The Demographic Promise of Expanded Female Education: Trends in the Age at First Birth in Malawi

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Abstract

The expansion of female education has been promoted as a way to postpone the age of first birth. In sub-Saharan Africa, the first cohorts to benefit from policies that expanded access to education are now reaching adulthood and beginning childbearing. I investigate whether the expansion of education in Malawi, which implemented a free primary education policy in 1994 and subsequently expanded secondary schooling, has led to a later age at first birth and whether the education gradient in fertility timing has remained stable over time. Despite increases in female grade attainment over the past twenty years, the age at first birth has not changed. Using instrumental variables analysis, I find a significant negative association between grade attainment and age at first birth, suggesting that the deterioration of school quality and shift in the age pattern of enrollment that accompanied educational expansion may have compromised the transformative potential of education.

Introduction

For decades, female education has been promoted as a means of changing demographic outcomes. Over this period, the expansion of access to education for women and the push to achieve "education for all" were not only promoted as desirable ends, but also in the hopes that greater opportunities for women would lead to later fertility at lower rates (UNESCO 1990; McIntosh and Finkle 1995). These policy shifts coincided with an emerging international emphasis on interventions that target adolescent girls in order to achieve development goals (Moeller 2013; Chisamya et al. 2012; Tembon and Fort 2008; Klugman et al. 2014; World Bank 2006; Levine et al. 2008; Mensch, Bruce, and Greene 1998; World Bank 2004a; Herz and Sperling 2004; Lloyd 2009). A central element of these policy discussions is the assertion that increased educational attainment will lead to later ages at first birth. In contrast to total fertility rates, which may not immediately respond to the expansion of education, age at first birth is expected to become older for the first generation of girls to benefit from improved access to schools (Caldwell 1982; Cleland 2002).

In sub-Saharan Africa, the first cohorts to benefit from policies that expanded access to education are now reaching adulthood and beginning childbearing. This provides the first opportunity to examine whether the demographic promise of these policies has come to fruition. Has the shift in the educational composition of young women led to a later age at

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first birth? Has the educational gradient in the timing of first births remained constant over time? This article uses the experience of Malawi as a case study to examine these questions. In 1994, Malawi became the first country in sub-Saharan Africa to implement a free primary education (FPE) policy after the international declaration of "education for all". Four years later the government expanded the secondary school system, creating a second tier of schools by turning existing distance education centers into lower-cost Community Day Secondary Schools. Four Demographic and Health Surveys were collected in Malawi between 1992 and 2010, creating the opportunity to examine how the transition to first birth has varied across cohorts of young women who had different degrees of exposure to these education policies. If the demographic promise of expanded female education has come to fruition, then the median age at first birth would be expected to shift to older ages as the educational composition of young women shifted to higher levels of schooling attainment. Instead, I find that the age at first birth in Malawi has remained relatively constant over this period, despite dramatic increases in female schooling attainment. This pattern is largely driven by a declining age at first birth across cohorts of women who attend secondary school. I explore the sources of this pattern, with a focus on changes in the selectivity of school enrollment, age patterns of enrollment, school quality, and contextual factors, and discuss the conditions that may be necessary in order for expanded female education to delay the onset of childbearing.

Schooling and the Age at First Birth

The demographic promise of expanded female education emerged from evidence of the education gradient across a range of demographic outcomes. In the case of fertility, demographers found that women with higher levels of educational attainment, especially secondary schooling, consistently had later ages at first birth than less educated women or women who had never been to school (Ainsworth, Beegle, and Nyamete 1996; Jejeebhoy 1995; Lloyd 2005). Less than a handful of studies, however, have examined whether education gradients in the timing of first birth have changed over time. One study pooled Demographic and Health Survey data from 52 countries to examine how the education gradient in the prevalence of births before age 18 differed for 20–24 and 40–44 year olds (Lloyd 2005). This report found that education gradients in early childbearing were stable across all world regions, and that, within sub-Saharan Africa, the negative association between primary school completion and early childbearing may even have strengthened over these cohorts. Gupta and Mahy (2003) examined five African countries and also concluded that education gradients in the age at first birth were stable over time. Other studies have used education policy changes, such as new classroom construction or changes in the years of compulsory schooling, to instrument the relationship between education and age at first birth (De Paoli 2011; Ferré 2009; Kirdar, Dayioglu, and Koc 2009; Angeles, Guilkey, and Mroz 2005). Although these studies consistently found a positive education gradient after adjusting for the potential endogeneity of schooling attainment and the timing of first birth, the consequences of these policies may not be comparable to the consequences of free primary education policies and other education changes that have come to categorize African education policies in the last 15–20 years.

Although some of the literature has emphasized the positive demographic externalities of increased access to schooling at the community level (Caldwell 1980; Axinn and Barber 2001; Kravdal 2002), the effect of a woman's own educational attainment on her fertility has been theorized to be the product of a number of ideational and instrumental factors. Schooling may serve as a conduit for exposure to different values and ways of thinking about the world (LeVine, LeVine, and Schnell 2001; Thornton 2005), and the skills and credentials gained through schooling may also create new opportunities for labor force participation, greater decision making autonomy, and shifts in time preferences that increase women's status and the opportunity cost of women's childbearing (Caldwell 1980; Caldwell, Orubuloye, and Caldwell 1992; Diamond, Newby, and Varle 1999). Age at first birth may be particularly sensitive to the potential of schools to empower women, as the timing of childbearing may depend, among other things, on the perception of alternatives to early childbearing, greater acceptance of non-traditional gender roles, and the ability to exercise decision-making power about sexual relationships and contraception early in the life course. Finally, even if schooling fails to change attitudes, expectations, and behaviors among young women, it may still be associated with a later age at first birth to the extent that girls enrolled in school at older ages are less likely to be sexually active or at risk of marriage (Bledsoe and Cohen 1993).

However, schooling may not always create the conditions to postpone fertility. The knowledge and experiences gained at school may increase the efficiency with which women carry out their roles and responsibilities, such as improving child survival, while failing to transform the options that women perceive to be available (Kabeer 2005). The information, knowledge, and new ideas encountered at school may not be sufficient to change women's status and demographic behavior if pedagogical practices and curricula do not challenge gender hierarchies or encourage young women to participate and exercise critical thinking in the classroom (Stromquist 2003; Aikman, Unterhalter, and Challender 2005). Schools may also expose young women to the risk of gender-based violence. Students may be sexually harassed on the way to and from school, and subject to abuse from male classmates and teachers (Dunne, Humphreys, and Leach 2006). Young women may also be pressured to begin sexual relationships in exchange for financial support to pay school fees or other school-related expenses (Luke 2003; Gerver 2013; Vavrus 2003), putting those students at risk for early pregnancy.

Ironically, international efforts to expand school participation and attainment may have compromised the potential of schools to empower young women. An emerging body of evidence suggests that the rapid expansion of primary school enrollments in sub-Saharan Africa, most often stimulated by free primary education policies introduced over the past twenty years, has been at the expense of school quality (Pritchett 2013; World Bank and UNICEF 2009). Increasing student-teacher ratios, reliance on unqualified teachers, and insufficient budgets for new school materials may limit the feasibility of executing the types of gender sensitive classroom practices that foster women's empowerment and lead to later childbearing. To the extent that improved outcomes for women depend on literacy and other skills gained in school, low school quality will also compromise the instrumental effects of schooling. Nonetheless, the expansion of education has led to the enrollment of large numbers of students who would previously have limited exposure to schooling. Some

scholars argue that this shift in the composition of students is driving declines in average academic performance, as the newly enrolled have greater barriers to learning such as less family support for education, uneducated parents, greater labor demands, and worse health and nutrition than past cohorts of students (Filmer and Schady 2009). Even as average test scores in sub-Saharan Africa have declined over time, the absolute number of students who have gained skills has increased (Taylor and Spaull 2015), supporting the counter-narrative that observed achievement patterns are driven more by the declining selectivity of enrollment than by declining school quality. It is possible that more young women are attending school, completing more grades, and gaining greater literacy relative to past cohorts at the same time that schools are becoming less effective at fostering autonomy and challenging traditional gender norms.

Furthermore, educational attainment has expanded faster than modern wage employment in most African countries, such that the labor market will not be able to absorb larger cohorts of educated youth; the most recent data suggest that the majority of African young adults who ever attended secondary school will be unable to find wage work (Filmer and Fox 2014). A study of secondary school leavers in Malawi, Tanzania, Uganda, and Zimbabwe found that wage employment for educated youth declined over the 1990s and early 2000s, with a corresponding increase in the proportion of educated youth who were either underemployed or unemployed and seeking work (Al-Samarrai and Bennell 2007). Young women have substantially lower rates of wage work than men, with their opportunities often limited by the persistence of gender segregated labor markets (Filmer and Fox 2014). If young women are unable to find meaningful employment or do not anticipate finding productive work after they leave school, then they may perceive few benefits to postponing childbearing.

Finally, the HIV epidemic may have changed patterns of early childbearing. In particular, young women who are concerned about their chances of becoming infected with HIV/AIDS may give birth at earlier ages, which may make it difficult to disentangle the effect of the education policies from that of the HIV epidemic. Ueyama and Yamauchi (2009) provide evidence that the age at first marriage in Malawi became younger as the level of adult mortality increased over the course of the HIV epidemic, suggesting that young women began forming families at earlier ages in the hopes of marrying an HIV-negative partner. Although the authors did not look at the timing of first birth, the relatively short marriage to first birth interval in Malawi suggests that the age at first birth may also have responded to local mortality levels. More recent survey data, however, did not find an association between HIV risk perceptions and the transition to marriage (Grant and Soler-Hampejsek 2014). Concerns about HIV may also lead some women to adopt a "now or never" attitude, intending to accelerate childbearing in order to start a family before the onset of illness (Hayford, Agadjanian, and Luz 2012). A recent study from Malawi found that young women with greater uncertainty about their current or future risk of HIV infection report a shorter desired waiting time until their next birth (Trinitapoli and Yeatman 2011), although the authors also found that current school enrollment was strongly associated with a longer waiting time until next birth.

Education Change in Malawi

The simultaneous expansion of female schooling and possible deterioration of school quality in Malawi raise important questions about whether the school experiences of the most recent cohorts of young women will transform their demographic behavior. As one of the earliest adopters of a free primary education program in sub-Saharan Africa, Malawi provides the first opportunity to examine the potential consequences of the FPE policies. The government removed all school fees at the primary level shortly after the country's transition to multiparty democracy in 1994. The policy was implemented quickly, around four months after the election and with limited time to train new teachers or build new classrooms to meet the expected increase in enrollments.

Following the implementation of the FPE policy, school participation increased rapidly not only among primary school aged children, but also for older students who either enrolled in primary school for the first time or re-enrolled following an early school dropout. Enrollment levels increased from 1.9 million students in the 1993–94 academic year to almost 2.9 million in 1994–95 (EMIS 2012). As a consequence of this policy, almost all children in Malawi enter school, even if grade attainment remains relatively low. In 1992, 59 percent of children aged 6–14 years old were enrolled in school, relative to 91 percent in 2010, but primary school completion rates only increased from approximately 24 percent to 37 percent among 20–24 year olds over the same period (National Statistical Office (NSO) and ICF Macro 2011; National Statistical Office (NSO) and Macro International Inc. 1992).

Before the implementation of the FPE policy, less than 11 percent of students who successfully passed the primary school leaving certificate examination (PSLCE), taken at the end of the eighth grade, were able to find a place at a conventional government secondary school (EMIS 1994). In the years following the policy, the number of students taking and passing the PSLCE increased, placing even greater pressure on placement into secondary schools. In 1998, the government expanded access to secondary school by converting existing distance education centers into Community Day Secondary schools (CDSS). These new schools were intended as a second tier of schools for students who did not score high enough on the PSLCE to gain admission to the conventional secondary schools that existed before the education reforms. After the CDSS were introduced, the government was able to admit to secondary school approximately 40 percent of students who passed the PSLCE (EMIS 2000). The number of private schools also increased over this period; from 2001 to 2012, the proportion of students enrolled in private schools increased from 13 to 30 percent of all secondary school students (World Bank 2010; EMIS 2012). Despite these gains, participation in secondary school remains limited and the secondary school gross enrollment ratio in Malawi, estimated at 16 percent of secondary school-aged youth in 2007, is only a third as high as the levels estimated for the other countries in southern Africa (World Bank 2010).

Although primary school enrollment rates increased and school entry has become virtually universal since the 1994 education reform, primary school quality declined due to the state's limited ability to finance the school system (World Bank 2010). From the 1993/94 to 1994/95 academic years, the average student-teacher ratio actually declined from 68 to 62,

but this improvement was due to the recruitment of underqualified teachers to staff primary schools; the ratio of students to qualified teachers increased from 82 to 108 over the same period, and has continued to remain high over time (EMIS 1994; EMIS 1995). Learning outcomes have also declined over time and reading and mathematics performance on the SACMEQ exams have not yet returned to their pre-FPE levels (Chimombo 2005; Milner, Mulera, and Chimuzu 2011). Despite increased numbers of students reaching the final year of primary school, the pass rate of the PSLCE has also declined over time from 79 percent of examinees in 1994 to 69 percent in 2012 (EMIS 1994; EMIS 2012). The quality of secondary schools has also become more heterogeneous, as the CDSS receive less funding and have fewer qualified teachers than the conventional secondary schools, and private secondary schools are not well regulated (World Bank 2004b; Chimombo et al. 2014). Student performance on the junior secondary certificate of education (JCE), taken at the end of the second year of secondary school, is substantially better in the conventional secondary schools than in the CDSS. Although part of this difference can be attributed to differences in the abilities of students between these two types of government schools, regression discontinuity analyses have shown that enrollment at the conventional schools yields significantly better JCE performance than enrollment at the CDSS for students with comparable performance on the PSLCE (Hoop 2010).

Despite deteriorating school quality, school enrollment increased in Malawi and has remained high for the past twenty years. This situation provides an interesting context for examining whether the demographic promise of expanded female education has been achieved. If the education gradient in age at first birth remained constant over time, then the increased schooling attainment in the years following the free primary education policy and the expansion of secondary schooling should have led to a later age at first birth at the population level. It is also possible that the expansion of schooling increased the positive externalities of education (Caldwell 1980; Axinn and Barber 2001), as women with little or no education adopt the demographic behaviors of their more educated peers. In this scenario, women with little or no education would begin to postpone their first birth to later ages, leading over time to a weaker education gradient and, as with the first hypothesis, a later age at first birth at the population level. The shift to low school quality, however, may undermine these potential outcomes, eroding the extent to which additional years of schooling attainment postpone the age at first birth. As with the second hypothesis, this shift would also lead to a weaker education gradient, albeit one driven by earlier fertility amongst more educated women. The experiences of young women in Malawi serve as an important harbinger of the demographic consequences of the push for "Education for All" in deeply resource-constrained systems.

Data

This study uses data from the Demographic and Health Surveys (DHS) to evaluate changes in the association between schooling attainment and the timing of first birth in Malawi. Four Demographic and Health Surveys have been collected in Malawi: 1992, 2000, 2004, and 2010. This range of survey dates makes it possible to compare the age of first birth for women who came of age prior to the implementation of Malawi's education policies in the

mid-1990s to the experience of women from later cohorts who had either partial or full exposure to these policies during childhood.

The DHS are nationally representative stratified cluster surveys of reproductive aged women, aged 15–49 years old. At each survey round, a sample of clusters was stratified by urban/rural status and selected with the probability proportional to size. Households were then selected within each cluster and all resident reproductive aged women were interviewed. Although the DHS also interviews a representative sample of men aged 15–54 years old, the survey does not ask men questions about the timing of their first birth; this analysis, therefore, focuses only on female respondents. Each survey round is weighted to yield nationally representative results. The survey rounds differ, however, in their degree of sub-national representation. The 1992 survey oversampled respondents in the Northern region and in urban areas in order to achieve sufficient statistical power to produce representative estimates at the regional and urban/rural levels. In contrast, the 2000 and 2004 surveys oversampled a subset of the country's districts[i] in order to produce district-level estimates for the selected areas. Finally, the 2010 survey was designed to be representative at the district level for all districts in the country. All rounds are weighted to be nationally representative.

The DHS records age at first birth in months. Any young woman who has not yet given birth at the time of the interview is censored at their age at the time of the interview. The first section of the analysis uses event history analysis[ii] to examine whether the expansion of education led to a later age at first birth across the four survey rounds, and whether the education gradient in fertility timing changed over time. This analysis is restricted to women aged 20–24 years old at each survey round, yielding an analytic sample of 11,201 respondents (see Table 1). All regressions are adjusted for the complex survey design of the DHS.[iii] The key explanatory variables are years of schooling completed and birth cohort. Years of schooling completed is coded as a categorical variable: never attended, lower primary (grades 1–4), upper primary (grades 5–8), and secondary or higher (grades 9+). As the analysis is restricted to respondents aged 20–24 years old at the time of each survey, birth cohort is, in this case, determined by survey round: 1992, 2000, 2004, and 2010. The interaction between schooling attainment and birth cohort is used to determine whether the relationship between schooling attainment and the timing of first birth has changed over time. In addition to these variables, all regression models control for urban/rural residence and region (Northern, Central, Southern) in order to account for historic differences in schooling enrollment and the distribution of ethnic groups.[iv]

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[i]Malawi currently has 28 districts. In 2000, 11 districts were oversampled by the DHS to produce representative district-level estimates (Lilongwe, Blantyre, Zomba, Mzimba, Mangochi, Kasungu, Salima, Machinga, Mulanje, Thyolo, and Karonga). The same districts were oversampled in 2004, with the exception of Karonga. The sample size was expanded in 2010 in order to produce district-level estimates for all districts. However, two districts (Likoma and Nkhata Bay) were combined in the 2010 data, for a total of 27 districts identified in the dataset.

[ii]The covariates violate the proportionality assumption, indicating that an accelerated failure time model is more appropriate than a proportional hazards model for these data (Cleves et al. 2013). Preliminary analyses indicated that a Weibull distribution provided the best model fit. These analyses were conducted using the "streg" command in Stata (StataCorp 2013).

[iii]The accelerated failure time regressions are made using the "svy" command in Stata (StataCorp 2013), which uses the sampling weights and clusters to adjust the estimates.

[iv]Formal education was historically available through British missionary schools, which had a greater presence in Northern Malawi. Under the Banda regime, the state instituted enrollment quotas that favored members of the Chewa ethnic group, who mostly resided in the Central region. The largest ethnic group in the Southern region, the Yao, are predominantly Muslim, and have been less well

The second section of the analysis uses a two-stage least squares (2SLS) regression to examine the causal effect of exposure to the education policies on age at first birth in Malawi. This analysis follows the example of Behrman (Behrman 2015a) and uses exposure to the education reforms as an instrumental variable: women who were primary school-age (13 years old or younger) in 1994 would have benefitted more from the implementation of the FPE policy than women who were 14 years old or older. Young women just above and below this cut-off age would be expected to be similar in all observed and unobserved characteristics other than their exposure to the FPE policy. Furthermore, these same young women would have been just above and below 18 years old in 1998 when the government expanded secondary schooling. In order to maximize the comparability of women above and below the cut-off for exposure to the policies, this section of the analysis is restricted to women born 1978–1984 and sampled in the 2010 Demographic and Health Survey. Almost 98 percent of these women reported a birth by the time of the survey, so there is minimal bias due to right censoring of the age at first birth.

In the first stage of the analysis, I use exposure to these education policies as an instrument to predict years of schooling completed. This binary variable is constructed so that women who were born 1981–1984 are coded 1 for exposure, and women born 1977–1980 were coded 0 for non-exposure. In the second stage of the regression, the years of schooling predicted in the first stage are used to estimate age at first birth. Similar to the event history analysis, these models include an indicator of urban residence. However, since the 2010 DHS was designed to be fully representative at the district level, I am able to use fixed effects for the 27 districts measured in the 2010 DHS instead of region. Additional control variables are also available in the 2010 DHS, including religion and ethnicity. Religion is included as a four category variable (Catholic, Protestant, Muslim, and Other/No religion), and ethnicity is included as a six category variable (Chewa, Tumbuka, Lomwe, Yao, Ngoni, and Other ethnicities). Finally, following Ueyama and Yamauchi (2009), I use the sibling history module to calculate the level of adult mortality—deaths per 1,000 adults aged 26–30 —to which respondents were exposed at age 15[v] as a proxy for exposure to the HIV epidemic prior to the onset of childbearing. The results of the 2SLS regression are presented in comparison to an ordinary least squares regression that does not address the endogeneity of schooling.

Results

Schooling Attainment

Schooling attainment increased rapidly following the implementation of Malawi's education policies. Women from the earliest cohort, who were interviewed before the policy was put in place, completed a median 2.9 years of schooling (Table 1). Over 40 percent of women interviewed in 1992 never attended school, 52 percent attended primary school, and less than seven percent attended secondary school or higher (Figure 1). Women from the more recent

integrated into schooling opportunities, contributing to lower school participation rates, especially for women, in the South (Kalipeni 1997; Kendall 2007).
[v]The level of adult mortality was calculated at the district level as the number of deaths to cohort c between the ages 26 and 30, divided by the number of persons in cohort c who survived to age 26. Cohort c refers to adults who would be 26–30 years old at the time the respondent was 15 years old.

cohorts, however, had varying degrees of exposure to the policies. Individuals interviewed in 2000 were 14–18 years old in 1994 and 18–22 years old in 1998. Although a student who progressed through school on time and without any interruptions would be expected finish primary school at age 14 and to finish secondary school by age 18, the reality is that delayed school entry and grade repetition are very common, resulting in many students who are enrolled behind the appropriate grade for age (World Bank 2010). The median number of completed school years was one grade higher for the cohort interviewed in 2000 relative to the oldest cohort, demonstrating that at least some women were able to take advantage of the policies despite being older than the standard age range. A more dramatic shift occurred in the rate of school ever attendance: Figure 1 shows that from the 1992 to the 2000 survey, the proportion of 20–24 year old women who had never attended school declined from 41 percent to 20 percent.

The two younger cohorts, interviewed in 2004 and 2010, were still primary-school aged at the time the FPE policy was implemented. By the time these women were 20–24 years old and interviewed in the DHS, the median years of school completed for these cohorts were 5.2 and 5.8, respectively (Table 1). The proportion of women who had never enrolled in school continued to decline; by the time of the 2010 survey, only eight percent of women had never attended school. Not only did more young women ever attend school, but the proportion who attended upper primary school, beyond standard five, increased across the four cohorts from 28 to 40 percent (Figure 1). These cohorts also benefited from the expansion of government secondary schools in 1998 and the parallel expansion of private secondary schools; by 2010, 27 percent of young women had ever attended secondary.

Timing of First Birth

If the education gradient in the age at first birth remained constant over time, then the shift to higher schooling levels should have led to a later age at first birth in the most recent cohorts. Alternately, if the expansion of education increased the positive externalities of education and women with little or no education began to postpone their first births and behave more similar to women with more education, then the median age at first birth should also have increased over time. Instead, the median age of first birth has been resistant to change over time. The median age at first birth for 20–24 year old women was 18.9 for both the 1992 and the 2010 cohorts (Table 1), despite a brief increase to 19.3 in 2000.[vi] The relative stability of the median age at first birth belies larger shifts in the timing of first birth by level of schooling attainment. Figure 2 shows the proportion of women aged 20–24 who had given birth before age 20 by survey year and highest level of schooling attainment. First, there was no significant difference in the proportion of women who gave birth before age 20

[vi]If the median age at first birth is measured using data from women aged 30–34 in 2010, the same cohort as women aged 20–24 in 2000, it decreases from 19.3 to 19.0. Given that prior studies of the quality of event reporting have documented a greater tendency for forward displacement of the time of events (Blanc and Rutenberg 1990; Gage 1995), the backward displacement observed for women in the Malawi Demographic and Health Surveys is surprising. Given the higher levels of educational attainment and the social bias against schoolgirl pregnancy in Malawi, one would have expected to observe forward displacement. A possible explanation for the backward displacement might be differential mortality related to the HIV epidemic. Studies from Malawi and other African countries have observed a positive education gradient in HIV prevalence, such that more educated individuals are more likely to become infected than less educated individuals, although this association is stronger for men than for women (National Statistical Office (NSO) and ICF Macro 2011; Fortson 2008). If more educated women with later ages at first birth were more likely to become infected and die, this might lead to a lower observed median age at first birth among surviving women.

between women who had never attended school and those who had attended primary school. Women who had attended secondary school, however, were more than half as likely to have had a birth by age 20 as compared to women who had never attended school or who had stopped schooling at the primary level. Second, the trend toward larger proportions of women giving birth by age 20 was statistically significant for women who attended primary and secondary school. The largest difference was amongst women who had attended secondary school; in 1992 only 18 percent of secondary school attenders had given birth by age 20, as compared to almost 36 percent of women in 2010. There was a similar change for women who had attended primary school, with the proportion rising from approximately 62 to almost 79 percent across the earliest and most recent cohorts. These patterns, however, disguise more subtle shifts that occurred in the age of first birth.

Table 2 presents the coefficients from the event history analysis. Positive coefficients indicate covariates that increase the expected time to failure (Cleves et al. 2013), or, in this analysis, a later age at first birth. Negative coefficients, therefore, indicate an earlier age at first birth. The first column examines the hypothesis that the expansion of education has led to a later age at first birth across the four cohorts. Although all of the coefficients are negative, indicating that women in each cohort interviewed in 2000–2010 gave birth earlier than women in the earliest cohort, only the coefficient for the 2010 cohort was statistically significant at the 5 percent level. This pattern confirms the earlier finding that the shifting educational composition of women failed to lead to a later age at first birth among the more recent cohorts relative to the cohort interviewed before the implementation of the education policies and indicates that the demographic promise of postponed fertility has failed to materialize in Malawi.

The second column adds the highest level of schooling attainment to the previous model. Schooling attainment is significantly associated with the timing of first birth. Although there was no statistically significant difference in the timing of first birth between women who had never attended school and women who had attended primary school, young women who had ever attended secondary school were only 29 percent as likely to have a birth as women who had never attended school (hazard ratio = $\exp(-p*\beta)$). Controlling for education, the cohort differences also become statistically significant and increase in magnitude with each successive cohort. The cohort interviewed in 2010 had a hazard of giving birth that was more than 1.5 times larger than the hazard for the women interviewed in 1992.

The third model presented in Table 2 adds terms for the interaction between cohort and schooling attainment in order to test whether the education gradient in the timing of first birth has changed over time. Figure 3 shows the predicted survival function for women from the earliest and most recent cohorts who never attended school and who attended secondary school based on the third model. In contrast to Model 2, the coefficient estimated on the most recent cohort is not statistically significant, indicating that there is no difference in the transition to first birth when comparing women from the earliest and most recent cohorts who never attended school. There is also no significant association between attending primary school and the timing of first birth; this association has been stable over time, as indicated by the non-significant interactions between primary school attainment and cohort, with the exception of an earlier transition to first birth for women who only attained lower

primary in the most recent cohort. In contrast, women who attended secondary school gave birth at significantly later ages than women who never attended school; for the earliest cohort, the hazard ratio for women with secondary schooling relative to never attending was 0.15. The interaction between secondary school and cohort, however, is negative and significant for all cohorts. Even though attending secondary school decreases the hazard of first birth, the effect is not as large for secondary school attenders from the more recent cohorts.

Possible Contributing Factors

The impact of Malawi's education reforms has been mixed. School participation and schooling attainment increased dramatically: for the most recent cohort, relatively few women never enroll in school and the average young woman has completed three additional years of schooling relative to women who grew up before the policy was implemented. Given the compositional shift in schooling attainment, one would have expected to observe a population-level delay in the median age at first birth. Instead, no such change in fertility materialized and the median age at first birth reported by young women did not significantly change from 1992 to 2010, in part due to a declining age at first birth amongst women who ever attended secondary school. The next section of the paper explores several factors that may be contributing to this pattern.

Changing Selectivity

The first possibility is lower selectivity over time for young women who achieve higher levels of grade attainment. The FPE policy removed all school fees through the eighth grade; although families were still responsible for other schooling costs, such as school supplies and uniforms, the 1994 policy weakened the financial barrier for school enrollment. This shift increased access to schooling for the poor, although socio-economic disparities in grade attainment persist (Al-Samarrai and Zaman 2007; Kadzamira and Rose 2003). Furthermore, students who in past cohorts would not have been eligible to attend secondary school given their relatively lower PSLCE scores were able, after the 1998 secondary school expansion, to gain admission to either a CDSS or to a private school. If prior cohorts were self-selected by the expected gains from education or by their schooling and fertility preferences, then the expansion of primary and secondary schooling may have accommodated more "marginal" students (Filmer and Schady 2009), suggesting that additional years of schooling may not postpone fertility in the same ways for all students.

Instrumental variables are one tool for controlling for the selectivity of grade attainment and its potentially endogenous relationship with fertility timing. If young women who complete more grades of school possess characteristics that also make them more likely to delay childbearing, then a simple regression will overestimate the effect of schooling attainment on the timing of first birth. Columns 1 and 2 of Table 3 present results of the ordinary least squares (OLS) and two-stage least squares (2SLS) regressions. The 2SLS regression uses exposure to Malawi's education policies, defined as young women who were born 1981–1984 relative to women who were born 1977–1980, as an instrument to estimate years of schooling completed. Results from the OLS regression are in the first column of Table 3. In

this model, there is a significant and positive association between years of schooling completed and age at first birth, controlling for ethnicity, religion, urban residence, and district.[vii] The second column of Table 3 presents the second-stage results of the instrumental variable analysis (see Appendix Table 1 for the first-stage results).[viii] In contrast to the OLS results, the association between years of schooling and age at first birth is significant and negative in the 2SLS model. For each additional year of schooling, the age at first birth is 0.44 years *earlier*.[ix]

The instrumental variables model assumes that the education policy was the only change in the environment that affects timing of birth and that otherwise the cohorts before and after the policy faced similar choices and constraints. This assumption, however, may not be valid if the two cohorts experienced different stages of the HIV epidemic. HIV prevalence in Malawi peaked in 1999, when 16.4 percent of adults aged 15–49 were estimated to be infected with HIV (Government of Malawi 2014). The level of adult mortality to which respondents were exposed at 15 significantly increased from the earlier to the later cohort, from 43 to 52 deaths per 1,000 adults aged 26–30. Adult mortality was significantly associated with age at first birth in the OLS, although the magnitude of the association was small; each additional death per 1,000 lowered the age at first birth by 0.01 years (Table 3, Model 3). When adult mortality was included in the 2SLS regression (Table 3, Model 4), the association between years of schooling and the age of first birth became smaller and was no longer statistically significant (p=0.113). Furthermore, the association between adult mortality and age at first birth was no longer statistically significant. Consistent with the first set of models, these findings indicate that, controlling for adolescent exposure to the HIV epidemic, additional years of schooling do not postpone the age of first birth.[x]

Table 4 presents the second-stage regression results for a set of alternate measures of early fertility. Models 1 and 2 use a probit regression with instrumental variables to examine the probability of giving birth by ages 18 and 20. When exposure to the education reforms is included as an instrumental variable, the probability of giving birth by age 20 *increases* by 11 percent with each year of schooling. The probability of giving birth by age 18 increases by 9 percent with each year of schooling, although this result is only marginally significant (p=0.094). Given that almost 90 percent of first births in Malawi occur within marriage (NSO and ICF 2010), the age at first marriage serves as an alternate measure of early

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[vii]The analysis in Table 2 suggests that the fertility postponing effects of attending secondary school have been particularly vulnerable to change over time. Unfortunately, instrumental variable analysis does not support a more nuanced analysis of the association between schooling attainment and the age at first birth, and a continuous measure of grade attainment is used in the analysis presented in Table 3.

[viii]The first stage regression for Table 3, Model 2 (see Appendix Table 1) indicates that exposure to the policy is strongly associated with the endogenous variable, grade attainment. The first-stage F-statistic is 35.38.

[ix]Several robustness checks were also calculated. These results are presented in Appendix Table 2. First, I tested the sensitivity of the range of birth years included in the instrument for exposure to the education policy: 1976-1980/1981-1985, 1978-1980/1981-1983. These results were comparable to those of the main instrument. Second, I substituted an instrument that compared women who had full exposure to the education policy to those women who had early partial exposure: 1981-1984/1985-1988. There was no significant difference in the grade attainment of women with full and early partial exposure to the schooling policies; therefore, this variable is rejected as a valid instrument. Third, I recoded the grade attainment variable as years of secondary school. There was no significant association between the instrument and years of secondary school; therefore, the instrument is not valid.

[x]Given that adult mortality is not associated with years of schooling, it is rejected as an instrument and is included as an exogenous independent variable in the regression. The inclusion of adult mortality reduces the F-statistic for the education policy variable from 35.38 in Model 2 to 34.56 in Model 4.

childbearing. Model 3 shows that each additional year of schooling reduces the age of first marriage by 0.34 years, although this association is only marginally significant (p=0.083).

The development discourse around expanding female education assumes that the effect of education on demographic outcomes will remain stable and not be diluted by a changing student population. However, the results presented in Tables 2 and 3 suggest that the expansion of schooling in Malawi has not yielded the demographic benefits traditionally associated with greater schooling attainment. As Jennifer Johnson-Hanks notes (2006: 20), "selectivity effects are not threats to data quality, but are instead the processes most central to understanding a phenomenon." Although "selection" is an easy explanation, it is also clear from the pattern of education and fertility in Malawi that, in the years following the education reforms, schools were not addressing the needs of all students. These findings highlight the need to understand the schooling conditions required for education to change the fertility behavior of more 'marginal' students.

Shifts in Age Pattern of Enrollment

One process commonly hypothesized to explain the education gradient in the age at first birth is the incapacitation effect: the time that young women spend in school reduces their exposure to the risk of pregnancy by reducing time available to engage in sexual activity and by culturally categorizing schoolgirls as ineligible for marriage or sexual relationships. The longer a young woman remains enrolled in school, the more the onset of childbearing is postponed. However, due to the shifts in school enrollment and grade progression triggered by Malawi's education policies, young women from the most recent cohorts may not exit school at the same ages as women from earlier cohorts. If the FPE policy enabled children to enter school earlier or to have less grade repetition due to the inability to pay school fees, then the average age of students at a given grade level should decline over time. Lucas and Mbiti (2012) found evidence for this pattern in Kenya, where the implementation of an FPE policy was associated with an earlier age at school entry for girls, as well as an earlier age at primary school completion. Furthermore, the creation of the CDSS, with a lower test score threshold for admission, means that students may be more likely to gain admission to secondary school the first time that they take the PSLCE, rather than repeating the last year of primary school in order to improve their chances of admission. Figure 4 shows that, in each year of secondary school, currently enrolled students in the two most recent surveys are younger than students enrolled at the same level in the earlier surveys. T-tests comparing the average age of students enrolled in each grade across the survey rounds indicate that there is no significant difference in the average age of students in 1992 compared to 2000, but all other differences are statistically significant, confirming that female secondary school students have become younger over time. A similar process has occurred for male students (results not shown). It is important to note, however, that these shifts in the age composition of secondary school students can only be contributing to the age pattern of first birth for 20–24 year old women interviewed in 2010; the group of 20–24 year olds interviewed in 2004 would have been attending secondary school at the time of the 2000 survey, when the age shift had not yet begun. Nonetheless, this age shift suggests that subsequent cohorts of young women will complete secondary school at younger ages, contributing to an early transition to first birth.

Shifts in School Quality

The diversification of secondary schools may also have generated heterogeneity in the effects of secondary school, contingent on the type of school attended. One possible consequence of these differences in school quality is that the timing of first birth has remained unchanged among young women enrolled in the conventional secondary schools, but students at the community day or private secondary schools give birth at younger ages. Students at these lower performing secondary schools may be less likely to find wage employment, either because of lower skill levels or perceived worse quality credentials. CDSS are also more likely than conventional secondary schools to be located in rural areas where employment opportunities are limited. The lack of post-educational opportunities for students with poor skills may weaken the motivation of young women to postpone family formation in order to focus on career development. Unfortunately, the DHS does not collect information about the type of school attended by respondents (National Statistics Office and ORC Macro 2011).

Differences in school quality across the types of secondary schools may also lead to differences in schoolgirl pregnancy rates. Schoolgirl pregnancy draws into question the direction of causality between education and the timing of first birth, if a pregnancy or birth prematurely truncates schooling attainment. As Frye (2012) notes, secondary school teachers in Malawi claim responsibility for enforcing taboos against schoolgirl pregnancy, actively discouraging student sexual activity and patrolling student dorms in order to supervise student behavior. Schools with fewer resources may provide less supervision of students or be less vigilant about student attendance. Unsupervised time may create opportunities for more frequent sexual activity and increase the chances of an early pregnancy and birth. Given that the CDSS are underfunded relative to the conventional government secondary schools (World Bank 2004), the CDSS may be less successful at delaying childbearing. It is also possible that students at lower performing schools may be more pessimistic about their academic prospects and less motivated to avoid a mistimed pregnancy or birth (Bledsoe and Cohen 1993). Finally, if less advantaged students are more likely to enroll at the CDSS than at the conventional government schools, then those students may be more reliant on financial support from relatives or boyfriends, putting them at greater risk of pregnancy. Data from the Malawi Ministry of Education confirm that the reported rate of secondary school dropout attributable to pregnancy is twice as high in the CDSS as in the conventional secondary schools (EMIS 2012).

Other Contributing Factors

These potential explanations for the pattern of declining age at first birth among young women who attended secondary school focus on issues related to shifts in the selectivity of secondary school attendance and the nature of secondary school expansion. Alternative explanations, however, point towards macro-level issues and challenge the prevalent policy discourse about the transformative potential of expanded female education. The persistence of gendered school and classroom environments may constrain girls' opportunities for learning and skill development at all levels, reinforcing traditional gender norms that limit women's options and actions (Aikman, Unterhalter, and Challender 2005). Studies from a range of contexts across sub-Saharan Africa, including Malawi, have found evidence that

teachers provide a less challenging environment and maintain lower performance expectations for female students than for males, leading to lower skill acquisition and less in-class participation (Anderson-Levitt, Bloch and Soumare 1998; Mensch and Lloyd 1998; Colclough, Rose and Tembon 2000; Chisamya et al. 2012). The academic performance of female students is also more sensitive to school quality; one recent study from Malawi found that girls' math abilities were more adversely affected than boys' by high student-teacher ratios and less experienced teachers (Grant et al. 2011). These studies have also found that female students spend more time than males performing non-school activities, such as cleaning school facilities and fetching water, during school hours and after-hours; these responsibilities further reduce young women's opportunities to learn. As shown in Figure 5, female students are substantially less likely to pass the national examinations at the end of secondary school, although the performance gender gap has narrowed over time. Girls are also more likely to leave school with weaker literacy and numeracy skills that are more vulnerable than those of boys to being lost over time (Soler-Hampesjek et al 2014). If schooling expands without a shift towards more equitable gender environments, then the possibilities for delayed childbearing may be compromised.

The structure of the labor market may also limit the transformative impact of expanded schooling. The expansion of education has been framed as essential for economic development in less developed countries, as schooling is presumed to increase productivity and drive entrepreneurial activity. Greater participation in the labor force will, in turn, delay childbearing by increasing living standards and by shifting the opportunity cost of women's time as young women are motivated to develop their careers. These processes, however, will be limited if the labor force is unable to absorb greater numbers of educated youth. Participation in wage employment among secondary school leavers in Malawi declined in the years following the expansion of secondary schooling (Al-Samarrai and Bennell 2007). Furthermore, according to the 2010 Malawi Integrated Household Survey, only 13 percent of women older than 20 years who attended secondary school participated in wage employment, compared to almost 29 percent of men (National Statistics Organization 2010). As a result, many secondary school graduates are "just staying" in rural areas, with few local employment options outside of agriculture. To the extent that schooling attainment postpones childbearing through women's labor force participation or aspirations, the limited wage opportunities for educated young adults in Malawi may hinder this mechanism.

Conclusion

The free primary education policy and the subsequent expansion of secondary schooling in Malawi did not lead to a later age at first birth among women. The cohorts educated after these policies were implemented had median ages of first birth comparable to that of women from earlier cohorts; this stagnation over a period of schooling expansion was partly driven by an earlier transition to childbearing among women who ever attended secondary school. It remains to be seen whether the increased schooling of the most recent cohorts will affect subsequent fertility or change other demographic outcomes such as child mortality. A recent paper by Julia Behrman (2015b) used the same education policies examined here as instrumental variables to examine the association between years of schooling and desired fertility in Malawi. She found that each additional year of schooling reduced the ideal

number of children by a third of a birth; this finding suggests that although the expansion of education did not decrease early childbearing it may eventually lead to lower completed cohort fertility.

The pattern of first births in Malawi raises important questions about the consequences of educational expansion in other African countries that implemented FPE policies—and, in some cases, free secondary education policies—after Malawi. The emerging evidence from the region suggests that the expansion of school participation has been at the expense of school quality (Pritchett 2013; World Bank and UNICEF 2009), which may compromise the potential for these policies to trigger demographic change. As one of the earliest countries in sub-Saharan Africa to implement a lasting FPE policy, Malawi may signal the future of demographic patterns in the region. While FPE policies subsequently implemented in other countries were executed with greater sensitivity to their effects on school quality in the face of rising enrollment numbers, school quality nonetheless deteriorated across the region. The student-teacher ratio increased after the abolition of school fees in countries including Kenya, Mozambique, Tanzania, Uganda, and Zambia (Taylor and Spaull 2015; Grogan 2006), and many countries continue to struggle with the financial sustainability of these policies (World Bank and UNICEF 2009). Although indicators of school quality and learning outcomes in Malawi are among the worst in Southern and Eastern Africa (Taylor and Spaull 2015), these general patterns suggest that other countries are also experiencing the conditions that weakened the association between schooling attainment and age at first birth in Malawi.

Countries have also had different responses to the increased demand for secondary schooling created by larger numbers of students completing primary; in many cases, this demand has been met largely through an expansion of the private school sector (Heyneman and Stern 2014). These circumstances create unique environments for disentangling the discrete contributions of grade attainment, age at school leaving, and academic skills to fertility timing and for investigating the pathways through which these dimensions of education operate. If education postpones childbearing by improving women's empowerment and autonomy, there may be a threshold level of school quality necessary for girls to gain these skills. Young women's ability to gain confidence, decision-making, and critical thinking skills may be bolstered by lower student-teacher ratios and better teacher training and qualifications, coupled with a more concerted effort to promote gender equality within the classroom (Aikman, Unterhalter, and Challender 2005). Attending school may not be sufficient for young women to gain these skills if they are treated differently from their peers and teachers maintain lower performance expectations for female students. These patterns also point toward the possibility that expanded schooling attainment will not change demographic outcomes unless it is reinforced by more far reaching development initiatives that create economic opportunities for educated youth. If young women perceive few options other than marriage after leaving school, then patterns of childbearing are unlikely to change.

These findings also raise the question of whether the expansion of secondary schooling in the absence of the free primary education policy would have led to the same decline in the average age at first birth among women who attended secondary school. Given the

extremely limited access to secondary schooling before the FPE policy was implemented, it would have been possible for secondary education to expand even without an increase in the number of students completing primary school. Any expansion of secondary school would have weakened the selectivity of enrollment, as students with lower exam performance gained admission to secondary school. It may have been possible, however, to expand secondary school and maintain a higher level of quality, although it's unclear whether increased access to high quality secondary would have created more economic opportunities for young women without a parallel expansion of the labor market.

Although the expansion of schooling has not led to a later age at first birth in Malawi, this is not to imply that these cohorts would have been better off in the absence of these education policies. Even though there has been an increase in the years of school required to achieve basic literacy and numeracy (Kadzamira and Rose 2003), population level literacy rates improved as the proportion of young women who never attended school declined (Feeney 2014). Similarly, Taylor and Spaull (2015) found that the absolute number of literate youth increased with schooling expansion, even as the average performance of students on national exams declined. Some scholars have argued that literacy may be the most important dimension of education for improving child survival (LeVine et al. 2012; Smith-Greenaway 2013), with a recent study by Gakidou and colleagues (2009) suggesting that more than half of the global decline in child mortality could be attributed to expanded female education. Therefore, the possibility remains that young women in Malawi will be able to translate their expanded educational opportunities into improved child outcomes, even though the transition to first birth was not delayed.

Acknowledgments

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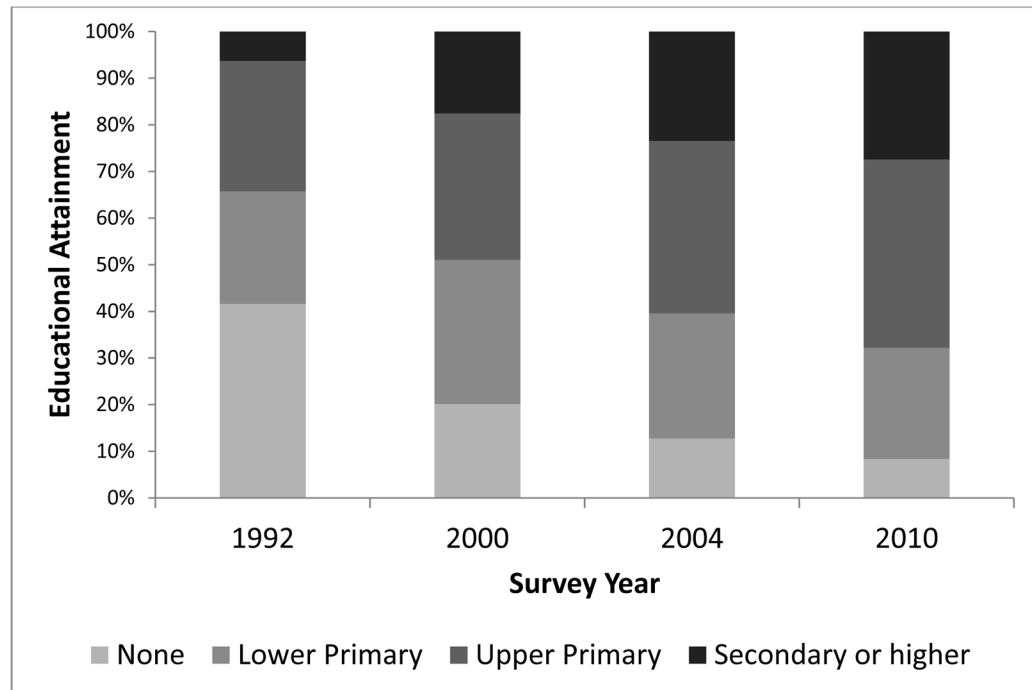
Figure 1.
Schooling attainment of 20–24 year olds, by survey round, Malawi 1992–2010
Source: Demographic and Health Surveys 1992, 2000, 2004, 2010
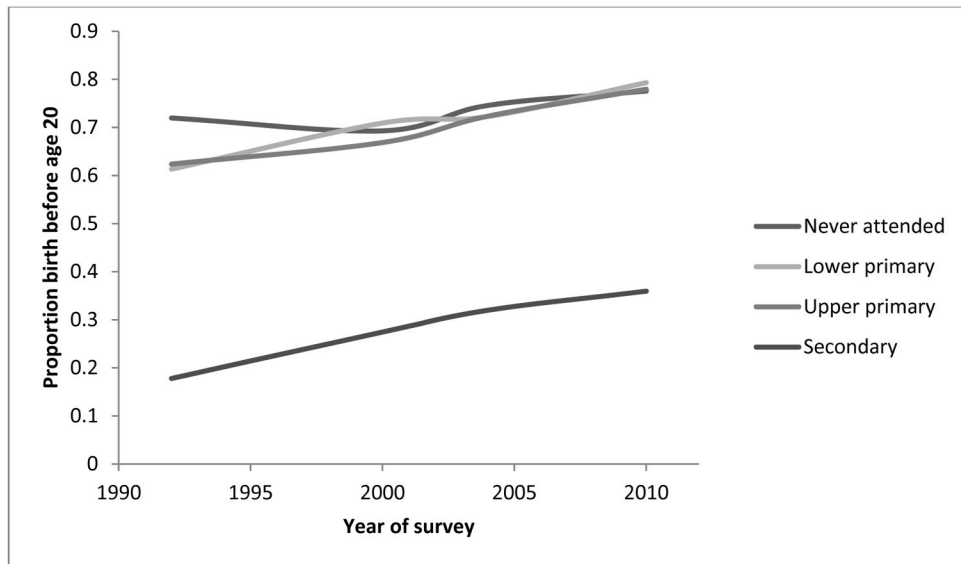
Figure 2.
Birth before age 20, 20–24 year olds, by level of schooling attainment and survey round,
Malawi 1992–2010
Source: Demographic and Health Surveys 1992, 2000, 2004, 2010
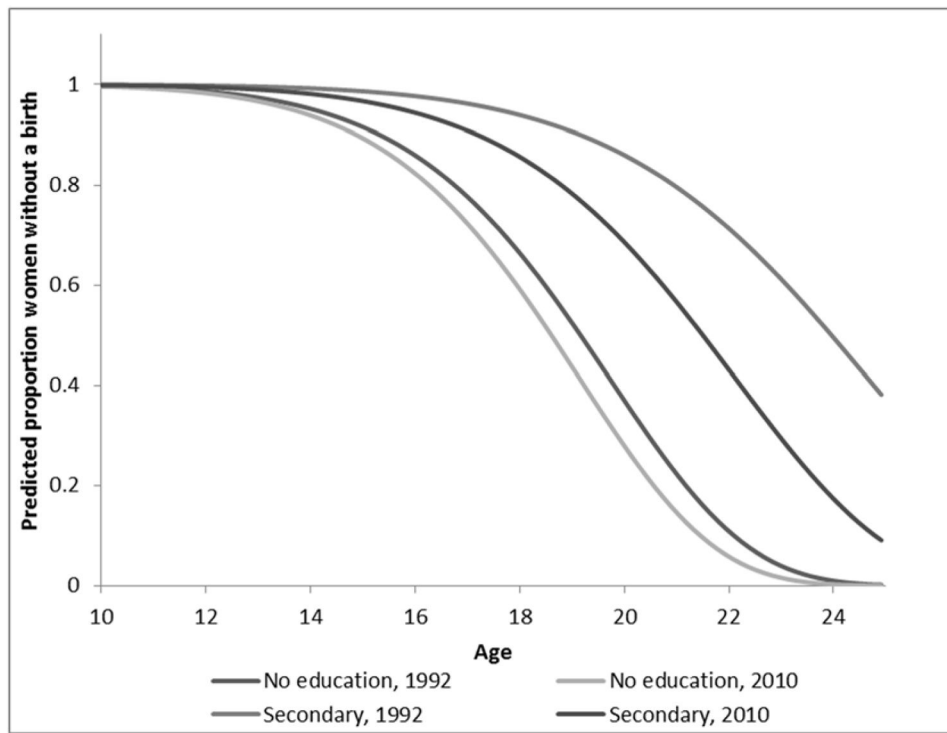
Figure 3.
Predicted proportion women who had not given birth, by schooling attainment and cohort,
Malawi 1992–2010
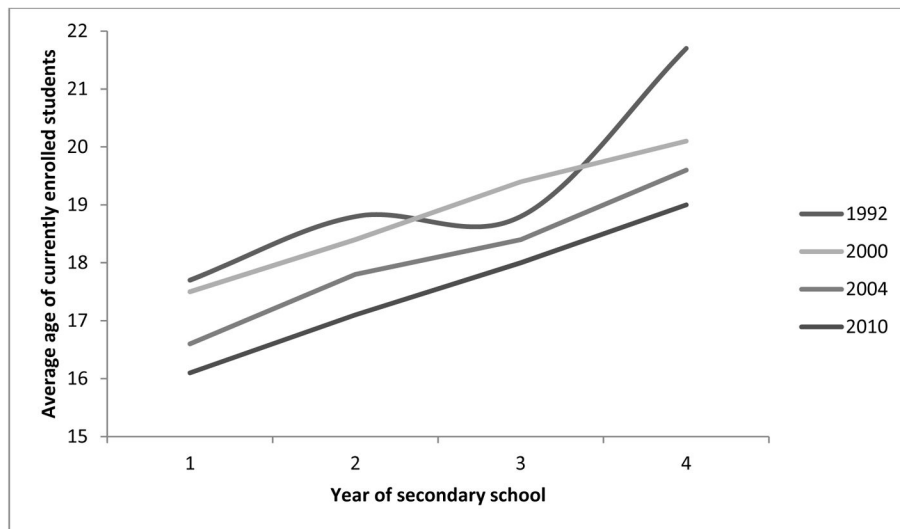
Figure 4.
Average age of currently enrolled female secondary school students, by year of secondary
school and survey round, Malawi 1992–2010
Source: Demographic and Health Surveys 1992, 2000, 2004, 2010
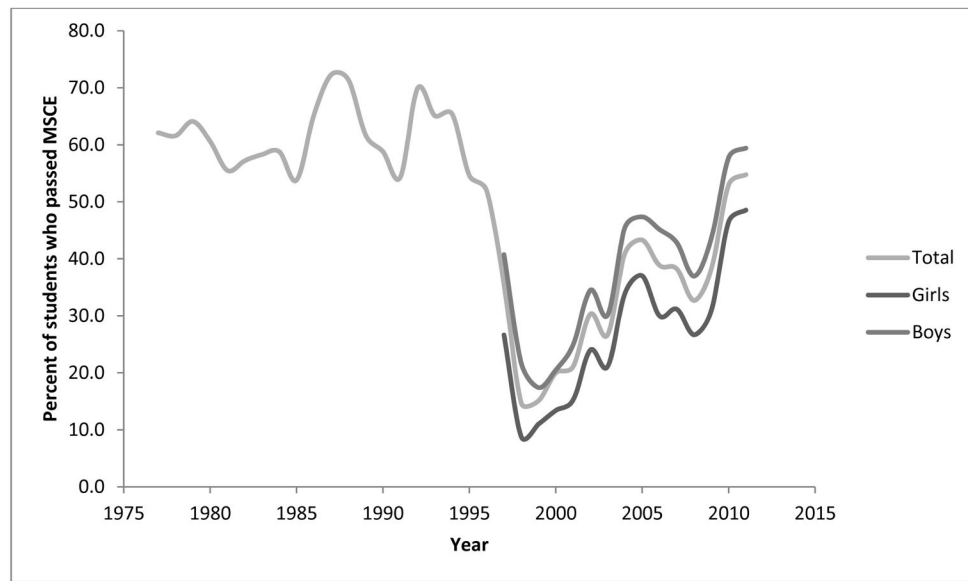
Figure 5.
Passed Malawi School Certificate Exam (MSCE), 1977–2011
Source: Education Management and Information Systems, Government of Malawi

Table 1

Descriptive characteristics of sample, females age 20–24 years old at time of survey, Malawi

Survey year	Age when free primary introduced	Age when CDSS created	Exposure to education policies	Median years of schooling completed	Median age of first birth	N
1992	22–26	26–30	None	2.9	18.9	953
2000	14–18	18–22	Partial late	3.9	19.3	2957
2004	10–14	14–18	Partial early	5.2	19.0	2870
2010	4–8	8–12	Full	5.8	18.9	4555

Source: Demographic and Health Surveys

Event history regression results, age of first birth, females age 20–24 years old, Malawi 1992–2010

	(1)		(2)		(3)	
	Coef.	**S.E.**	**Coef.**	**S.E.**	**Coef.**	**S.E.**
Survey year (ref. 1992)						
2000	−0.01	0.01	−0.02	0.01 **	−0.01	0.01
2004	−0.01	0.01	−0.04	0.01 ***	−0.03	0.02
2010	−0.02	0.01 *	−0.05	0.01 ***	−0.03	0.02
Urban	0.07	0.01 ***	0.02	0.01 **	0.02	0.01 **
Region (ref. Northern)						
Central	0.02	0.01 ***	0.04	0.01 ***	0.04	0.01 ***
Southern	−0.01	0.01	0.02	0.00 **	0.01	0.00 **
Schooling attainment (ref. None)						
Lower primary			0.00	0.01	0.02	0.02
Upper primary			0.01	0.01	0.02	0.02
Secondary +			0.15	0.01 ***	0.22	0.03 ***
Interaction terms						
2000 * Lower primary					−0.02	0.02
2000 * Upper primary					−0.01	0.02
2000 * Secondary +					−0.08	0.03 *
2004 * Lower primary					−0.01	0.02
2004 * Upper primary					−0.01	0.02
2004 * Secondary +					−0.09	0.03 **
2010 * Lower primary					−0.04	0.02 *
2010 * Upper primary					−0.02	0.02
2010 * Secondary +					−0.08	0.03 *
Constant	3.00	0.01 ***	2.98	0.01 ***	2.97	0.01 ***
ln_p	2.06	0.01 ***	2.13	0.01 ***	2.13	0.01 ***
p	7.86	0.08	8.41	0.09	8.43	0.09
N	11201		11201		11201	

Note:

*
p<0.05

**
p<0.01

***
p<0.001

Table 3

Linear regression, age at first birth, women born 1977–1984, Malawi 2010 Demographic and Health Survey

	(1)			(2)			(3)			(4)		
	Coef.	SE		Coef.	SE		Coef.	SE		Coef.	SE	
Years of schooling	0.29	0.01	***	−0.44	0.21	*	0.29	0.01	***	−0.34	0.22	
Adult mortality at age 15							−0.01	0.00	***	−0.00	0.01	
Ethnicity (ref. Chewa)												
Tumbuka	−0.25	0.24		0.83	0.43		−0.25	0.24		0.69	0.42	
Lomwe	−0.50	0.17	**	−0.44	0.26		−0.49	0.17	**	−0.45	0.24	
Yao	0.06	0.22		0.27	0.31		0.07	0.22		0.25	0.29	
Ngoni	−0.03	0.19		0.52	0.32		−0.01	0.19		0.46	0.31	
Other	−0.16	0.18		−0.14	0.25		−0.15	0.18		−0.15	0.23	
Religion (ref. Catholic)												
Protestant	−0.03	0.11		−0.61	0.24	*	−0.04	0.11		−0.54	0.24	*
Muslim	−0.40	0.21		−1.62	0.48	***	−0.40	0.21		−1.46	0.47	**
Other/none	0.10	0.59		−1.78	0.82	*	0.07	0.59		−1.55	0.81	
Urban	0.03	0.15		2.02	0.65	**	0.03	0.15		1.77	0.65	**
Constant	17.47	0.25	***	21.84	1.34	***	18.18	0.34	***	21.54	1.26	***
Instrument for years of schooling	No			Yes			No			Yes		
District Fixed Effects	Yes			Yes			Yes			Yes		
N	6037			6037			6037			6037		

Note:

*
p<0.05

**
p<0.01

***
p<0.001

Table 4

Regression results for alternate measures of early childbearing, women born 1977–1984, Malawi 2010 Demographic and Health Survey.

	(1) Birth by age 18			(2) Birth by age 20			(3) Age at first marriage		
	Coef.	SE		Coef.	SE		Coef.	SE	
Years of schooling	0.09	0.05		0.11	0.05	*	−0.38	0.22	
Ethnicity (ref. Chewa)									
Tumbuka	−0.20	0.14		−0.34	0.12	**	0.79	0.47	
Lomwe	0.17	0.09		0.10	0.09		−0.63	0.28	*
Yao	−0.13	0.10		−0.11	0.10		0.13	0.33	
Ngoni	−0.12	0.10		−0.15	0.09		0.61	0.35	
Other	0.03	0.09		−0.04	0.09		−0.01	0.26	
Religion (ref. Catholic)									
Protestant	0.16	0.06	**	0.11	0.06		−0.59	0.24	*
Muslim	0.42	0.11	***	0.37	0.11	***	−1.74	0.48	***
Other/none	0.53	0.21	*	0.41	0.21		−1.76	0.80	*
Urban	−0.42	0.15	**	−0.62	0.12	***	2.18	0.68	***
Constant	−0.88	0.29	**	−0.26	0.37		20.73	1.35	***
District Fixed Effects	Yes			Yes			Yes		
N	6185			6185			6037		
Model type	IV probit			IV probit			2SLS		

Note:

*
p<0.05

**
p<0.01

***
p<0.001

Appendix Table 1

Years of schooling, first-stage instrumental variable analysis for Table 3, women born 1977–1984, Malawi 2010 Demographic and Health Survey

	(2)		(4)	
	Coef.	**SE**	**Coef.**	**SE**
Exposure to education policies	0.57	0.12 ***	0.60	0.13 ***
Adult mortality at age 15			–0.00	0.01
Ethnicity (ref. Chewa)				
Tumbuka	1.47	0.32 ***	1.47	0.32 ***
Lomwe	0.08	0.25	0.08	0.25
Yao	0.26	0.31	0.26	0.31
Ngoni	0.73	0.26 **	0.73	0.26 **
Other	0.01	0.27	0.01	0.27
Religion (ref. Catholic)				
Protestant	–0.79	0.16 ***	–0.79	0.16 ***
Muslim	–1.64	0.30 ***	–1.64	0.30 ***
Other/None	–2.48	0.52 ***	–2.49	0.52 ***
Urban	2.71	0.20 ***	2.71	0.20 ***
Constant	5.63	0.35 ***	5.75	0.45 ***
District fixed effects	Yes		Yes	
N	6037		6037	
R-squared	0.1988		0.1988	
F-statistic	35.38		34.56	

Note:

+ p<0.10

* p<0.05

** p<0.01

*** p<0.001

Appendix Table 2

Robustness checks for instrumental variables analysis, first stage regression results for years of schooling, Malawi 2010 Demographic and Health Survey

	Years of schooling						Years of secondary schooling	
	(1) 1976–1985		(2) 1978–1983		(3) 1981–1988		(4) 1977–1984	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Exposure to education policies	0.77 ***	0.30	0.47 ***	0.13	0.12	0.10	0.13	0.15
Ethnicity (ref. Chewa)								
Tumbuka	1.62 ***	0.27	1.55 ***	0.32	1.49 ***	0.29	1.52 **	0.51
Lomwe	0.15	0.22	0.22	0.28	0.47 *	0.22	-0.31	0.33
Yao	0.34	0.27	0.09	0.35	0.43	0.28	0.39	0.40
Ngoni	0.72 **	0.24	0.73 *	0.30	0.77 **	0.24	0.71	0.36
Other	-0.06	0.23	0.14	0.30	0.00	0.24	0.18	0.35
Religion (ref. Catholic)								
Protestant	-0.71 ***	0.14	-0.94 ***	0.18	-0.82 ***	0.14	-0.37	0.22
Muslim	-1.55 ***	0.26	-1.54 ***	0.34	-1.58 ***	0.28	-1.55 ***	0.38
Other/none	-2.52 ***	0.40	-3.12 ***	0.57	-2.12 ***	0.42	-2.34 ***	0.41
Urban	2.70 ***	0.18	2.61 ***	0.24	2.68 ***	0.19	3.09 ***	0.28
Constant	5.40 ***	0.30	5.75 ***	0.39	6.16 ***	0.30	2.44 ***	0.43
District Fixed Effects	Yes		Yes		Yes		Yes	
N	7484		4625		6528		6037	
F-statistic	42.63		27.00		34.66		11.17	

Note:

*
$p < 0.05$

**
$p < 0.01$

***
$p < 0.001$

Appendix Table 3

Years of schooling, first-stage linear regression results for Table 4, women born 1977–1984, Malawi 2010 Demographic and Health Survey

	(1) Birth by age 18			(2) Birth by age 20			(3) Age at first marriage		
	Coef.	SE		Coef.	SE		Coef.	SE	
Exposure to education policies	0.61	0.12	***	0.61	0.12	***	0.58	0.12	***
Ethnicity (ref. Chewa)									
Tumbuka	1.81	0.33	***	1.81	0.33	***	1.59	0.32	***
Lomwe	0.10	0.25		0.10	0.25		0.08	0.25	
Yao	0.27	0.31		0.27	0.31		0.33	0.31	
Ngoni	0.90	0.26	***	0.90	0.26	***	0.89	0.27	***
Other	0.18	0.27		0.18	0.27		0.10	0.27	
Religion (ref. Catholic)									
Protestant	−0.78	0.16	***	−0.78	0.16	***	−0.73	0.16	***
Muslim	−1.67	0.29	***	−1.67	0.29	***	−1.59	0.30	***
Other/none	−2.51	0.53	***	−2.51	0.53	***	−2.39	0.53	***
Urban	2.89	0.20	***	2.89	0.20	***	2.78	0.20	***
Constant	5.53	0.34	***	5.53	0.34	***	5.49	0.35	***
District Fixed Effects	Yes			Yes			Yes		
N	6185			6185			6066		
Model type	IV probit			IV probit			2SLS		
F-statistic									

Note:

*
p<0.05

**
  p<0.01

***
  p<0.001