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Abstract

This paper estimates the effects of a childbirth grant policy introduced in Armenia in 2009 in response to low fertility rates. We employ a quasi-experimental strategy exploiting the timing of the policy change and eligibility rule—women could get a larger transfer only for third and higher order births. We find an overall positive impact of the policy on the fertility of women who already had two births and we do not find heterogeneity in response to the policy by wealth, schooling or residence in rural versus urban area. While Armenia has one of the highest sex imbalances at birth, we do not find that additional newborns are significantly more likely to be male. We do find, however, that parents without any son are more likely to have an additional birth after the policy change in comparison to parents who already have at least one son.
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Introduction

Aging population has been a top policy concern in high-income countries, and increasingly so in middle-income countries. By transitioning in a few decades into an aged society, middle-income countries lose the window of opportunity to grow, and need to face policy problems which have taken high-income countries years to address and which require large resources. As a result, many middle-income countries, and almost all transition economies, are implementing policies—and dedicating substantial shares of social spending—to promote fertility and avoid transitioning too quickly into an aging society. However, the impact of these policies is less well-known, probably due to the scarce settings that allow rigorous evaluations.

In 2009, Armenia reformed the Childbirth Benefit Program to respond to the sharp reduction in fertility it has experienced during the two preceding decades.[2] The total fertility rate (TFR) decreased from 2.5 births per woman in 1990 to 1.7 births in 2000 and has remained flat afterwards.[3] The reform consisted in increasing the amount of the transfer and differentiating it by order of birth. Under the reformed Childbirth Benefit Program, women became eligible to receive a one-time cash transfer at birth of about 125 USD for their first and second birth and about 1,050 USD for the third and higher order births.

Besides the reduction in fertility rates, Armenia has experienced other significant demographic changes following the dissolution of the Soviet Union, the recovery from a large earthquake in 1988 and the conflict with neighboring Azerbaijan. First, it is estimated that roughly a third of the population has migrated out of the country since 1990 (World Bank, 2011). Second, sex ratio at birth has increased from 107 to 117 between 1990 and 2002.[4] Previous studies discussed the role of sex selective abortions (Duthé et al. 2011, Guilmoto 2013) and showed that overall strong son preference is also exhibited by decreasing likelihoods of additional pregnancies by parents who already have sons—usually called stopping behavior (Ebenstein 2013).

In this paper, we study the impacts of the childbirth lump-sum grants on fertility in Armenia. The paper addresses the following questions: (i) what is the effect of the program reform on overall fertility rates? (ii) do responses to the program reform vary by different socio-economic groups? (iii) do responses to the program reform differ by whether parents already have sons? (iv) do the financial incentives affect the sex imbalance in the country's population?

To estimate the impacts of the increased childbirth grants introduced in 2009, we implement a quasi-experimental empirical strategy that exploits the timing of the policy change and the fact that the grant amount differs by the number of children parents already had. We construct a panel dataset using fertility histories reported in the 2015 round of the Armenia Demographic and Health Survey (ADHS). The rules of the policy change, described in more detail below, enable us to define treatment and control groups according to year and number of previous births women had.

We find that the universal childbirth grant policy increased fertility among women who already had at least two prior births, who are the intended target group. The annual birth probability for this

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[2] Prior to 2009, flat childbirth grants were offered to all the population but they did not differentiate by birth order. Beneficiaries of the main cash transfer program, the Family Benefit Program, also received a cash top-up with each birth that starting in 2007 was larger for the 3rd and higher order births.
[3] Statistics from World Development Indicators.
[4] Number of male births per 100 female births. Statistics from World Development Indicators.

group increased by 1.7 percentage points. We do not find heterogeneous impacts by household wealth, education level or urban versus rural residence. There is no statistically significant difference in the impact of the childbirth grant on the likelihood of having a newborn boy or girl. In addition, the program impacted both mothers who had no sons and those who had at least one son. However, those without any son are significantly more likely to respond to the policy change with an additional birth.

Most of the economic literature on the impact of financial incentives on fertility present results from high-income countries. Such examples include a childbirth grant in Spain, monthly child subsidy in Israel and pro-natalist tax policies in France, Canada, the USA and Germany (Gonzalez 2013, Cohen, Dehejia and Romanov 2013, Laroque and Salanie 2014, Milligan 2005, Whittington et al. 1990, Crump et al. 2011, Zhang, Quan and van Meerbergen 1994, and Riphahn and Wiynck 2017).[5] The results of these studies show that, overall, fertility can increase with the introduction of financial incentives. However, results differ with respect to impact of the financial incentives on beneficiaries of different socio-economic backgrounds and policy instrument. For example, Milligan (2005) finds that women with higher income are more likely to respond to a pronatalist transfer in Canada while Cohen et al. (2007) find that, in Israel, the magnitude of the child subsidy effect decreases with income.

Our study does not only contribute to the literature by presenting results from a middle-income country but we also present results of a pronatalist financial incentive introduced in a context with a strong son-preference by parents. Relatedly, Anukriti (2018) studies a program in the Indian state of Haryana that used financial incentives to *reduce* both fertility and the sex ratio at birth. Families with one daughter received a high monthly benefit while families with one son or two daughters received a lower monthly benefit. While the program was successful in reducing fertility, it had a perverse impact on the sex-ratio at birth. The difference in the incentive amount between having a single son and a single daughter was not high enough and the program increased the likelihood of new parents to have sons. The author concludes that the demand for sons is less price-elastic than the demand for daughters.

The rest of this paper is organized as follows. In the next section we describe fertility trends in Armenia and the Childbirth Benefit Program. Section 3 describes the data used in the analysis and our empirical strategy. Section 4 presents our main fertility results, together with robustness tests, the analysis of heterogeneous effects and the results in the context of son-preference. Finally, section 5 concludes.

Background

Fertility rates in Armenia have fallen rapidly over the last few decades, especially after the transition from the Soviet system to a market economy. According to the World Development Indicators, the total fertility rate was about 2.5 births per woman at the beginning of the nineties; by 2000, the fertility rate leveled off at 1.7, representing about a 30 percent fall (Figure 1). In 2010, and the following five years, the fertility rate has leveled at 1.6. This pattern is not particular to

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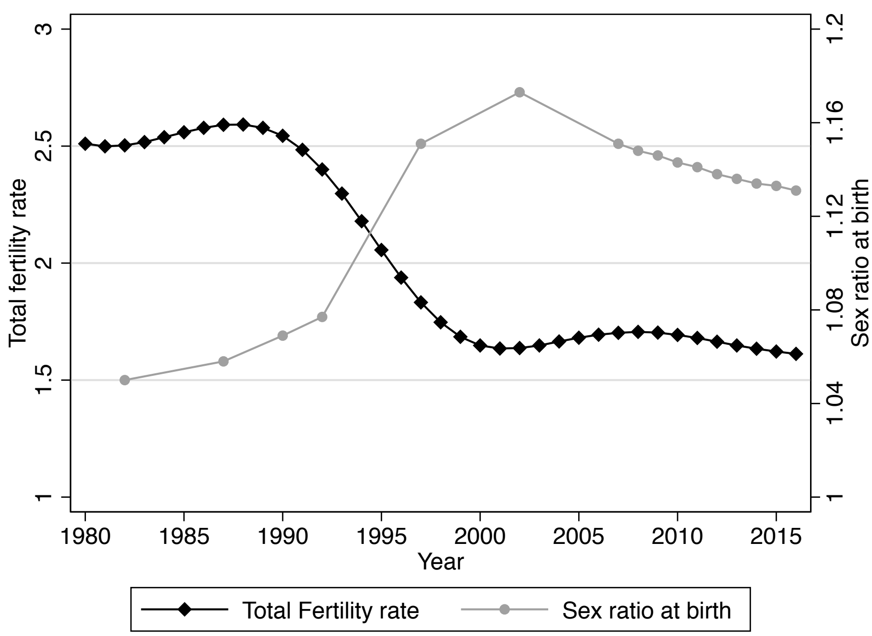
[5] Another set of papers study more generally the impact of family and work-life balance policies on fertility. Gauthier (2007) and Olivetti and Petrongolo (2017) provide reviews of the literature.

Armenia: in almost every former Soviet country fertility rates declined below their replacement level during the transition years (Billingsley 2010). The existing evidence among the determinants of this sudden decline puts emphasis on the crises faced by Armenia in the last two decades. The collapse of the former Soviet Union, where the costs associated with raising children were mostly born by the state, implied a dramatic increase in the burden of children. In addition, the slow growth in real wages throughout the transition, together with the recent history of armed conflict with neighboring Azerbaijan contributed as well to the declining fertility. Ebenstein (2013) documents lower fertility among families forced to migrate, as well as couples where the husband is unemployed, suggesting a link between the instability of the economic situation and low fertility rates.

Figure 1. Fertility rate and sex ratio at birth in Armenia



Note: Source: World Development Indicators.

At the same time, the sex-ratio imbalance at birth emerged in Armenia: it rose from a biologically normal range of 104-107 boys per 100 girls (see, for instance, Chahnazarian 1988) to 117 in the early 2000s, reaching levels comparable to those in China, Azerbaijan and some Indian states. It has been slowly decreasing after that, though still above normal levels. This result suggests a link between observed fertility rate and son preference. In other words, although son preference might exist in a country, it may not be revealed until families reduce the number of children they have.

This is a consequence of both more common stopping behavior of parents who already have a son (Filmer et al. 2008) as well as sex selective abortion (Duthé et al. 2012, Ebenstein 2013).[6]

While Armenia has had a universal childbirth lump-sum transfer—the Childbirth Benefit Program (CBBP)—in place since the 1990s, it was of a small magnitude and did not differentiate by birth order. In 2009 the benefits were increased and the program introduced a differentiation in the benefit size by birth parity. The size of the transfer was increased from 87 USD (35,000 AMD) to about 125 USD (50,000 AMD) for parents having their first or second child, and from 87 USD (35,000 AMD) to 1,050 USD (430,000 AMDs) for the third and higher order births. In addition to the universal Childbirth Benefit Program, poor families receive additional support: under the Family Benefit Program (FBP),[7] the main social assistance program in Armenia, beneficiary families received a Childbirth One-Off Assistance, that provided additional cash transfers at the moment of a birth. The Childbirth One-Off Assistance associated to the FBP was also modified in 2007 and again in 2008 and 2009 to adjust to the changes introduced in the CBBP. In a way, the Government of Armenia was probably first piloting the policy change with the Childbirth One-Off Assistance that were applied to universal CBBP in 2009. In 2007, the Childbirth One-Off Assistance introduced a differentiation by birth order, which affected only 12 percent of households,[8] that was undone in 2009 when the government introduced the reform to the CBBP. The universal Childbirth Benefit quickly gained support among policymakers and in January of 2014 the amount of the benefit was further increased.

Table 1 details the sizes of the transfers by year, program, and birth order. [9] The amount of the benefit is not negligible in size, both in terms of income and compared to similar programs in other countries. In 2009 the benefit for first and second order births were higher than the minimum wage, while the benefit for third or higher order births were over one third of Armenia's GNI per capita.[10]

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[6] Actually, as documented by Ebenstein (2013), Armenian couples are also more likely to have a son even at the first parity, which has not been previously found in countries with strong son preference such as China or India.

[7] The Family Benefit program is a means tested social assistance program that gives a monthly allowance to support poor families. Program participation is based on an eligibility formula that takes into account the vulnerability of the household (based mainly on family structure and labor force status), income of the household, place and dwelling of residence, and a set of automatic disqualifiers (such has owning land, etc.). There are no associated conditionalities and the participation on the program grants access to other benefits (such as the *Childbirth One-Off Assistance*, gas subsidies and more).

[8] The coverage of the FBP in 2009 was 12.04 percent, according to the Social Protection and Expenditure Database for East Europe and Central Asia (SPEED) of the World Bank.

[9] In sum, Armenia has a history of giving lump-sum transfers at the moment of birth that were universal and with top-ups for the beneficiaries of last-resort social assistance (the FBP program). In 2007, the government introduces for the first time a differentiation in the size of the lump-sum transfer that is only applicable to FBP beneficiaries (about 10 percent of the households), the size of the transfer is further increased for this group in 2008, and then reverted to a flat transfer in 2009 when the differentiation by birth order is introduced in the universal program, the CBBP.

[10] The minimum wage was 30,000 AMDs in 2009, while Armenia's Gross National Income per capita was of 3440 (USD) in the same year.

Table 1. Childbirth grant in Armenia

Period	Program	Beneficiary	Size of transfer (AMDs)				
			First Child	Second Child	Third Child	Fourth Child	Fifth+ child
Before 2007	Childbirth One-Off Assistance	FBP	35,000	35,000	35,000	35,000	35,000
	Childbirth Benefit	Universal	35,000	35,000	35,000	35,000	35,000
2007	Childbirth One-Off Assistance	FBP	35,000	35,000	200,000	200,000	200,000
	Childbirth Benefit	Universal	35,000	35,000	35,000	35,000	35,000
2008	Childbirth One-Off Assistance	FBP	35,000	35,000	300,000	300,000	300,000
	Childbirth Benefit	Universal	35,000	35,000	35,000	35,000	35,000
2009-2013	Childbirth One-Off Assistance	FBP	50,000	50,000	50,000	50,000	50,000
	Childbirth Benefit	Universal	50,000	50,000	430,000	430,000	430,000
2014-	Childbirth One-Off Assistance	FBP	50,000	50,000	50,000	50,000	50,000
	Childbirth Benefit	Universal	50,000	50,000	1 million*	1 million*	1.5 million*

Source: Karapetyan (2014). Notes: FBP in the Family Benefit Program. (*) 500,000 AMD at birth, and remainder deposited in a "Family capital" account that can be used for child or other family members (loans for purchasing a new house, as well as education and/or medical expenses).

The first mention of the 2009 policy change is from a government decree from April 2008. The document does not detail the actual changes to the program, but mentions that the benefit will increase. The first mention of the change found in the (English) news is dated October 27th 2008. To our knowledge, no other policies affecting fertility in different ways for different parities were enacted in the same period.

A couple of features make Armenia different from other economies with similar policies to address declining birthrates and which have been rigorously evaluated (including France, Germany, Sweden, and the Canadian province of Quebec). First, Armenia is a middle-income country, with a large share of the population under the poverty line (about 30 percent), who also tend to have more children. Second, there is a high preference for sons in the country. Armenia has the third largest male to female ratio at birth in the world, smaller only to those in China and Azerbaijan (World Bank 2012). It is important to note that, unlike China, low fertility levels in Armenia are not imposed by law. Then, if the sex-ratio imbalance is caused by the rapid decrease in fertility, we might expect that, through an increase in fertility, the Childbirth Benefit influences the sex ratio, getting closer to normal values.[11]

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[11] The son preference has been found to be caused by various other factors (Jayachandran, 2014). For example, Das Gupta et al. (2003) found that in Korea, the lack of a pension system combined with low female labor force participation was influencing the son preference.

One last point to note is that the Armenian economy was at distress around the time of the introduction of the Childbirth Benefit Program due to the global financial crisis. Indeed, real GDP dropped by 14 percent in 2009 (World Development Indicators). As it has been suggested by previous studies, individuals tend to postpone childbearing decisions when faced to economic uncertainty and job instability, and the Great Recession was no exception. For instance, Comolli (2017) finds that a 1 percent increase in unemployment rate is associated with a decline in total fertility rates the following year of 0.08 percent.

Data and Empirical Framework

Data

This analysis uses the latest round of the Armenian Demographic and Health Survey (ADHS), collected in 2015-16. The ADHS is a nationally representative sample of women 15-49 years old and includes detailed fertility histories that enable us to construct a panel of annual birth outcomes from 2003 to 2013 linked with women's number of previous births by gender and a set of socio-demographic characteristics. From a sample of 6,116 women in 4,684 households, we created an unbalanced panel of 64,528 woman-year observations. We excluded observations of women below 15 and above 49.[12]

Table A1 in the Appendix presents the summary statistics of some key indicators related to women's socio-demographic characteristics, their fertility histories, children, and, for married women, their husbands' characteristics. These statistics refer to characteristics observed for the 6,116 women in the sample at the time of survey.[13] Women in the sample are on average 32 years old, 63 percent of them are married, and a similar proportion lives in urban areas. More than half of them have higher education, while the average number of years of education in the sample is almost 12. Only 34 percent of women in the sample report to be working at the time of survey or to have a job from which they were absent due to leave, and the prevalence of migration for work in the last 3 years among these women is only 1 percent. This group of women have given birth 1.4 times on average, and in 53 percent of the times to boys. Moreover, more than a third have no children at all, while over half of them have two children. The average age at first birth is 22. Finally, married women are on average 4.6 years younger and slightly more educated than their husbands: 42 percent of their husbands have higher education compared to 53 percent of women in the sample. Contrary to what is observed for women, 22 percent of husbands have migrated for work-related reasons in the three years previous to the survey interview.

Identification strategy

To identify the impact of the childbirth grants on fertility outcomes, we rely on the timing of the

[12] Given that the ADHS sample is of women who are 15-49 years by 2015, older women who were 49 years old or less at some point before but who are over 49 by the time of survey are not included in the sample.
[13] Although we are able to reconstruct each woman's fertility history thanks to the reported date of birth of each child, most of the covariates used in the analysis refer to the time of the survey, except for women's age, composition of their children and (imperfectly) marital status, which can be obtained backwards for each point in time.

unexpected policy change and on the number of children women had in each year, because the amount of the benefit was different by birth rank. The baseline econometric specification is the following linear probability model:

$$b_{it} = \alpha + \beta_1 Two\_more_{it} + \beta_2 After_t + \beta_3 Two\_more_{it} \times After_t + \gamma X_{it} + \epsilon_{it}$$

Since the main goal of the universal childbirth benefit was to increase fertility, our main outcome of interest b_{it} is an indicator for whether woman *i* gave birth in year *t*. Two_more_{it} is a dummy variable equal to one if woman *i* had at least two children at time *t*, and $After_t$ is a dummy equal to one for the years after the policy change (2009-2013). X_{it} is a vector of women's (and eventually their husbands') individual characteristics, that aim at controlling for differences between women with two or more and women with less than two children (see the last two blocks of columns in Table A1 in the Appendix). Standard errors are clustered at the mother level. In this context, β_3, the coefficient that corresponds to the interaction between both dummies can be interpreted as the impact of the policy change on fertility, assuming that changes in fertility rates will be similar for women with different number of children in the absence of the policy change (parallel trends assumption). Finally, given that we do not observe whether a woman actually received the childbirth transfer, but only her eligibility condition based on the number of children she had at each point in time and the date of birth of each of her children, our estimates represent Intention-to-Treat effects.

While we cannot rule out the existence of other factors contemporaneous to the 2009 policy change that might have affected birth rates differently for women with different number of children, we can test whether the parallel trends assumption could be rejected prior to the policy change. We run a model of the fertility outcome on the Two_more dummy, year dummies and the interaction between them, during the pre-reform period. The results of this test (Table 2) validate the assumption: none of the coefficients associated with each of the interactions is individually significant, neither in a specification without controls (Column 1) nor when controls are added (Column 2). Moreover, we perform an F-test of joint significance of all the interaction terms together, and in neither of the two specifications we find evidence that allows us to reject the hypothesis that all of the coefficients together are equal to zero.

One concern about the identification strategy comes from the fact that eligibility for the childbirth benefit is not fixed but it can vary over time since once a woman with one child (not eligible for the high benefit) has a second one, she becomes eligible to receive the large childbirth grant. In theory, women with less than two children could also respond to the policy by increasing their fertility in order to get to have a third child faster. This could be particularly the case if the policy was not perceived to continue over a long period of time. If such fertility behavior by the control group exists, then it is likely to diminish the size of our estimate, with our results providing a lower bound for the true fertility increase.

Table 2. Parallel trends test

	Dep. variable: =1 if gave birth in year t	
	(1)	(2)
2003 * Two_or_more	0.010	0.006
	(0.012)	(0.011)
2004 * Two_or_more	-0.009	-0.009
	(0.011)	(0.010)
2005 * Two_or_more	-0.006	-0.006
	(0.011)	(0.010)
2006 * Two or more	0.014	0.013
	(0.010)	(0.010)
2007 * Two or more	-0.008	-0.006
	(0.011)	(0.010)
Two or more	-0.083***	-0.145***
	(0.008)	(0.013)
Constant	0.106***	-0.293***
	(0.007)	(0.087)
N	25,974	25,974
Adjusted R2	0.024	0.205
F-statistic	1.540	1.250
Prob>F	0.175	0.284
Socio-demographic characteristics	No	Yes
Composition of previous children	No	Yes
Geographic controls	No	Yes

Note: The data corresponds to a yearly panel with birth history for the period 2003-2008 for all women aged 15-49 by the time of survey. Each row reports the coefficients for year dummies interacted with the indicator "Two or more" (a dummy equal to one for women with at least two children). The omitted category is 2008. All columns include year fixed effects. The F -statistic tests the joint significance of all the interaction terms together. Socio-demographic characteristics include age, marital status, whether the woman had birth during the last year, whether she has a son or not, as well as dummies for educational level (primary or less -omitted-, secondary or higher). Composition of previous children are dummy variables indicating the number of children in the specific gender-age group (interaction of female/male and age ranges 0-4, 5-13, 14-17, 18+). Geographic controls include a dummy for urban/rural and dummies for region of residence. The coefficients are estimated using a linear probability model. Standard errors clustered at the mother level in parentheses below each estimate, *** significant at 1%; ** significant at 5%; * Significant at 10%. Source: RA DHS 2015-16.

Results

Table 3 reports the results from estimating our benchmark model. The results in Column 1 are from the sample of all women while results in Column 2 are restricted to married women.[14] In both

[14] ADHS contains a question about marital status with 6 different categories (never in union, married, living with partner, widowed, divorced, separated), which refers to the time of survey (i.e., 2015-2016). In order

cases we control for women's socioeconomic background characteristics, the sex and age composition of her previous children (if any), and regional dummies. The specification in Column 2 includes controls for the husband's age and education. The first row presents the coefficient of interest, corresponding to β_3 in equation 1. The estimate of the interaction suggests an increase in the probability of having a child for women with at least two children after the 2009 policy change of 1.7 percentage points, very precisely estimated. It is somewhat stronger for married women, at 2 percentage points.[15]

Table 3. Fertility results

	Dep. variable: =1 if gave birth in year t	
	(1)	(2)
Post 2009 x Two or more	0.017***	0.020***
	(0.004)	(0.006)
Post 2009	-0.007**	-0.010**
	(0.003)	(0.005)
Two or more	-0.131***	-0.158***
	(0.009)	(0.010)
Constant	-0.247**	-0.153
	(0.098)	(0.118)
N	52,741	40,444
Adjusted R2	0.193	0.201
Socio-demographic characteristics	Yes	Yes
Composition of previous children	Yes	Yes
Geographic controls	Yes	Yes
Husband's characteristics	No	Yes

Note: The data corresponds to a yearly panel with birth history for the period 2003-2013 for all women aged 15-49 by the time of survey. "Two or more" is a dummy equal to one for women with at least two children, while "Post 2009" equals 1 for the period 2009-2013 and 0 otherwise. Socio-demographic characteristics include age, marital status, whether the woman had birth during the last year, whether she has a son, and dummies for educational level (primary or less -omitted-, secondary or higher). Composition of previous children are dummies indicating the number of children in the specific gender-age group (interaction of female/male and age ranges 0-4, 5-13, 14-17, 18+). Geographic controls include a dummy for urban/rural and for region of residence, and husband's characteristics include husband's age, and educational level. Coefficients estimated using a linear probability model. Standard errors clustered at the mother level in

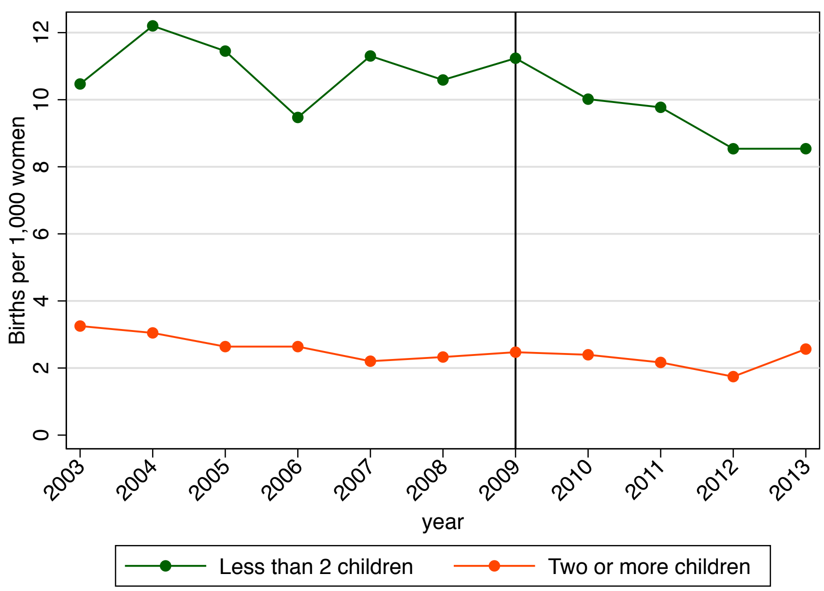
to identify married women at the time of giving birth, we use information about the date of their first cohabitation. How accurately this measure captures the actual marital status at each point in time will vary for different groups of women. It will be measured without no error for women married at the time of the survey who have only had one relationship in their life, as well as for women who never had a relationship. It is less accurate for women who are married at the time of survey but had more than one union in their life (and therefore were lone at some point), or women who had only one union in their life but are currently divorced/widowed/separated, and for whom we do not know the date of end of cohabitation. However, 93 percent of women in the sample correspond to the group with the highest accuracy, which yields a very low level of measurement error in our constructed marital status indicator.

[15] The results using a probit model yield similar effects, although smaller in magnitude.

parentheses, *** significant at 1%; ** significant at 5%; * Significant at 10%. Source: RA DHS 2015-16.

To complement this regression analysis, Figure 2 presents plots of the (unconditional) birth rates per thousand women with two or more children and women with less than two children. As we can see, birth rates for women with less than two children (i.e., having their first or second child) are always higher than for women having their third or higher order child, and this gap seems to be relatively flat before the 2009 policy change, at about 9 children per thousand women. After that point, however, the difference is gradually reduced to about 7 children. Surprisingly, the reduction in the difference seems to come from a decrease in birth rates for women with less than 2 children, rather than from an increase in births for women with 2 or more children. One potential reason behind this observed behavior is that the 2008 economic crisis may have had a negative impact on fertility, and the Child Benefit Program was introduced at a very particular point in time, helping eligible women to counteract it and avoid this fall.

Figure 2. Birth rates, 2003-2013

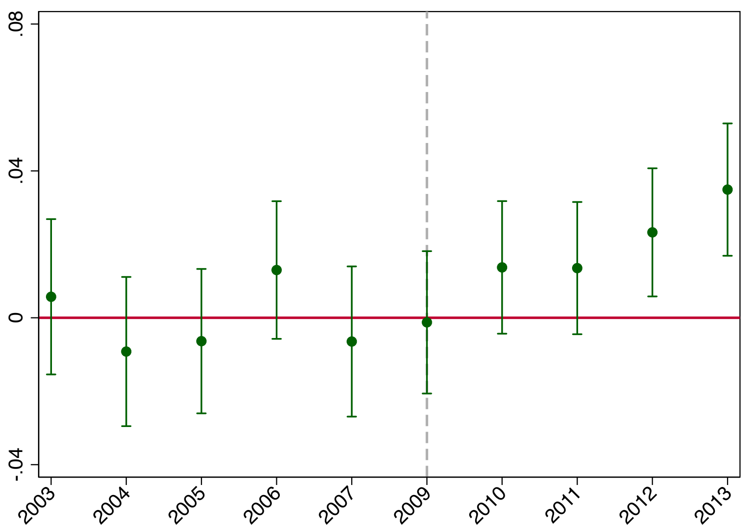


Note: The figure shows the number of women giving birth in a given year per 1,000 women. Source: RA-DHS 2015-16.

To better understand whether the response to the policy was immediate or had some delay, we repeat the analysis in a dynamic difference-in-difference framework. This more flexible alternative allows us to understand whether there was a dynamic response to the policy change, given that we might expect delays between the moment in which a couple actively starts trying to conceive, the actual conception, and the birth. Moreover, it could also be that it takes time for the population to learn about the childbirth grants and how they are being administered.

In Figure 3, each dot represents the point estimate of the interaction between the corresponding year dummy and the Two_more dummy, with the last year before the policy change, 2008, as the omitted category, and including the dummy Two_more and year dummies by themselves as well as other controls (Table A2 in the Appendix shows the corresponding results). The bars represent the 95% confidence intervals around the point estimate.

Figure 3. Fertility results, dynamic difference in difference



Note: The data corresponds to a yearly panel with birth history for the period 2003-2013 for all women aged 15-49 by the time of survey. Each row reports the coefficients for year dummies interacted with the indicator "Two or more" (a dummy equal to one for women with at least two children). The omitted category is 2008. All columns include year fixed effects. Socio-demographic characteristics include age, marital status, whether the woman had birth during the last year, whether she has a son or not, as well as dummies for educational level (primary or less -omitted-, secondary or higher). Composition of previous children are dummy variables indicating the number of children in the specific gender-age group (interaction of female/male and age ranges 0-4, 5-13, 14-17, 18+). Geographic controls include a dummy for urban/rural and dummies for region of residence, while husband's characteristics include husband's age, and educational level. The coefficients are estimated using a linear probability model. Standard errors clustered at the mother level in parentheses below each estimate, *** significant at 1%; ** significant at 5%; * Significant at 10%. Source: RA DHS 2015-16.

First, this analysis enhances the robustness of our identification strategy: the coefficients associated with the interaction between the treatment indicator in each of the years before the policy change are not statistically different from zero (which corresponds to the omitted year 2008), supporting the hypothesis of parallel trends between women with less and more than two children prior to the childbirth benefit introduction. Regarding the effect of the child benefit reform on birth rates, the coefficient is close to zero for the first year after the policy implementation (i.e. 2009) but it starts increasing afterwards. It remains marginally not significant in 2010 and 2011 (point estimates of 0.014 and standard errors of 0.009), but becomes significant starting in 2012. Overall, these results point towards a positive effect of the childbirth benefit on fertility that does not materialize immediately but shows up gradually.

Robustness

In this section we provide alternative robustness checks of our main results: we first remove the time window around the policy change, then we estimate the fertility impact of the childbirth benefit excluding childless women from the control group, and we estimate a mother fixed-effects model. Finally, we present a discussion about potential response to the policy by the control group, analyzing birth spacing behavior.

Addressing potential leakages or lack of accuracy in the policy announcement by removing time window around the policy change. If the policy change modified the incentives of couples, we might expect a response on the probability of conception immediately after the childbirth introduction, or even later taking into account normal delays in conceiving for couples when actively trying. This means that all babies born at least during the first nine months of 2009 were actually conceived before the benefit introduction. On the other hand, as mentioned before, the policy change was mentioned in a government decree in April 2008 and the first leak to the press took place in October 2008. If the population was aware that the policy change was under discussion it could be that couples in early 2008 delayed conceptions to later in 2008, so that the births are in 2009, leading to an overestimation of our effect of interest.

The first column in Table 4 reports the results of the standard difference in difference but excluding years 2008 and 2009 from the analysis. As we can see, the coefficient associated to the interaction suggests an increase in the probability to give birth of 2.2 percentage points, an estimate in line with our baseline specification, although a bit larger. The interpretation of these results is twofold: First, they are in line with the dynamic difference in difference analysis in the previous section, that already anticipated that the impact was virtually zero in 2009. Second, they are suggestive that overall our results are not driven by anticipation effects.

Enhancing comparability of women with more and less than two children by excluding childless women from the analysis. It has been argued that the decision to have a first child (extensive fertility margin) is intrinsically different from the decision to have an additional child conditional on already being a mother (extensive margin). For instance, Billari et al. (2009) analyze the impact of different factors on fertility decisions, and show that, while first births (i.e. the decision to become a parent) are more influenced by norms, higher order parities are more influenced by attitudes, which depend on economic incentives. In other words, economic incentives are more important for higher parities than for first births, where other factors are more relevant. In our identification strategy, the control group is defined as women with less than two children, which comprises both childless women as well as women with one child. Moreover, the group of childless women includes as well infertile women (or couples), for which we don't expect the childbirth benefit to have any impact. We next redefine our control group, in order to be as comparable as possible with our treatment group, excluding childless women from the analysis, i.e. keeping only women with one child. The results, presented in the second column of Table 4, reveal that the fertility impact of the introduction of the childbirth benefit more than doubles when compared to the results using the initial control group. In other words, when we compare groups which share similar sensitivity to economic incentives, women with at least two children are 4.8 percentage points more likely to give birth after 2009, compared to women with only one child.

Table 4. Robustness checks

	Dep. variable: =1 if gave birth in year t		
	Excluding years 2008 and 2009	Excluding childless women	Mother's fixed effects
Post 2009 x Two or more	0.022***	0.048***	0.019***
	(0.004)	(0.010)	(0.005)
Post 2009	-0.010***	-0.036***	-0.005
	(0.003)	(0.010)	(0.005)
Two or more	-0.124***	-0.150***	-0.173***
	(0.009)	(0.009)	(0.011)
Constant	-0.329***	0.418***	-5.844***
	(0.075)	(0.073)	(0.230)
N	42,860	31,086	52,741
Adjusted R2	0.191	0.114	0.245
Socio-demographic characteristics	Yes	Yes	Yes
Composition of previous children	Yes	Yes	Yes
Geographic controls	Yes	Yes	No
Husband's characteristics	No	No	No
Mother's fixed effects	No	No	Yes

Note: The data corresponds to a yearly panel with birth history for the period 2003-2013 for all women aged 15-49 by the time of survey. “Two or more” is a dummy equal to one for women with at least two children (treatment group), while “Post 2009” equals 1 for the period 2009-2013 and 0 otherwise. Socio-demographic characteristics include age, marital status, whether the woman had birth during the last year, whether she has a son or not, as well as dummies for educational level (primary or less -omitted-, secondary or higher). Composition of previous children are dummy variables indicating the number of children in the specific gender-age group (interaction of female/male and age ranges 0-4, 5-13, 14-17, 18+). Geographic controls include a dummy for urban/rural and dummies for region of residence, while husband's characteristics include husband's age, and educational level. The coefficients are estimated using a linear probability model. Standard errors clustered at the mother level in parentheses below each estimate, *** significant at 1%; ** significant at 5%; * Significant at 10%. Source: RA DHS 2015-16.

Using mother fixed-effects to address further unobservables. As mentioned before, the fact that ADHS reports the exact date of birth of each child is critical for this analysis, since it allows us to construct a panel of birth history, recording every child born to a woman in the 15-49 age group between 1st January 2003 and 31st December 2013. This makes possible the estimation of a mother fixed-effects model, which allows us to control for any remaining time invariant unobserved heterogeneity which might affect fertility decisions. Column 3 in Table 4 reports the results, which suggest a significant 1.9 percentage point increase in the likelihood of giving birth for the treatment group, a magnitude similar to the baseline estimation.

Heterogeneous effects

After establishing that the policy change impacted overall fertility, we turn to study heterogeneity in response to the policy change by socio-economic background. The childbirth grant associated with a third or higher order birth is substantial relative to the average income in the country. Yet, it represents a higher share increase in the income of a poor household relative to wealthier ones. Another important factor could be women's employment or broader economic opportunities that might vary for women with different education level and residence in urban versus rural regions of the country. To assess whether the response to the childbirth benefit was heterogeneous among Armenian women with different characteristics, we run a set of regressions that include interactions of the $Two\_more_{it}After_t$ dummy and a set of women's characteristics.

We do not find heterogeneous response to the policy change by household wealth. The first column of Table 5 shows the coefficient on the interaction of the $Two\_more_{it}After_t$ dummy with an indicator for the women's households wealth being above median.[16] There is no statistically significant difference in the response of women of households below and above the wealth median. We also found no statistically significant differences when we consider finer breakdowns of the wealth distribution (results not reported).

In Column 2 of Table 5, we test whether response to the childbirth grant differs by education level. We interact the coefficient of interest with a binary variable for having education above secondary level (53 percent of the sample). We do not find statistically significant difference in responses. We also do not find difference in responses to the program by whether women reside in rural or urban areas.

Fertility incentives in the context of sex-imbalance

As experienced in other countries such as China, India and South Korea, the reduction in fertility was coupled with an increase in sex imbalance. Several previous studies have argued that increasing sex imbalance was caused by the reduction in fertility rates (Park and Cho 1995, Das Gupta and Bhat 1997, Ebenstein 2010, Jayachandran 2017). As we established that the Childbirth Benefit program has increased fertility, it theoretically could contribute to attenuate the sex imbalance. Son preference in Armenia is exhibited by both stopping rules by parents who already have at least one son as well as sex selective abortion. We therefore apply two approaches for studying the impact of the childbirth grant program in the context of strong son preference. First, we test whether fertility responses to the policy change differ by whether parents already have a son. Second, we test whether parents are as likely to have male and female newborns.

The first two columns of Table 6 present results of our baseline regression model when restricting the sample by the gender of already born children.[17] Column 1 presents results from a subsample of women who previously only gave birth to daughters. Women with at least two daughters increase their annual birth likelihood by 7.4 percentage points. If we focus on the subsample of

[16] We use a wealth index provided by the ADHS, which is constructed taking into account urban-rural differences in household and dwelling characteristics, based on assets owned. For more information on the index construction, see National Statistical Service Armenia et al. (2017).

[17] The samples exclude childless women.

women who had at least one boy (Column 2), the point estimate drops to 2.8 percentage points. Both estimates are statistically significant at least at the 5% level. The difference between the two estimates is significant at the 5% level. While parents with at least one son are more likely to have a third offspring because of the policy change, they are less likely to do so relative to parents with two daughters.

Table 5. Heterogeneous effects

	Dep. variable: =1 if gave birth in year t			
	(1)	(2)	(3)	(4)
Post 2009 x Two or more	0.016***	0.017***	0.017***	0.013**
	(0.006)	(0.005)	(0.006)	(0.006)
Interactions of Post 2009 x Two or more with:				
Above median wealth	0.004			
	(0.008)			
Higher education		-0.002		
		(0.008)		
Urban			0.001	
			(0.008)	
Youngest child 7-11 years old				-0.017**
				(0.007)
Youngest child 12+ years old				-0.012*
				(0.007)
Constant	-0.264***	-0.258***	-0.256***	-0.170*
	(0.099)	(0.099)	(0.099)	(0.092)
N	52,741	52,741	52,741	52,741
Adjusted R2	0.193	0.194	0.193	0.225
Socio-demographic characteristics	Yes	Yes	Yes	Yes
Composition of previous children	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes
Husband's characteristics	No	No	No	No

Note: The data corresponds to a yearly panel with birth history for the period 2003-2013 for all women aged 15-49 by the time of survey. The first row reports the treatment effect (Post 2009 x Two or more) for the omitted group, which corresponds to women below median wealth in column (1), women with secondary or lower education in column (2), women in rural areas in column (3) and women whose youngest child is 6 years or less in column (4). Also included (but not reported) are the interactions of each characteristic with the Post 2009 dummy and with the Two or more dummy. Socio-demographic characteristics include age, marital status, whether the woman had birth during the last year, whether she has a son or not, as well as dummies for educational level (primary or less -omitted-, secondary or higher). Composition of previous children are dummy variables indicating the number of children in the specific gender-age group (interaction of female/male and age ranges 0-4, 5-13, 14-17, 18+). Geographic controls include a dummy for urban/rural and dummies for region of residence, while husband's characteristics include husband's age, and educational level. The coefficients are estimated using a linear probability model. Standard errors clustered at the mother level in parentheses below each estimate, *** significant at 1%; ** significant at 5%; * Significant at 10%. Source: RA DHS 2015-16.

In Columns 3 and 4 we present results of our regression analysis on the outcome of having a son or a daughter. The full sample is used for this analysis. The childbirth grant policy increased the annual likelihood of having a son and a daughter by one and 0.7 percentage points respectively. The coefficients are significant at the 1% and 5% but the difference between them is not statistically significant (p-value of 0.8551). We therefore cannot reject the null hypothesis that the policy increased the likelihood of giving birth to boys as much as it did for girls.

Table 6. Impact of the childbirth benefit and sex imbalance

	Dep. variable: =1 if gave birth in year t		Dep. variable: =1 if gave birth to …. in year t	
	Subsample: All girls	Subsample: At least one boy	A boy	A girl
Post 2009 x Two or more	0.074***	0.028**	0.010***	0.007**
	(0.019)	(0.012)	(0.003)	(0.003)
Post 2009	-0.059***	-0.019	-0.004	-0.004
	(0.016)	(0.012)	(0.003)	(0.003)
Two or more	-0.138***	-0.138***	-0.065***	-0.065***
	(0.020)	(0.011)	(0.006)	(0.006)
Constant	0.408***	0.369***	-0.065	-0.181***
	(0.109)	(0.089)	(0.086)	(0.037)
Mean (pre-program)	0.159	0.049	0.041	0.035
N	6,490	24,596	52,741	52,741
Adjusted R2	0.101	0.104	0.098	0.089
Socio-demographic characteristics	Yes	Yes	Yes	Yes
Composition of previous children	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes
Husband's characteristics	No	No	No	No

Note: The data corresponds to a yearly panel with birth history for the period 2003-2013 for all women aged 15-49 by the time of survey. “Two or more” is a dummy equal to one for women with at least two children (treatment group), while “Post 2009” equals 1 for the period 2009-2013 and 0 otherwise. Socio-demographic characteristics include age, marital status, whether the woman had birth during the last year, whether she has a son or not, as well as dummies for educational level (primary or less -omitted-, secondary or higher). Composition of previous children are dummy variables indicating the number of children in the specific gender-age group (interaction of female/male and age ranges 0-4, 5-13, 14-17, 18+). Geographic controls include a dummy for urban/rural and dummies for region of residence, while husband's characteristics include husband's age, and educational level. The coefficients are estimated using a linear probability model. Standard errors clustered at the mother level in parentheses below each estimate, *** significant at 1%; ** significant at 5%; * Significant at 10%. Source: RA DHS 2015-16.

Discussion

This paper estimates the effects of a pro-natalist policy reform introduced in Armenia in 2009 in response to low fertility rates. The reform of the universal Childbirth Benefit Program, consisted in giving a substantially larger transfer to families after having two or more children. This policy change allows us to rely on a quasi-experimental strategy using the timing of the policy change and eligibility rule, making women with two or more children the treatment group and women with less than two children the control group. We find an overall positive impact of the policy on the fertility of women who already had two births. The impact of the policy is not driven by an absolute increase in the fertility level among of treatment women, but rather from a decrease in birth rates for women with less than 2 children. In other words, the policy succeeded at avoiding further decreases in fertility among women with 2 or more children. We do not find heterogeneity in response to the policy by wealth, schooling or place of residence.

Moreover, Armenia is one of the countries with the highest sex imbalances at birth. Given that the connection between sex ratio imbalances and rapid decrease in fertility (Das Gupta et al. 2003), it could have been expected that the policy change could also have an impact in this development outcome. However, we find that newborns that are the result of the policy change are statistically equally likely to be male or female. We do find, however, that parents without any son are more likely to have an additional birth after the policy change in comparison to parents who already have at least one son. The positive impact of the policy is reassuring given the large amount of resources that middle-income countries are starting to devote to pro-natalist policies. Delaying becoming an aged society is very important for middle-income countries that are not prepared to afford putting in place the expensive aged care programs that are now available in OECD countries, and where there are still market failures that prevent their population to generate savings and insurance mechanisms to adopt private solutions for the elderly. Moreover, having a sizable workforce, for which is essential having a sizable working age population, is important for growth, and particularly in those countries where growth depends on the increases of the labor productivity. This is then the first study, to our knowledge, that rigorously evaluates a pro-natalist policy in a middle-income country.

Many policy relevant questions remain to be answered regarding the impact of pro-natalist policy instruments. What is the right level of the size of the transfer? Does intertemporal discount affect the decision and are parents more likely to respond to a lump-sum transfer at the moment of birth (like in Armenia or Spain) rather than monthly subsidies (like in Israel)? How long do government need to have these policies in place, given that the policies take time to show an impact? This is a first step, to try to open the discussion in an area that is going to gain importance given that countries are getting older before getting rich.

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Appendix

Table A1. Summary statistics

	All women			By number of children					
				Less than two			Two or more		
	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.
Age	6,116	31.5	9.5	2,891	25.8	8.1	3,225	37.0	7.1
Married	6,116	0.63	0.5	2,891	0.32	0.5	3,225	0.93	0.3
Urban	6,116	0.60	0.5	2,891	0.14	0.4	3,225	0.06	0.2
Education - Primary	6,116	0.10	0.3	2,891	0.27	0.4	3,225	0.45	0.5
Education - Secondary	6,116	0.36	0.5	2,891	0.59	0.5	3,225	0.48	0.5
Education - Higher	6,116	0.53	0.5	2,891	12.13	2.3	3,225	11.65	2.3
Years of education	6,116	11.89	2.3	2,891	3.18	1.4	3,225	3.02	1.4
Employed	6,114	0.34	0.5	2,891	0.01	0.1	3,225	0.01	0.1
Worked abroad	6,116	0.01	0.1	2,891	0.64	0.5	3,225	0.56	0.5
Children born	6,116	1.39	1.2	2,891	0.29	0.5	3,225	2.44	0.7
Sons born	6,116	0.73	0.8	2,891	0.16	0.4	3,225	1.28	0.8
Daughters born	6,116	0.66	0.8	2,891	0.14	0.3	3,225	1.16	0.8
No children	6,116	0.35	0.5	2,891	0.71	0.5	3,225	0.00	0.0
One child	6,116	0.14	0.4	2,891	0.29	0.5	3,225	0.00	0.0
Two or more children	6,116	0.51	0.5	2,891	0.00	0.0	3,225	1.00	0.0
Age at first birth	4,006	22.37	3.6	852	24.16	4.2	3,154	21.86	3.2
Husband's age	3,995	39.32	8.8	964	32.80	8.0	3,031	41.49	7.9
Age differential w/husband	3,995	4.61	3.8	964	4.17	3.9	3,031	4.76	3.8
Husband education - Primary	3,992	0.10	0.3	964	0.07	0.3	3,028	0.10	0.3
Husband's education - Secondary	3,992	0.48	0.5	964	0.45	0.5	3,028	0.50	0.5
Husband's education - Higher	3,992	0.42	0.5	964	0.48	0.5	3,028	0.40	0.5
Husband worked abroad	3,985	0.22	0.4	962	0.23	0.4	3,023	0.22	0.4

Note: The sample includes all women aged 15-49 at the time of the survey. Statistics referring to husbands' characteristics refer to the subsample of married women only. Source: RA-DHS 2015-16.

Table A2. Fertility results, dynamic difference in difference

	Dep. variable: =1 if gave birth in year t	
	(1)	(2)
2003 * Two_or_more	0.006	0.009
	(0.011)	(0.014)
2004 * Two_or_more	-0.009	-0.002
	(0.010)	(0.013)
2005 * Two_or_more	-0.006	-0.002
	(0.010)	(0.013)
2006 * Two or more	0.013	0.019
	(0.010)	(0.013)
2007 * Two or more	-0.006	-0.003
	(0.010)	(0.014)
2009 * Two or more	-0.001	-0.005
	(0.010)	(0.014)
2010 * Two or more	0.014	0.021
	(0.009)	(0.013)
2011 * Two or more	0.014	0.015
	(0.009)	(0.014)
2012 * Two_or_more	0.023***	0.039***
	(0.009)	(0.014)
2013 * Two_or_more	0.035***	0.057***
	(0.009)	(0.015)
Two or more	-0.131***	-0.163***
	(0.011)	(0.013)
Constant	-0.245**	-0.148
	(0.098)	(0.118)
N	52,741	40,444
Adjusted R2	0.194	0.201
Socio-demographic characteristics	Yes	Yes
Composition of previous children	Yes	Yes
Geographic controls	Yes	Yes
Husband's characteristics	No	Yes

Note: The data corresponds to a yearly panel with birth history for the period 2003-2013 for all women aged 15-49 by the time of survey. Each row reports the coefficients for year dummies interacted with the indicator “Two or more” (a dummy equal to one for women with at least two children). The omitted category is 2008. All columns include year fixed effects. Socio-demographic characteristics include age, marital status, whether the woman had birth during the last year, whether she has a son or not, as well as dummies for educational level (primary or less -omitted-, secondary or higher). Composition of previous children are dummy variables indicating the number of children in the specific gender-age group (interaction of female/male and age ranges 0-4, 5-13, 14-17, 18+). Geographic controls include a dummy for urban/rural and dummies for region of residence, while husband's characteristics include husband's age, and educational level. The coefficients are estimated using a linear probability model. Standard errors clustered at the mother level in parentheses below each estimate, *** significant at 1%; ** significant at 5%; * Significant at 10%. Source: RA DHS 2015-16.