Effects of Education on Fertility and Labour Supply: Evidence from Malawi

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Abstract
Women play a crucial role in the development of the Malawian economy. Their ability to blend household demands with labour market activities has been a remarkable phenomenon, one that has attracted the attention of an emerging literature on gender dynamics. This paper, in an attempt to add to this growing literature, sought to model female labour force participation and fertility in Malawi with a focus on the role of education using demographically enriched household survey data from the 2015/16 Malawi Demographic and Health Survey. The study results showed that empowered women who are educated and engaged in the labour market will have less time for many children as the opportunity cost of staying at home and taking care of children becomes very high. In this regard, extending free education beyond primary school level to include secondary education could be an important measure that could help further reduce the fertility rate in Malawi. Policies to reduce fertility can also play direct and indirect roles in enhancing maternal and child mortality reductions. When women give birth to fewer children, it reduces their exposure to the risks of childbirth, particularly in rural areas where health and maternal care services are poor or non-existent.

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1. Introduction

Malawi has recorded significant socio-economic progress over the past two decades. Real GDP per capita rose from USD 297 in 1998 to USD 391 in 2018; prevalence of stunting of children under the age of five years improved from 62% to 38% between 1998 and 2016. Infant mortality declined from 110 per 1,000 live births in 1998 to 35 per 1,000 live births in 2016, which was lower than the Sub-Saharan average of 56 and not far off from the world average of 31 (World Bank, 2017). Progress has been notable in advancing towards universal primary education enrolment with a primary net enrolment rate of 90 in 2016 and gender parity in primary education of 1.01 in 2016 (Malawi Government, 2017). Efforts in the fight against HIV and AIDS saw prevalence falling to 8.8% in 2016 from 15.2% in 1999 (World Bank, 2017).

However, challenges remain in other key socio-economic areas such as ensuring gender parity in secondary education, reducing fertility, and improving maternal health. Consequently, Malawi still experiences some of the poorest health indicators and outcomes in the world. For example, the country's maternal mortality ratio (per 100,000 live births) while improving from 859 in 2004 to 451 in 2016 was still high compared to 286 in neighboring Zambia (World Bank, 2017).

Total fertility rate (TFR) while improving from an average of 6.7 children per woman in 1992 to 4.4 in 2016 in Malawi was still almost double the world average of 2.4 (NSO, 2017; World Bank, 2017). Both women and men have consistently reported that their ideal family size is smaller than the national total fertility rate; often couples have more children than they want (NSO, 2017).

As a result of high fertility rates, Malawi registered a high population growth rate of 2.71% and high dependency ratio of 90 dependents for every 100 working-age population in 2016 (World Bank, 2017). The adverse implications of these trends are large. From both a theoretical and empirical perspective, it is notable that Malawi's high population growth is constraining its per capita income growth and service delivery prospects. In 2015, there were approximately 6.7 million child dependents in Malawi. Malawi Government and University of Malawi (2017) estimated that if the fertility rate remained constant, there would be 15.9 million child dependents by 2050. If the fertility rate declined to 2.3, this number was projected to fall to 9.6 million, which would permit greater investment in health and education per child.

Furthermore, under a reduced fertility scenario, GDP per capita was projected to be 25% higher at approximately USD 1,100 by 2050, compared to USD 880 per capita if fertility remained constant (Malawi Government & University of Malawi, 2017). Such a fertility decline would also have the potential to contribute significantly to the acceleration of reductions in poverty and inequality.

The 2015/16 Malawi Demographic and Health Survey (MDHS) prepared by the Malawi National Statistics Office elaborated on some of the factors that contribute to the high fertility rates among women in Malawi. Some of these factors include sexual characteristics of women such as the age at which a woman first enters marriage, age of first sexual relations and frequency of sexual relations. The MDHS analysis provides descriptive evidence on the underlying factors, dwelling mainly on age group and regional differences but does not provide a rigorous quantitative analysis, for example on the impact of the level of female education on fertility or the level of education on labour force participation.

There has been considerable interest in the relationship between female education and participation in the labour force, and fertility rates. This has been particularly so following the development of economic models of fertility behavior. In these models, price and income variables are postulated to affect fertility decisions. Accordingly, childbearing and early nurturing of infants, which are of biological necessity a woman's role (Ellis, 1988), are seen as activities that intensively use a woman's time. With increased education, urbanization and modernization, the opportunity cost of women staying at home and taking care of children also rises. These activities also consume a lot of the woman's time, which can otherwise be used to earn income. Therefore, a woman's expected lifetime wage rate is an important variable that may affect the number of children she gives birth to. But since a woman's expected lifetime wage rate is not a directly observable variable, her educational attainment provides an important proxy for her expected lifetime wage rate.

A number of studies, using data from both developed and developing countries, show that female education is associated with a decrease in fertility (Sackey, 2005; Lam & Duryea, 1999; Ainsworth *et al*., 1996; Vavrus & Larsen, 2003; Guilkey *et al*., 1998; Ben-Porath, 1973; Gardner, 1973). While studies from various countries show fertility declines to follow periods of active family planning programmes, Brazil provides an example of a country where, despite the limited family planning programmes and volatile economic growth, fertility has steadily declined since the 1960s, underscoring the importance of women's education in this trend, even in the absence of other factors (Lam & Duryea, 1999). In addition to the importance of women's education, higher levels of education of people in the community have a strong negative impact on fertility. Using demographic and health surveys data for 22 Sub-Saharan African countries, Kravdal (2002) finds a strong negative impact of the level of education at community level on fertility rates. These findings confirm the neoclassical theory, which suggests that as investment in human capital increases and as more women participate in the labour market, the fertility behaviour of households is bound to change in favour of fewer children. However, the quantitative impact had not been explicitly estimated for Malawi. This study aimed to test this theory using data from the 2015/16 MDHS. Given Malawi's high fertility rates, it is important to gain more understanding into the factors that affect household fertility decisions.

The study seeks to provide answers to the following questions: Does the level of education acquired by a woman affect her decision in terms of the number of children born, and if so, how many years of a woman's schooling have a significant negative impact on fertility in Malawi? What are the factors that are more likely to influence a woman's decision to participate in the labour force? This study provides evidence on the impact of female education and labour force participation on fertility in Malawi and makes recommendations on how to achieve the optimal fertility targets. The study also adds to the stock of knowledge on female education, fertility and labour force participation.

The remainder of this study is organized as follows: Section 2 discusses the importance of education in fertility reduction. Section 3 reviews the relationship between female employment and fertility. The nature of the data used in the empirical analysis is covered in Section 4. Section 5 presents trends in Malawi's fertility rate. The theoretical framework underpinning this study is presented in Section 6 while Section 7 presents the methodology and models for estimation thereof. Penultimately, empirical results and their interpretation are covered in Section 8 and finally, Section 9 concludes.

2. Importance of education in fertility reduction

Empirical evidence from both developed and developing countries unambiguously reveals that female education is associated with a decrease in fertility (Sackey, 2005; Lam & Duryea, 1999; Ainsworth *et al*., 1996; Vavrus & Larsen, 2003; Singh, 1994; Ben-Porath, 1973; Gardner, 1973). Increased participation of women in schooling and the labour market raises the economic value of their time, which increases the opportunity cost of raising children (Guilkey *et al*., 1998; Singh, 1994; Ben-Porath, 1973; Gardner, 1973).

Studies on female education and fertility conclude that female education leads to a decrease in fertility; that is, with higher levels of education, the number of children born per woman reduces (Guilkey *et al*., 1998; Ben-Porath, 1973; Gardner, 1973). Schultz (1993) confirms that women's education is associated with smaller desired family sizes across the world. This negative relationship between women's education, fertility and desired family size is explained by several factors that have been explored by both economists and sociologists. First, with higher levels of education, a woman's expectations of future earnings are higher, increasing the opportunity cost of giving birth to, and raising children. Second, the longer a woman stays in school, the lower the chances of giving birth to many children. Related to this is the fact that with more education and exposure, women acquire more information about their bodies and are more able to process that information to their advantage (Vavrus & Larsen, 2003; Singh, 1994).

The positive impact of women's education on their autonomy leads to later marriages, increased use of contraceptives, and lower fertility as discussed by Mason (1986). More importantly, higher levels of women's education are associated with lower child mortality rates, in the order of 5-10% for each additional year of the mother's schooling (Schultz, 1993; Mensch *et al*., 1985; Cochrane *et al*., 1980). This is because higher levels of women's education lead to improved childcare, nutrition, and basic health and better child outcomes – health and school attainment (Strauss & Thomas, 1995).

In general, there are two major determinants of fertility in Malawi. First, are the underlying or indirect factors known as socio-cultural and economic (intermediate) determinants, including education, the desire for large families, extended family influence, economic value of children, occupation, property ownership, and residence. Second, is the immediate or direct (proximate) determinants, including marriage patterns, sexual customs, and frequency of sexual activity, access to and use of contraceptives, length of post-partum amenorrhea, sterility, and abortion. In this study, focus is on education, a factor that policy makers can influence. It is also a factor that has other important implications, including participation in labour force, poverty reduction and improved standards of living.

Table 1: Trends in total fertility rates in Malawi between 2010 and 2016

Background characteristics	Total fertility rate (TFR	
	2010	**2016**
Education		
No education	6.9	5.5
Primary	5.9	4.8
Secondary	3.8	3.3
More than secondary	2.1	2.3
Residence		
Urban	4	3
Rural	6.1	4.7
Wealth quintile		
Lowest	6.8	5.7
Second	6.8	5.2
Middle	6.3	4.6
Fourth	5.3	4.1
Highest	3.7	2.9

Source: Malawi DHS 2010 and 2015/16

In Malawi, women start giving birth at an average age of about 15 years and in some cases, girls have given birth at ages as low as 12 years (NSO, 2017). The peak age group for childbearing is 20-29 years (NSO, 2017), such that if between these ages the women are still at school it would tremendously reduce their chances of having many children. Table 1 illustrates how the TFR in Malawi has improved over time and that the level of education has been found to significantly reduce the ideal number of children both women and men would choose to have.

The Malawi DHS 2010 and 2016 show that women with more than secondary education have fewer children (approximately 2) compared to those with no education at all (an average of 6). It is also noteworthy that TFR is significantly lower in urban areas (between 3 and 4) than in rural areas (between 5 and 6). One reason for the urban-rural differential is the concentration of women with secondary and higher levels of schooling in urban areas, and also the greater access to contraceptives and other medical facilities in urban areas. Women who have completed primary schooling or those with some secondary schooling have a lower TFR than women without schooling. Overall, Table1 shows that there is a strong negative relationship between female education and fertility. The intention of this study is to explicitly estimate the quantitative impact for Malawi and provide empirical evidence on this assertion, and thereafter draw policy recommendations.

3. Female employment and fertility

The participation of women in the economic market is presumed to compete with their family obligations, since mothers are usually primarily responsible for household duties in many cultures. Accordingly, a negative relationship is generally expected between female labour force participation and fertility at the micro level, although there is controversy about the casual direction of the relationship between the two phenomena (Felmlee, 1993; Cramer, 1980; Stolzenberg &

Waite, 1977). Beguy (2009) observes that while a consistent negative relationship between women's paid work and fertility has been found at the micro level in developed countries, no clear pattern has emerged in developing countries. In particular, in Sub-Saharan Africa it has been suggested that no relationship should exist between labour force status and fertility because of limited wage employment, extended family networking, and cheap domestic labour, as well as traditional social norms regarding gender roles and the division of household duties between men and women. However, it is likely that these mediating factors vary across different settings in sub-Saharan Africa, thereby resulting in the discrepancy in the female employment-fertility relationship in this region (Beguy, 2009).

The maternal role incompatibility hypothesis in socio-demographic literature attempts to explain the work-fertility relationship. Unlike the economic approach, the socio-demographic approach does not focus on female wages, which represent the opportunity cost of childbearing, as a determinant of fertility (Beguy, 2009). Rather, this approach argues that an inverse relationship exists between female employment and fertility owing to the assumed conflict between women's work and their reproductive roles (Standing, 1983). Conflict between the roles of mother and worker is understood to originate from concurrent demands of the home and workplace, the nature of employment and social norms regarding the roles of men and women (Beguy, 2009). There are certain circumstances under which this conflict can be attenuated. For instance, some jobs have characteristics that allow for simultaneous fulfilment of worker and mother roles, hence reducing incompatibility between the two. For example, women occupied in agriculture and working at home are largely able to combine their working and mothering roles. These women are more likely to have higher fertility. For women working predominantly outside the home, particularly in the modern sector, it is more difficult to combine parenting and worker roles (Beguy, 2009). These types of jobs are therefore conducive to small family size.

The availability and low cost of domestic help or parental surrogates (grandparents, cousins, older children) is another factor that could attenuate the conflict between work and childbearing, allowing women to fulfill both roles and thereby resulting in higher fertility (Blau & Robins, 1989; Rindfuss & Brewster, 1996). The traditional social norms regarding gender roles and the division of household duties between men and women could also affect the relationship between female employment and fertility (Beguy, 2009). In many societies, such norms assign to women the role of rearing children, while men have the responsibility to take care of the household by working and providing revenue. When prevailing, these social norms can alter women's aspirations and attitudes towards work outside the home. Negative attitudes towards work outside the home could reduce a woman's employment chances or predispose her towards a job that is more compatible with her maternal responsibilities. Traditional women favour the mother-and-wife role, resulting in large family sizes, while modern women favour professional life and are therefore more likely to have lower fertility levels. These conditions, which prevail generally in developing countries have led to the assumption that no or weak relationship should exist between labour force status and fertility. This could be true in rural settings in developing countries only, where such conditions are more likely to prevail. By contrast, urban areas offer opportunities to women to be involved in paid, non-agricultural work outside the home and to have aspirations more favourable to paid work.

4. Data

This analysis used data from the Malawi Demographic and Health Survey (MDHS) conducted from October 2015 to February 2016 by the Malawi National Statistics Office (NSO). At the time of conducting this study, the 2015/16 MDHS was the most recent nationally representative household survey covering a sample of 26,361 households; 24,562 female and 7,478 male respondents. The survey collected detailed information on topics including demographic characteristics of the population, education, health, occupation of household members, household income and marital status among others. Similar to Bbaale (2014), a wealth index was constructed by combining information on household assets, such as ownership of consumer items, type of dwelling, source of water, and availability of electricity into a single asset index. The sample is divided into five equal quintiles from 1 representing the lowest or poorest segment to 5 representing the highest or richest segment. The poorest quintile is used as the base category in the estimations where the wealth index is used.

5. Trends in Malawi's fertility rates

In the 36-year period between 1980 and 2016, Malawi's TFR declined from 7.6 children per woman to 4.4 and was marginally below the Sub-Saharan Africa average of 4.8 children per woman but still significantly higher than the world average of 2.4 (World Bank, 2017). In the period between 2006 and 2016, Malawi's population grew rapidly at an average of 2.8% per annum reaching 17.2 million people in 2016 (World Bank, 2017). The country's population is youthful and predominantly rural based; 45% of the population is below the age of 15 and 81% of the population lives in rural areas (NSO 2017). The youthfulness of Malawi's population carries a demographic momentum toward further population growth. Teenage childbearing generally declined between 1992 (35%) and 2010 (26%) before increasing slightly in 2016 (29%). In rural areas, 31% of women aged 15-19 have begun childbearing, compared with 21% in urban areas (NSO, 2017). This descriptive evidence that Malawian women start giving birth at early ages is important for policy and actions to reduce fertility. It implies that female education and campaigns that are intended to keep girls in school could play an important role in reducing fertility. Malawi instituted a Universal (Free) Primary Education (UPE) programme, which aimed to provide an avenue to keep girls in school.

Until the 1980s, family planning in Malawi was banned under the one-party system regime. The idea of limiting births was slow to catch on, in a traditionally conservative society that saw promotion of family planning as foreign influence and opted to defend cultural values of large families (Chimbwete *et al*. 2005; Solo *et al*., 2005). Family planning was forbidden and "child-spacing" was preferred as an integral part of the maternal and child health program in the 1980s, which acknowledged the health problems a woman faced when pregnancies were too early, too many, too late, and too frequent (Solo *et al.*, 2005; Chintsanya, 2013).

The advent of a multiparty system in Malawi in 1994 ushered in a new environment in which family planning programs could be implemented. While levels of use of modern contraceptive methods (oral pills, condoms, intrauterine devices, sterilization, implants, and injectables) have traditionally been low in sub-Saharan Africa, modern contraceptive use increased dramatically in Malawi in the 24-year period between 1992 and 2016 rising from 7% to 58%. (NSO, 2017).

While access to family planning is critical for keeping population growth at sustainable levels and also important to the reduction of poverty, several barriers hinder contraceptive access in Malawi. Most people live in rural areas, and these are the least served by health centres. Gender inequity remains pervasive, especially in the rural areas, where traditional values are strong and gender inequality practices such as support for early marriage of girls, polygamy, and widow inheritance make women less autonomous (Matinga and McConville 2002; Chintsanya, 2013). Such an environment impedes women's greater say in decision-making in general, and particularly concerning their own reproductive health.

6. Theoretical framework

This study adopts the one-period static life cycle model previously applied by McCabe and Rozenzweig (1976), Ben-Porath (1973), Willis (1973) and Sackey (2005) when examining the various dimensions of fertility and labour force participation. The model defines a woman's utility as a function of the number of children (c), which has been adjusted for quality, consumption of market goods (x), leisure (v) and taste (t) (i.e. U = U[c, x, v, t]). The woman is assumed to maximize a well-behaved twice-differentiable utility function subject to a time allocation constraint and an income budget constraint.

Theory indicates that lifetime demand for births is predicated on various socioeconomic factors. Notable among the factors affecting fertility are the woman's productive opportunities (which could be perceived as being primarily determined by her educational attainment), her households non-human capital assets, the survival rate of her children and her social environment (i.e. locality, and religion) (Sackey, 2005). Increases in the schooling of women enhances their probability of participating in the labour market only if the schooling causes a larger increase in their market wage than in their reservation wage (Lam & Duryea, 1999). The decision to participate reflects a comparison between gains from the market earnings and the opportunity costs in terms of forgone household production in childcare and in other activities for a given level of household income from all other sources.

7. Methodology and models for estimation

The analysis and models used in this study are based on the neoclassical labour supply model of labour-leisure choice (Abbott & Ashenfelter, 1976) and household production theory (Becker, 1965). The neoclassical model, which is an extension of the fertility maximization problem of consumer theory, analyses how individuals make choices in deciding how they will spend a fixed amount of time. In the model, an individual has two uses of their time; either working in the labour market at a real wage rate of W per hour or enjoying leisure (Baah-Boateng et al., 2013). According to this model, individuals wish to maximize their utility by purchasing consumption goods in the marketplace and by consuming time in leisure activities, conditional on individual's market wage, personal preferences and non-labour income. This study uses this model to explain family-size decisions. Households could be perceived to maximize their welfare by making choices between having children and other consumption goods. In this case, children are treated as a special type of good from which utility is derived and the cost of which is the time required to raise them.

To achieve the objectives of this study, approaches by Sackey (2005) and Bbaale (2009) were followed, whereby the reduced form specifications for female labour force participation and fertility were estimated. It is assumed that the covariates are exogenous and also that the error

term, which captures all unobserved variables, is uncorrelated with any of the right-hand-side variables. Since the reduced form equations have no inherent simultaneity, they do not violate the classical assumption of non-correlation between explanatory variables and the stochastic term.

First, a model of labour force participation is estimated using a probit model with the aim to establish what factors explain women's decisions to participate in the labour market. Of particular interest is the role played by educational attainment. The coefficients obtained in our probit estimation would only serve to provide a sense of the direction of the effects of the covariates on participation in the labour market and cannot be used for magnitude of impact analysis. The marginal impact of these right-hand-side variables on the probability of participation is calculated to examine the magnitude of impact. The estimated model has the following form:

$$Y_i^* = X_i\beta + \mu_i, \quad \forall i = 1, \dots, n \tag{1}$$

$$Y_i = \begin{cases} 1: if\ Y_i^* \\ \\ 0: otherwise \end{cases} \tag{2}$$

Where Y_i is a binary response variable of the i^{th} woman determined by the underlying latent variable Y_i^*. This takes on a value of 1 if the i^{th} woman participated in the labour force in the year of the survey and is equal to zero otherwise. X_i is a row vector of explanatory variables, while β is a vector of unknown parameters to be estimated and μ_i is the error term. In estimating the empirical probit model, labour force participation (*LFP*) will take the form:

$$LFP = f(MED, BIR, WEA, LOC, REL, FED) \tag{3}$$

Where LFP, $MED, BIR, WEA, LOC, REL, FED$ are the probability of female labour force participation, mothers level of schooling completed, birth cohort dummies, wealth status (measured by wealth quintiles), locality, religion and fathers education level respectively.

Following Bbaale (2009), Duryea and Lam (1999) and Ainsworth (1996), fertility is defined as a cumulative outcome and a fertility choice model is estimated. Variables for number of children born by age 20, 25 and 30 respectively, were created using birth histories of live births before the woman reached 20, 25 and 30 from the DHS. Regressors in this model include mother's education, father's education and education dummies for the birth year cohort. Ordinary Least Squares is used to estimate the reduced form equation with the fertility model specification taking the form:

$$CMF = f(MED, BIR, LOC, REL, FED) \tag{4}$$

where CMF, MED, BIR, REG, REL, FED are cumulative fertility, woman's level of schooling completed, birth cohort dummies, locality, religion and father's education level, respectively.

8. Results and interpretation

This section presents results of estimations of a probit model where output was obtained related to the marginal impact of a woman's education level, marital status, age, residence, wealth status, religion and husband's education on her participation in the labour force. The section also presents OLS estimation results for total and cumulative fertility regression models. These are detailed in the sections below.

8.1. Results from probit model on female labour force participation

The marginal impact of respective right-hand-side variables on the probability of participation by women is shown in Table 2. The results confirm that women's education plays an important role in their labour force participation, which from the literature has important implications for fertility. Women with a primary school level of education and those with a secondary level are about 5% and 7%, respectively, more likely to be working (significant at 5% level) compared to those with no education at all (Table 2). Among the married, women with a post-secondary school education are about 10% more likely to be working compared to the uneducated. This is in line with theoretical expectations and attests to the fact that schooling in general and higher levels in particular increase the opportunity cost of women's time in household production. Through education, human capital of women becomes enhanced, thus increasing their employability.

Table 2: Female labour force participation

Variable	All women	Married women
Dependent variable is currently working women		
Woman's education		
Primary	0.053** [2.51]	0.036* [1.80]
Secondary	0.068** [2.63]	0.008 [0.42]
Post-secondary	0.029 [1.41]	0.098*** [3.01]
Partner's education		
Primary		0.077** [2.90]
Secondary		0.081*** [2.98]
Post-secondary		0.075* [1.94]
Age cohort		
20-24 years	0.104*** [10.81]	0.058** [2.42]
25-29 years	0.149*** [15.74]	0.105*** [4.31]
30-34 years	0.154*** [13.29]	0.109*** [4.55]
35-39 years	0.152*** [13.83]	0.121*** [5.27]
40-44 years	0.148*** [13.04]	0.113*** [4.72]
45-49 years	0.144*** [11.22]	0.122*** [5.27]

Variable	All women	Married women
Locality		
Rural resident	0.059*** [4.82]	0.129*** [5.44]
Religious affiliation		
Protestant	-0.009 [1.17]	0.004 [0.15]
Muslim	-0.011 [1.23]	-0.015 [0.27]
Other faith	0.012 [1.08]	-0.009 [0.22]
Wealth quintile		
Poorer	-0.054*** [3.62]	-0.041 [1.20]
Middle	-0.109*** [5.54]	-0.083** [2.33]
Rich	-0.137*** [7.41]	-0.117*** [3.41]
Richest	-0.172*** [8.44]	-0.155*** [4.36]
Observations	3,760	1,219
Pseudo R-squared	0.19	0.18

Absolute value of z statistics in parentheses: * Significant at 10%; ** Significant at 5%; * Significant at 1%.**

The results show the partner's education (at all levels) tends to have a significant positive effect on the probability of female labour force participation. Women whose partners have primary, secondary and post-secondary school education are about 8% more likely to be working compared to those whose partners have no education. The impact of age cohort on women's participation in the labour force is generally the same, ranging between 14-15% (except for the age cohort 20-24 years, which is 10% - some of whom are expected to still be in school) compared to the age cohort 15-19 years.

Women residing in rural areas are 6% more likely to be currently working compared to those in urban areas. For married women, the probability is even higher (13%) than that of unmarried women.

Women in poor households are more likely to be working compared to those in relatively richer households. Women in the second to the fifth wealth quintiles are 5-17% less likely to be working compared to those in the poorest quintile. Apart from those in the poorer quintile, the scenario is almost the same when comparing married with unmarried women.

8.2. Determinants of total and cumulative fertility

To understand the fertility behaviour of younger (married and unmarried) women in Malawi, Table 3 present the OLS regression results from the reduced form fertility model for determinants of fertility using the number of children ever born as the dependent variable. Table 4 presents evidence on the determinants of cumulative fertility by age 20, 25 and 30. It is observed from Table 3 that an inverse relationship is implied between education and fertility from the negative and significant coefficients on women's schooling levels. In particular, women's post-primary education reduces fertility in a significant manner. This suggests that efforts to improve access to education beyond the primary school level needs to be strengthened. The model suggests that relative to no schooling, completion of post-primary level leads every 10 women to have on average between 4 to 11 fewer children (Table 3). For all women, by age 20, 25 and 30 (cumulative fertility), every 10 women with at least secondary education will, on average, have 2 to 13 fewer children than those with no education at all (Table 4).

For married women, the husband's post-primary schooling reinforces the tendency towards reduced fertility. Yet, partners' secondary and post-secondary school education has limited impact on fertility given the statistical insignificance of the coefficients. The results indicate the male partners' primary education raises fertility compared to those without any education. This may be explained by those with at least primary education being able to earn higher incomes compared to those with no education and this may influence higher fertility.

Table 3: Determinants of fertility

Variable	All women	Married women	Married by age 20	Married by age 25
Dependent variable is currently working women				
Woman's education				
Primary	-0.136*** [2.64]	0.006 [0.007]	-0.341*** [5.03]	-0.470*** [5.59]
Secondary	-0.779*** [10.41]	-0.637*** [5.81]	-0.436*** [5.17]	-0.522*** [5.63]
Post-secondary	-1.044*** [16.54]	-1.030*** [10.43]	-1.127*** [8.98]	-0.775*** [6.92]
Partner's education				
Primary		0.286*** [4.03]		
Secondary		-0.041 [0.36]		
Post-secondary		-0.044 [0.38]		
Age cohort				
20-24 years	1.340*** [21.09]	1.205*** [9.90]		
25-29 years	2.815*** [46.18]	2.054*** [19.59]	1.749*** [22.77]	
30-34 years	3.679*** [61.04]	3.381*** [29.78]	2.460*** [29.51]	2.181*** [19.67]
35-39 years	4.228*** [65.19]	4.316*** [37.11]	3.482*** [37.85]	3.263*** [25.49]
40-44 years	4.860*** [70.01]	4.418*** [38.14]	4.036*** [47.92]	3.669*** [28.75]
45-49 years	5.402***	5.313***	4.114***	3.803***

Variable	All women	Married women	Married by age 20	Married by age 25
	[73.68]	[44.87]	[40.70]	[26.34]
Locality				
Rural resident	0.547*** [8.33]	0.404*** [5.30]	0.245*** [4.33]	0.120** [2.18]
Religious affiliation				
Protestant	0.040 [1.19]	0.034 [0.84]	0.019 [0.37]	0.038 [0.92]
Muslim	0.061 [1.32]	0.063 [1.28]	0.049 [0.50]	0.004 [0.03]
Other faith	0.027 [0.31]	0.002 [0.02]	0.019 [0.024]	0.046 [0.78]
Observations	3,760	2,358	1,512	1,015
Pseudo R-squared	0.65	0.57	0.70	0.63

Absolute value of t statistics in parentheses: * Significant at 10%; ** Significant at 5%; * Significant at 1%.**

Table 4: Determinants of cumulative fertility by ages 20, 25 and 30.

	All women			Married women		
	By age 20	**By age 25**	**By age 30**	**By age 20**	**By age 25**	**By age 30**
Dependent variable is currently working women						
Woman's education						
Primary	0.058** [2.30]	0.180*** [5.03]	0.219*** [3.73]	0.054 [1.32]	0.192** [2.67]	0.218** [2.31]
Secondary	-0.383*** [8.81]	-0.317** [2.92]	-0.205* [1.90]	-0.266** [2.87]	-0.317** [2.72]	-0.195 [1.09]
Post-secondary	-0.785*** [12.17]	-1.303*** [10.34]	-1.299*** [6.83]	-0.884*** [7.80]	-1.309** [6.75]	-1.255** [3.09]
Partner's education						
Primary				0.133*** [2.90]	0.199 [2.23]**	0.202* [1.90]
Secondary				0.124** [2.13]	0.289** [2.06]	0.235 [1.49]
Post-secondary				0.136 [1.42]	0.196 [1.38]	0.271 [1.55]
Age cohort						

	All women			Married women		
	By age 20	**By age 25**	**By age 30**	**By age 20**	**By age 25**	**By age 30**
25-29 years	0.028 [0.97]			-0.127** [3.14]		
30-34 years	0.071** [1.97]	0.008 [0.19]		-0.067 [1.02]	0.004 [0.07]	
35-39 years	-0.055 [1.48]	-1.529*** [3.72]	-0.187*** [2.70]	-0.206*** [3.66]	-0.157** [2.11]	-0.209* [1.89]
40-44 years	-0.149*** [4.01]	-0.364*** [5.99]	-0.377*** [4.11]	-0.309*** [5.02]	-0.425*** [4.60]	-0.399*** [3.40]
45-49 years	-0.133*** [3.05]	-0.401*** [6.08]	-0.492*** [5.12]	-0.345*** [5.22]	-0.471*** [4.79]	-0.555*** [4.88]
Locality						
Rural resident	0.086*** [2.89]	0.235*** [3.93]	0.362*** [3.99]	0.131*** [3.00]	0.244*** [2.72]	0.388*** [3.07]
Religious affiliation						
Protestant	0.030 [1.11]	0.056 [0.80]	0.077 [0.96]	0.068 [0.84]	0.085 [1.29]	0.089 [1.35]
Muslim	0.112 [1.22]	0.104 [1.01]	0.109 [1.13]	0.117 [1.25]	0.133 [1.27]	0.128 [1.16]
Other faith	-0.003 [0.12]	0.007 [0.11]	0.010 [0.12]	0.034 [0.70]	0.94 [1.02]	0.108 [1.00]

	All women			Married women		
	By age 20	**By age 25**	**By age 30**	**By age 20**	**By age 25**	**By age 30**
Constant	1.121*** [23.02]	2.503*** [31.24]	4.110*** [30.19]	1.076*** [13.44]	2.191*** [16.62]	4.002*** [16.71]
Observations	2,901	2,170	1,548	1,154	916	650
Pseudo R-squared	0.11	0.13	0.10	0.12	0.16	0.12

Absolute value of t statistics in parentheses: * Significant at 10%; ** Significant at 5%; * Significant at 1%.**

As expected, the average number of children ever born, is positively related to age, so that as one moves from younger age cohorts to older ones, the number of children born increases accordingly. It is noted that fertility among all women in the age cohort 20-24 years is, on average, about 1.3 children higher than those in the age cohort 15-19 years, while fertility in the age cohort 45-49 is approximately 5 children higher compared to the base age cohort category. The same trend is portrayed for married women (Table 3).

The estimation results show that on average, women living in rural areas are likelier to have more children than those in urban areas. Other factors held constant, every 10 women, married and unmarried, residing in rural areas has on average 5 children more than women residing in urban areas. Regarding cumulative fertility by age 20, 25 and 30, every 10 women, married and unmarried, on average has 1, 2 and 4 children respectively more than those in urban areas. This finding is similar to that of married women (Table 4). In rural areas there seems to be relatively less conflict between women's role as a caregiver and that of labour market participant because some forms of rural work allow supervision of children. For example, it is not uncommon to find rural women taking their children to the farm (Sackey, 2005).

9. Conclusion

This study used data from the 2015/16 Malawi Demographic and Health Survey to examine the relationships between female education, labour force participation and fertility rates for Malawi. This was conducted against the hypothesis that female education leads to higher labour force participation, which in turn leads to higher opportunity costs of time, leading to lower fertility rate.

The study reconfirms that female education attainments matter. Based on the probit model on female labour force participation, the study shows that education of women exerts a positive impact on their participation in the labour market. The opposite obtains in the fertility models, where education results in a reduction in the number of children ever born to a woman. These results have important policy implications. It can be argued that providing women with education would be a useful investment and a good mechanism for the realization of their empowerment. With enhancement in their human capital, they will be better equipped to participate in a more productive way in the labour market. The implication of this is that as more females get educated and acquire more skills, they will increase their employability in the formal labour market, with favourable impacts on their perceptions of ideal family size and fertility preference. It is important, however, to ensure that the educational gains are sustained.

The findings from this study also have important implications for improving the quality of life of Malawian women and their children through a number of policy actions. Policies to reduce fertility can play both direct and indirect roles in enhancing maternal and child mortality reductions. When women give birth to fewer children, it reduces their exposure to the risks of childbirth, particularly in rural areas where health and maternal care services are poor or non-existent. Having fewer children also implies that family income is shared among a few heads. With fewer children born, parents are likelier to provide adequate care, thus ensuring better chances of child survival and greater attention to early childhood development requirements.

The findings of the study suggest that efforts to reduce fertility need to target measures that aim to educate women beyond primary school level. A well-planned and adequately resourced Government programme to extend free education to the secondary school level could therefore potentially be an important measure that may help to reduce fertility. To succeed, this would

need to be embraced by all stakeholders and actively campaigned to encourage girls to remain in school beyond the primary school level. Measures should be strengthened to remove or at least to minimize factors that influence high dropout rates among girls in school. This could include improving the quality of schools and teaching and ensuring that all schools have separate sanitary facilities for girls and boys.

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