Does Male Education Affect Fertility? Evidence from Mali *

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Abstract

This paper studies how school access affects men's fertility decisions. To separately identify the male response, we adopt a regression discontinuity approach that exploits the timing of a major expansion in school access in Mali and the country's large gender gap in the age of marriage. Increased school access for boys led to large subsequent decreases in fertility by age 25. The effects appear to be driven by delayed marriage entry and urbanization. The study shows how failing to account for the impact of male education on fertility may lead to an underestimate of the potential for expansions in school access to stimulate demographic transition.

Keywords: School Access; Male Education; Fertility; Marriage
JEL Codes: J13; J18; I25; I28

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1 Introduction

The effect of education on fertility is a central question in development economics. Economists have long recognized that education increases the opportunity cost of women's time, and that investment in women's education should lead to decreases in fertility rates and greater investment in children (Becker and Lewis, 1973). An emerging research has documented the negative impact of women's education on fertility (Duflo, Dupas, and Kremer, 2015; Heath and Mobarak, 2015; Jensen, 2012; Lavy and Zablotsky, 2015; Osili and Long, 2008). In response, policymakers have promoted expanding access to school as a potential catalyst for demographic transition in developing countries.

The impact of male education on household fertility decisions has largely been overlooked.[1] Depending on the male response, studies focused on the link between women's human capital and fertility may overestimate or underestimate the general equilibrium effects of widespread investment in educational infrastructure. On the one hand, because men typically devote less time to childrearing, their opportunity cost of fertility is lower. As a result, a rise in male human capital may lead to an increase in desired fertility through a positive income effect, counteracting the effects on women's fertility. On the other hand, an increase in male human capital might reduce the demand for children through urbanization, decreased demand for child labor, or changes in preferences, reinforcing the female response.

This paper studies the effect of male education on fertility decisions in Mali. Mali provides an exceptional context to study this relationship for at least two reasons. First, a series of educational reforms in 1992 led to a sharp and unanticipated expansion in school access, allowing us to identify the causal impact on fertility decisions. Second, Mali is characterized by a large gender gap in the age of marriage, which allows us to disentangle the influence of men's education from confounding changes in women's human capital. To study the effects of school access on fertility, we adopt a regression discontinuity design (RDD), combining the large

[1] One notable exception is Breierova and Duflo (2004), who find that female education is a stronger determinant of early fertility than male education.

marriage age gap and sharp cross-cohort differences in school access with detailed individual-level data on socioeconomic outcomes in 2009.

We find that greater school access for males led to a significant decrease in their fertility by age 25. The reforms also caused delayed entry into marriage and increased urbanization, which may have lowered demand for children, although we find no effects on men's labor market outcomes. The findings suggest that policies that promote school access may lead to substantial reduction in overall fertility rates in lower income countries.

2 Historical Changes in Education Policy in Mali

Historically, Mali has had low levels of school attendance and literacy. From 1968 to 1991, the country was under the single-party leadership of Moussa Traoré. The first decade of the regime was characterized by gradual increases in education and literacy, although these trends reversed in the 1980s, when school quality stagnated and tuition costs rose. Despite a 33 percent increase in the country's population over the decade, enrollment in primary school rose by less than 10 percent (Lange and Diarra, 1999).

The early 1990s witnessed a radical shift in educational policy. Following the peaceful overthrow of the Traoré government in 1991, the country held its first multiparty elections in 1992. The new government adopted a series of policies that dramatically expanded access to education. The new constitution guaranteed children the right to free public school, eliminating the financial barriers to education. Other policies included large-scale hiring of teachers and schools openings. Within five years, 460 new primary schools opened, more than double the number of the previous decade (Lange, 2003). The reforms led to a 50 percent increase in primary school enrollment within three years (Lange and Diarra, 1999). The new policies led to sharp cross-cohort differences in school attendance: given the primary school entry age of seven, children born prior to 1985 were generally too old to be affected.[2]

[2]Malian child labor rates were higher than the average in sub-Saharan Africa, and once withdrawn from school, few children returned (Dillon, 2008). As a result, older cohorts of boys who had already begun farm

3 Data and Empirical Strategy

Our analysis is based on cohorts of males born between 1977 and 1991 in the 10% public-use microdata sample from the 2009 Mali census of population. The main outcome variables of interest include measures of schooling (school attendance, years of education, and literacy), number of children living with respondent, marital status, urban residency, and employment status.

We estimate the impact of expansions in education access on various outcomes using the following parametric regression discontinuity specification:

$$Y_{ic} = \alpha + \beta Post_c + F(Cohort_c) + \gamma X_{ic} + \epsilon_{ic} \tag{1}$$

where Y_{ic} denotes the outcome of interest for individual i of birth cohort c. $Post_c$ is a dummy variable that takes a value of one for individuals born in 1985 or later, who reached primary school age after the 1992 reforms were adopted.[3] We control for trends in outcomes across birth cohorts using a third-order polynomial, $F(Cohort_c)$. The term X_{ic} denotes a vector of fixed effects controls for region of birth. The coefficient of interest, β, captures the impact of program eligibility at age seven on school attendance and subsequent fertility decisions. We also present results based on alternate polynomials and local-linear models.

To disentangle the role of male school access from changes in women's education caused by the reforms, we exploit both the cohort-specific nature of the policy changes and the large gap in age of marriage. On average, a married woman born before 1985 was ten younger than her husband, and fewer than one percent of partners were born in the same year (Figure 1). Thus, cohorts of males born around 1985 would typically marry women who reached primary school age well after the education reforms were implemented.[4]

work were much less likely to have benefited from the 1992 educational reforms.

[3]The reforms may also have affected the likelihood of school attendance among pre-1985 cohorts through delayed school entry at older ages. If so, the estimates reflect the differential impact of eligibility at age seven.

[4]Any expansion in women's school access post-1992 will be controlled for by the polynomial specification.

4 Results

Before turning to the main estimates, we first present graphical evidence on the effects of the 1992 educational reforms on the main outcomes. Figure 2(I) plots the mean for several school outcomes. There was a large discontinuous jump in the probability of school attendance among the first cohort entering school after the 1992 reforms.[5] Among subsequent cohorts, school attendance rates continued to rise, coinciding with the continued expansion in access. The expansion in school access also led to a jump in male literacy rates and years of education. Figure 2(II) reports the corresponding effects for fertility. There was a general downward trend in both measures, in part, because fertility rates increase with age. There was also a discontinuous decrease in fertility among cohorts of males exposed to the educational reforms.

Table 1 presents the RDD estimates of β. The reforms led to a sharp increase in male schooling. School attendance increased by $21 = 0.084/0.408$ percent, years of education increased by 28 percent, and literacy rates increased by 19 percent. These increases in school attendance translated into significantly higher rates of adult literacy. The reforms also significantly decreased fertility, measured by both the number of children and the probability of having a child. An additional year of male education is thus associated with a $22 = \big((0.096/0.473)/0.907\big)$ percent decrease in the number of children by age 25. Taken together, the results suggest that increases in male human capital tend to lower desired fertility.[6]

In Table 2, we explore the mechanisms underlying the negative education-fertility relationship. The effects appear to have been driven by fertility decisions at the extensive margin. Greater school access caused men to delay entry into marriage, although the reforms had no impact on the rates of polygynous marriage or the spousal age gap. We also find that cohorts exposed to the education reforms were more likely to reside in urban areas and less likely to

[5]We find little evidence of pre-reform trends in education. Figure A.1 shows that in the 12 years prior to the reform, attendance rates increased by less than 5 percentage points, less than half of the one-year jump in attendance among the first cohort eligible for the 1992 reforms.

[6]In unreported results, we also find that the reforms led to increases in female school attendance and decreases in women's fertility, consistent with the previous literature.

farm. This rise in urbanization may have lowered their demand for children. In contrast, there is no evidence that greater school access affected male employment rates or household wealth, as measured by the number of rooms.

To conclude the empirical analysis, we examine the robustness of the main findings. The results are robust to alternative polynomial specifications, and local linear regression models that use the optimal bandwidth procedures outline in Imbens and Kalyanaraman (2012). Excluding the 1984 cohort, who may also have benefited from the educational reforms, does not affect the main findings. Columns (4)-(6) show that the main results are unaffected when we change the birth year cutoffs to be included in the sample. Finally, we re-run the analysis using the 2012 Demographic and Health Survey (DHS). These data allow us to track the reform's impact through ages 27 to 28.[7] Despite the smaller sample size, we find qualitatively similar results.

5 Conclusion

This paper studies the effects of male school access on subsequent fertility decisions, using an RDD analysis that exploits a series of major policy reforms in Mali in 1992. We find that increased access to education led to significant decreases in male fertility. The effects appear to have been driven by delayed entry into marriage and urbanization, which may have lowered the demand for children.

Our findings suggest that in high fertility societies, policies that promote school access may be effective tools to stimulate demographic transition. To the extent that these investments affect the school decisions of both males and females, the increase in male human capital appears to reinforce the well-documented negative education-fertility relationship among women. Given the timing of the Malian reform, we cannot observe whether these decreases in fertility by age

[7] A downside of the DHS is the limited sample size for males. The analysis is based on 1,612 males from cohorts born between 1977 and 1991. Because the DHS does not provide detailed information on region of birth, we control for ethnicity in these regressions.

25 translated into lower completed fertility. Exploring the dynamic relationship between school access and fertility over the lifecycle may be a fruitful area for future research.

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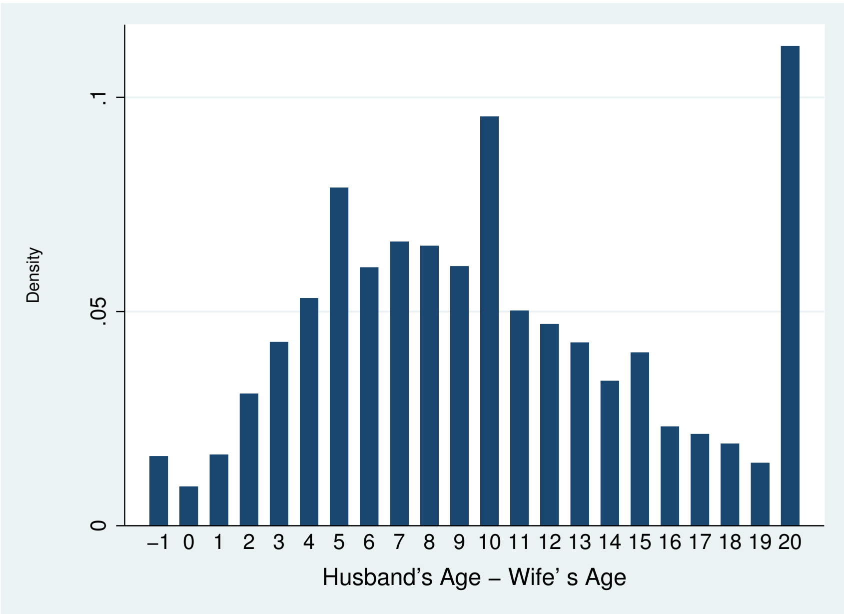
6 Figures and Tables

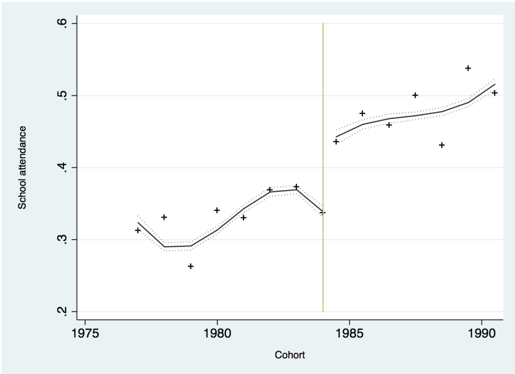
Figure 1: Distribution in the Marriage Age Gap



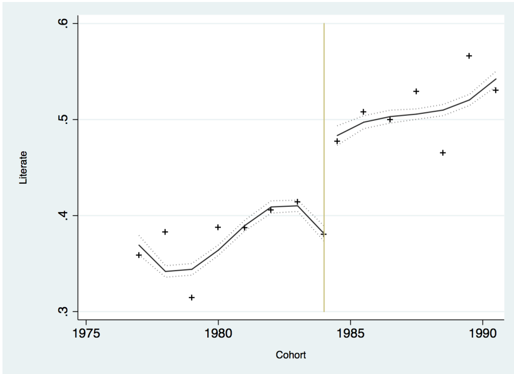
Notes: This figure reports the distribution of the gap between husband and wife's age. The distribution is calculated based on the sample of women born from 1977 to 1984 who were married in 2009. The values at points −1 and 20 represent the cumulative distribution of spouses with an age gap of less than zero years and twenty or more years, respectively.

Figure 2: The Impact of the 1992 Education Reforms on Male Schooling and Fertility

I. Schooling



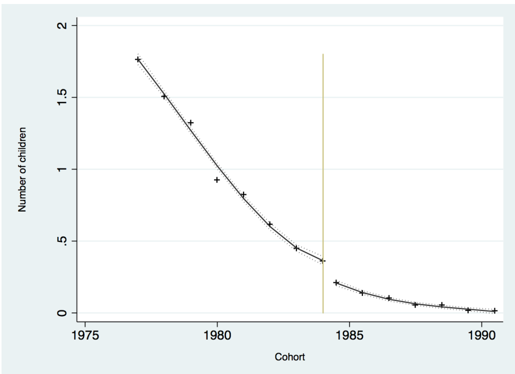
(a) Ever attended school



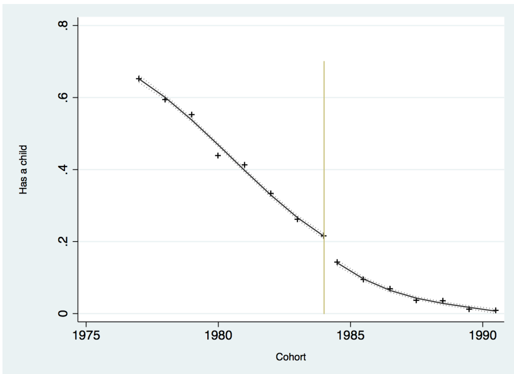
(b) Literate

(c) Years of education

II. Fertility



(a) Number of children



(b) Has a child

Notes: Each point represents the average outcome by cohort. The solid curves represent the predicted outcome based on a cubic polynomial fit. The vertical line represents the last birth cohort to enter primary school age prior to the 1992 educational reforms.

Table 1: Effects on School and Fertility Outcomes

Panel A: School Outcomes

	Ever attended school		Literate		Years of education	
	(1)	(2)	(3)	(4)	(5)	(6)
Mean(dep var)	0.408		0.449		3.19	
Post reform	0.123***	0.084***	0.120***	0.087***	1.264***	0.907***
	(0.011)	(0.011)	(0.012)	(0.011)	(0.123)	(0.113)
Observations	149161	149161	136782	136782	140302	140302

Panel B: Fertility Outcomes

	Number of children		Has a child			
	(7)	(8)	(9)	(10)		
Mean(dep var)	0.473		0.221			
Post reform	-0.095***	-0.096***	-0.025***	-0.024***		
	(0.018)	(0.017)	(0.009)	(0.008)		
Observations	149161	149161	149161	149161		
Birth cohort polynomial	Cubic	Cubic	Cubic	Cubic	Cubic	Cubic
Region of birth	No	Yes	No	Yes	No	Yes

Notes: Each cell reports the point estimate from a different regression based on equation (1). All regression include a cubic polynomial control for year of birth. Robust standard errors are reported in parentheses. ***,**, * denote significance at the 1%, 5%, and 10% level, respectively.

Table 2: Effects on Other Outcomes

	Marriage			Urbanization		Labor market	
	Currently married	In polygynous marriage	Spousal age gap	Lives in urban area	Farmer	Currently at work or school	Number of rooms in house
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mean(dep var)	0.356	0.054	6.2	0.310	0.471	0.896	3.66
Post reform	-0.027**	-0.004	0.115	0.024***	-0.036***	0.005	-0.016
	(0.011)	(0.005)	(0.233)	(0.009)	(0.011)	(0.007)	(0.073)
Observations	135568	135568	41525	149161	149161	148441	149161
Birth cohort polynomial	Cubic	Cubic	Cubic	Cubic	Cubic	Cubic	Cubic
Region of birth	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Each cell reports the point estimate from a different regression based on equation (1). The spousal age gap is defined as the husband's age minus the wife's age. All regression include a cubic polynomial control for year of birth and region of birth fixed effects. Robust standard errors are reported in parentheses. ***,**, * denote significance at the 1%, 5%, and 10% level, respectively.

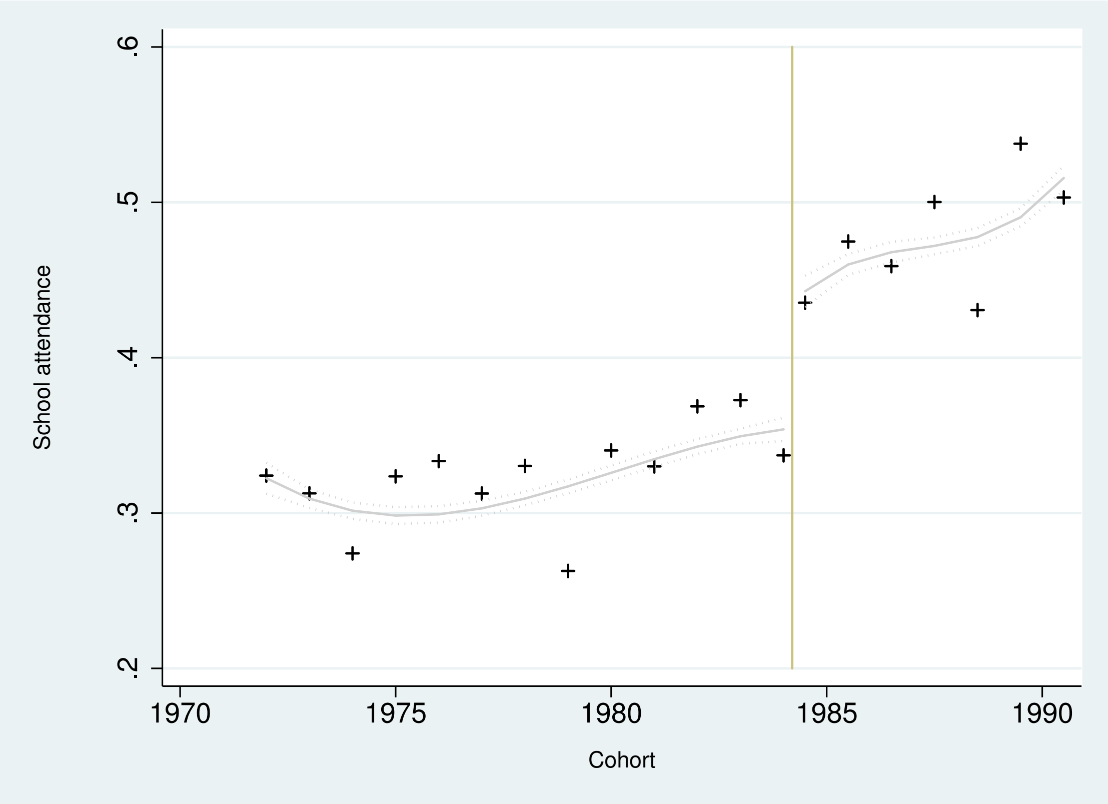
Table 3: Robustness Tests

	Alternate specifications		Alternate samples				
	2nd order polynomial	Local linear regression using IK bandwidth	Omit 1984 birth cohort	Extend to 1972-1991 birth cohorts	Restrict to 1980-1989 birth cohorts	Restrict to 1982-1987 birth cohorts	Analysis based on 2012 DHS sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: School attendance							
Mean(dep var)	0.408						0.364
Post reform	0.059***	0.096***	0.067***	0.053***	0.103***	0.065***	0.293***
	(0.007)	(0.011))	(0.024)	(0.010)	(0.016)	(0.008)	(0.111)
Observations	149161	38119	137288	182611	96021	56613	1612
Panel B: Number of children							
Mean(dep var)	0.47						1.83
Post reform	-0.051***	-0.069***	-0.149**	-0.038**	-0.139***	-0.121***	-0.615*
	(0.012)	(0.016)	(0.059)	(0.015)	(0.026)	(0.012)	(0.352)
Observations	149161	38119	137288	182611	96021	56613	1612
Birth cohort polynomial	Quadratic	Local linear	Cubic	Cubic	Cubic	Cubic	Cubic
Region of birth	Yes	No	Yes	Yes	Yes	Yes	No

Notes: Each cell reports the point estimate from a different regression. The bandwidth for local linear regressions is selected following the procedure outlined by Imbens and Kalyanaraman (2012). Column (6) reports the estimates based on the sample of males born between 1977 and 1991 in the 2012 Demographic and Health Survey (DHS). The DHS regressions include controls for individual ethnicity. Robust standard errors are reported in parentheses. ***,**, * denote significance at the 1%, 5%, and 10% level, respectively.

A Appendix

Figure A.1: Male School Attendance by Birth Cohort, 1972-1991



Notes: This figure reports long-run trends in school attendance for cohorts of males born between 1972 and 1991. Each point represents the average outcome by cohort. The solid curves represent the predicted outcome based on a cubic polynomial fit. The vertical line represents the last birth cohort to enter primary school age prior to the 1992 educational reforms.