
|---|---|---|---|
| Midwife * Birth cohorts 1977-1980 (Full) | 0.667* | 1.002** | 0.697* |
| | (0.403) | (0.397) | (0.404) |
| Midwife * Birth cohorts 1973-1976 (Part) | -0.0703 | 0.124 | 0.0938 |
| | (0.382) | (0.357) | (0.408) |
| Muslim (father) | | -2.133*** | -2.122*** |
| | | (0.708) | (0.729) |
| Primary education father | | 0.783*** | 0.795*** |
| | | (0.183) | (0.186) |
| Post-primary education father | | 2.566*** | 2.494*** |
| | | (0.254) | (0.263) |
| Primary education mother | | 0.761*** | 0.763*** |
| | | (0.193) | (0.202) |
| Post-primary education mother | | 2.496*** | 2.616*** |
| | | (0.330) | (0.342) |
| Farming primary income source | | -0.432** | -0.440** |
| | | (0.204) | (0.209) |
| Age at first menstruation | | 0.115** | 0.0107** |
| | | (0.0499) | (0.0494) |
| Age | | -0.0610 | -0.0415 |
| | | (0.063) | (0.063) |
| N | 2,348 | 2,348 | 2,348 |
| adj. R-sq | 0.095 | 0.249 | 0.251 |
| Individual variables | No | Yes | Yes |
| Community variables (1993-2000) * Birth cohorts | No | No | Yes |

Community and birth cohort dummies are included. Standard errors (in parenthesis) are clustered at the community level, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

**Table A6: Regression results for the restricted sample**

| Dependent variables: | Age at first birth | First birth >20 | # of school years |
|---|---|---|---|
| Midwife * Birth cohorts 1977-1980 (Full) | 1.076** | 0.083 | 1.052** |
| | (0.515) | (0.0632) | (0.484) |
| Midwife * Birth cohorts 1973-1976 (Part) | 0.249 | 0.0359 | 0.27 |
| | (0.524) | (0.0584) | (0.427) |
| Muslim (father) | -0.0713 | -0.106** | -1.141 |
| | (0.828) | (0.0513) | (0.794) |
| Primary education father | 0.34 | 0.0495 | 0.574*** |
| | (0.236) | (0.0304) | (0.220) |
| Post-primary education father | 0.858*** | 0.125*** | 1.949*** |
| | (0.266) | (0.0365) | (0.263) |
| Primary education mother | -0.688*** | -0.0448 | 0.633*** |
| | (0.241) | (0.0293) | (0.221) |
| Post-primary education mother | 0.307 | -0.0389 | 2.429*** |
| | (0.339) | (0.0381) | (0.389) |
| Farming primary income source | -0.381 | -0.0309 | -0.589*** |
| | (0.250) | (0.0305) | (0.226) |
| Age at first menstruation | 0.406*** | 0.0498*** | 0.0706 |
| | (0.0714) | (0.00827) | (0.0543) |
| Age | 1.199 | 0.171* | 1.014 |
| | (0.827) | (0.1000) | (0.793) |
| N | 1,569 | 1,569 | 1,569 |
| adj. R-sq | 0.053 | 0.054 | 0.175 |

Community and birth cohort dummies are included. Standard errors (in parenthesis) are clustered at the community level, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$