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Demographic Effects on Fertility Among Reproductive Aged Women in Ghana. A Demographic and Health Survey Analysis

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Abstract

In this paper, we argue that fertility is among the key components in the demographic transition process of many global economies. The study used the 2014 Ghana Demographic and Health Survey. We applied the conventional neo-classical consumer-theoretic approach to model the demand of children. The study aimed to estimate the demographic effects on fertility among women of reproductive age 15-49 in Ghana using the negative binomial regression. The results indicated that the age of women at first births, mother's years of education, number of unions, wealth level, women occupations, Partners occupation, contraceptive use and intention, marital status, are significant and negatively associated with the number of children ever born. However, current age of the woman, fertility preference, decision maker on contraceptive use, child sex, number of living children and experienced of the death of a son and/or daughter resulting from replacement effect and hoarding effects and residing in rural areas have positively and significantly influence fertility in Ghana. We recorded variations in the effects of some variables in total, urban and rural samples. We conclude that reduction in child mortality, increasing women access of formal education, increasing women power in decision making on contraceptive use, increasing access to and use of contraceptives as well as reducing income disparity between urban and rural population by providing employment opportunities in rural areas are keys policy issues that could help achieve fertility reduction in Ghana.

Keywords: demography, fertility, mortality, GDHS, binomial, regression

1. Introduction

Fertility is among the three key components beside mortality and migration that contribute significantly to the demographic transition of many economies globally. It can be influenced by child mortality, income, education and employment opportunities. Fertility can be higher among parents with high risk of child mortality. This is because, couples may immediately want to replace the lost children (replacement effect). This can be particularly so for parents who are considered risk averse. Couples may also want to have more children as a form insurance against the likelihood of experiencing the death of a child (hoarding effect). Children can serve as a form of investment or consumption good that provides services in the labour market. They can also represent a form of insurance for parents during old age (Angko, Arthur and Yussif, 2022; Nonvignon, and Novignon, 2014; Banerjee and Duflo, 2011). Particularly in Africa, children are the main source of economic security for their mothers (Boldrin, De Nardi, & Jones, 2015; Bledsoe, 1990). The number of children ever born to a woman has special implication for public health and family planning intervention (Cleland, 2008). Fertility does not only reduce economic growth but is also a cause of poverty and deprivation. Ghana faces a rapid population growth rate 1.9%. It has over 39% of its population less that 15years and only 4% above 65 years (Central Intelligence Agency, 2010). It is recorded that fertility rate Ghana has declined over the years from a high 6.4 births per woman in 1988 to 5.2 births per woman in 1993. Urban and rural fertility rate in Ghana reduced from 5.3 and 7.0 to 3.7 and 6.0 births respectively within the same period. The decline in fertility was seen more from 6.4 births in 1988 to 4.4 births in1998. This rates was stabilized between 1998 and 2003). It further declined to 4.0 in 2008. This rates however increased to 4.2 births in 2014 (GDHS, reports, 1988-2014). Globally, high fertility is known to have adverse consequences on maternal and child health. Although Ghana has made tremendous efforts toward reducing its fertility to 4.2births in 2014. This rate is still high compared to fertility within Africa. Namibia recorded fertility of 3.6 births in 2013 while Swaziland and Zimbabwe recorded 3.9births between 2006/2007 and 4.1births between 2010/2011 respectively. Rural fertility in Ghana is still high at 5.1births compared to urban fertility of 3.4 births in 2014. Despite

wide spread knowledge and access to family planning services in Ghana, its use for controlling births and unwanted pregnancies is still low. This has contributed to the prevailing high fertility in Ghana. Although the government of Ghana has prioritized family planning, little is known about the factor associated with changing fertility in Ghana. Empirical literature suggest the demographic nature of fertility. Fertility can also be influenced by individual, household and community level characteristics such as Mothers years of education, (Sulemana, Shei and Haruna, 2018), occupations, decision making process, access to contraceptive, healthcare and income (Boldrin at al. 2005; Rommonhan 2001). It is therefore important that any attempt at controlling fertility should begin with examining the demographic effects on fertility in Ghana. This is important as policy interventions may be justified in the quest to control fertility in Ghana.

2. Literature Review

Small family size is known to ensure quality of children and improve the health of both children and the mother. It also reduces the opportunity cost of child bearing by allowing the mother time to engage in employment opportunities. Fertility economics has been the dominant approach used in literature to provide explanation for demographic changes in fertility. Fertility studies has been analyzed within the economics theoretical frameworks of demand and supply of children since the 1950's. Studies on economics of fertility and contraception follows the seminal work by Berker (1960) and Leibesteins (1957). They argued that "families would try to balance the utility against disutility from child birth and determine their fertility". Robinson and Horlacher, 1971; Easterlin, 1969; Berker, 1960 used the conventional neo-classical consumer-theoretic approach to model the demand of children in terms of couple's fertility behaviour. This concept was later developed into the now "Chicago school". In his presentation, Berker (1960) treated children as consumer durable goods along with other consumer goods that yield some form of utility to the parents. He introduced the concept of quality vs. quantity of children. The Quality-Quantity tradeoff model has been viewed perhaps as the most important contribution in modeling fertility. Quality he measured in terms of expenditure spend on the child and quantity he viewed as the number of children. He concluded that as income increase, couples will usually demand more children. This would imply that children are "normal goods" and not "inferior goods". There also exist several views in analyzing fertility within a Consumer-theoretic approach (McLaren, 2012; Schultz (1973, 1974a). This models tries to highlight understanding of the link between fertility and economic factors. They concluded that as income increases, the opportunity cost of child bearing also increases, hence parents might desire less children. They cautioned this not to mean that children are "inferior goods". There are also such models that apply the economics concepts to fertility (Flodén, Kilström, Sigurdsson, and Vestman, 2021). Most studies viewed children as a special "kind of good" just like all other consumer durable goods that yield utility to the consumer. These models analyse fertility as a demand response for children relative to other consumer goods **(**Robinson and Horlacher, 1971; Easterlin, 1969, Schultz, 1973; 1974). Interestingly, a number empirical studies have also identified various set of socio-economic, cultural and religious, policy factors determining fertility levels (Torabi, 2011; Haub and Yanagishita, 2011). However, little is known about the demographic effects on fertility in Ghana.

Using panel data to examine the long run relationship between mortality and incomes on fertility, Herzer et al. (2010) found that a decrease in child mortality leads to decline in fertility. Additionally, he showed that higher income was associated with fertility reduction. Using the quality-quantity tradeoff model of fertility, Angrist et al. (2010) provided empirical evidence of a negative relationship between family size, education and income. Hondroyiannis (2004) estimated a count model of fertility using data on Greece. The study found that, fertility was influenced by socioeconomic factors such as age, education, social status and health status. Winkelmann, (1995) modeled the number of children in a household within age intervals on variations in fertility. The study found mother's years of schooling, age, and household income to have significant influence on fertility. Methodologically, other studies measured fertility via number of children ever as count or discrete. They treated fertility as a zero or nonnegative dependent variable. They suggested that a Poisson approximation would yield better results. They also stressed that such models of fertility should usually be estimated using the maximum likelihood estimator (Cameron and Trivedi, 1998; Winkelmann, 2003). Others suggested that a negative binomial model can better generalized results on fertility than the Poisson models (Cameron and Trivedi, 2013; Hilbe, 2014). However, Gaps exits to the extent of measure of fertility and methods of estimation. Most Studies are also inconclusive on the direction of demographic effects on fertility levels. On the relationship between child mortality and fertility, Bhalotra and Soest (2005) concluded that the death of a child in earlier years of birth shortens the interval until the next birth as mother are likely to want replacement of lost child (Replacement fertility). They therefore concluded that child mortality is positively correlated with number of birth. A similar study conducted by Benefo and Schultz (1994) used access of basic social amenities to proxy for child risk mortality and found that increase in the child risk of mortality let to a rise in fertility for Ghana and Cote D'Ivoire. They also found that education of the woman was negatively related to fertility. This implies that a year of additional education of a woman reduces fertility level. They also concluded that income had negative effect on fertility. However, they do not to suggest

that children were inferiors good. They explained that income measures the opportunity cost of child bearing hence as income increases, couple desire for less children in Ghana. However, for Cote D'Ivoire a positive relationship found.

In a similar study in South Africa by Gangadharan and Maitra (2001), they used a Poisson regression to establish a negative relationship between child risk of mortality, education and fertility. It is also well-documented that decreasing child mortality lowers the cost of having another surviving child and increases the net fertility rate (Boldrin and Jones 2002; Ferna ́ndez-Villaverde, 2001). Moreover, Bongaarts (1994), Miller (2010a), Angeles et al. (1998), and Bailey, (2012) also emphasize that improving access to and use of family planning reduces fertility. They concluded that access to family planning service reduces the risk of unwanted pregnancies and lowers child mortality. They recommended that increasing access to family planning services should be a priority aimed at fertility reduction. Kamaruddin and Khalili, 2015 also used panel data and a count model to empirically investigate the determinants of fertility in Malaysia, and found that marital status, owning a house and women child bearing age, socio-characteristics such as ethnicity, religion, working class and education had varying effects the fertility in Malaysia. Most studies on fertility focus mainly on the proximate determinants with emphasis on biological and behavioral factors through which socioeconomic, environmental and other related variables influence fertility (Bongaarts, 1987;Madhavan, 2014; Lailulo and Sathiya, 2017). However, only few of such studies focused demographic effects on fertility in Ghana. From the discussion above, it is evident that, to design any efficient reproductive health policies to control fertility, it is necessary to understand the demographic effects on fertility in Ghana.

3. The Demographic Model

We conceptualized that demographic characteristics of women affect their commonly shared characteristics. This also has influences on the child mortality, income and policy. Additionally, Child mortality, income and policy variables together influence couples individual attitude towards fertility. Furthermore, the couples' shared characteristics equally influence the way they balance off the costs of fertility regulation and unwanted child bearing. The study adopted the conventional microeconomic theory of consumer behaviour. The paper viewed the individual as trying to maximize utility, given a wide range of goods, their prices, income, tastes and other factors (Becker, 1960; Easterlin, 1975; Beaujot, Krotki and Krishnan, 1978; Montgomery, 1987; Bongaarts, 1993; Shapiro, 1997; Robinson, 1997). The underlying principle of the theory is that, children are viewed as a special kind of "durable good". Fertility is thus seen as spouse response to the consumer's demand for children relative to other goods. The theoretical framework is mainly drawn from the Becker's (1965) household economic model of fertility and the conceptual framework for determinants of fertility by Bongaarts, (1993) with modification by (Aggarwal et al. 2001; Iyer and Weeks, (2004). We argue that couples in this model tries to maximized their utility from children by choosing the optimal number of births/children (N), the quality of the children (Q) and quantity of market durable goods; domestically produced (X_d) and purchased goods (X_p) subject to the constraint of child quality production function, market durable goods production function, mother's time constraints and the household budget constraint. The Utility maximization problem for a typical couple can thus be expressed as follows;

$$\textbf{Max}\ U = u\big((N, Q, X_d, X_p\big) \tag{1}$$

Subject to the following constraints

1. Child Quality Production Function

$$Q = \big(T_q, X_d, X_p\big) \tag{2}$$

T_q = Mothers time used in production of child quality

X_d, X_p = Domestically produced goods and market purchased durable goods used in the production of child quality

2. Domestically produced goods production function

$$X = x(T_d, X_p) \tag{3}$$

3. Mothers time Constraint

$$T = NT_n + T_q + T_d + T_l \tag{4}$$

T_n =Time used for child bearing

T_l = Time spends working in the labour market

4. Household Budget constraint

$$I = wT_l + pX_d = pX_p \tag{5}$$

W= Market wage rate and P= price index of market durable goods,

Following the optimization process, the reduce form demand for children equation can be derived to be function of prices, incomes, women characteristics as well as policy variables that influence mother's preferences or choice between children and market durable goods. Thus, solution to the first order conditions yields the optimal demand for children function as follows;

$$N_i^* = FERT = f^*(P, W, Y, \theta) \tag{6}$$

Where θ is the mother's preference parameter which depends on child mortality factors (C), Income factors (Y), women characteristics (I), and Policy related variables (PV). Thus, this can be written as $\theta = \theta(C,$ I, PV) with the corresponding demand for children explicitly specified as;

$$N_i^* = FERT_i^* = f^*(Px, W, Y, I, C, PV) \tag{7}$$

We further assume that fertility decisions are deliberate choices made by the couples at the beginning of their reproduction period by choosing the optimal number of pregnancies after considering the expected number of child deaths. In Equation **(7),** we define N*, the dependent as fertility measured in terms of the total number of children ever born. The independent variable used in the model are; Px is the price of a child proxy by the woman years of education, C captured child mortality that include experienced of the death of a son and/or daughter, Y as an income variable proxy as wealth quintiles. We also control for partner's occupation and education. I includes the woman demographic characteristics; Age, Age at first birth, occupation, religion, number of unions, fertility preference, contraceptive use, number of living children and place of residence. PV is policy related variable proxy as decision makers for using contraceptives, Contraceptive use and intention).

3.1 Estimation Technique

The dependent variable, Fertility (FERT), is measured as number of children ever born. It is an observed count with possible values as the nonnegative integers. Then, it is logical to assume that its distribution can follows a Poisson distribution or negative binomial distribution rather than a normal distribution. The study estimated a negative binomial regression instead of a Poisson Regression. We adopted the Negative binomial regression because it is a generalized Poisson regression which relaxes the Poisson assumption of equality of the variance and the mean. This model further assumes a Poisson-gamma mixture distribution. This formulation is assume superior since it allows the modelling of Poisson heterogeneity using a gamma distribution. Negative binomial regression is also used to test for associations between predictor and confounding variables on a count outcome variable when the variance of the count is higher than the mean of the count. (Cameron and Trivedi, 2013; Hilbe, 2014). In negative binomial regression, the mean of y is determined by the exposure time t and a set of k regressors variables (the x's). The expression relating these quantities is;

$$U_t = \exp\left[\ln(t_i) + \beta_1 X_{1i} + \beta_2 X_{2i+} + \ldots + \beta_k X_{ki}\right] \tag{8}$$

Where Often, $x1 \equiv 1$, in which case β1 is called the intercept. The regression coefficients β1, β2, …, βk are unknown parameters that are estimated from a set of data. Their estimates are symbolized as b1, b2, …, bk.

The a gamma distribution function takes the form;

$$P_r(Y = y_i / \mu_i, \alpha) = \frac{\Gamma\left(y_i + \alpha^{-1}\right)}{\Gamma(y_i + 1)\Gamma(\alpha^{-1}}\left(\frac{\alpha^{-1}}{\alpha^{-1} + \mu_i}\right)^{\alpha^{-1}}\left(\frac{\mu_i}{\alpha^{-1} + \mu}\right)y_i \tag{9}$$

$$\mu_i = t_i \mu \tag{10}$$

$$\alpha = \frac{1}{v} \tag{11}$$

The parameter μ is the mean incidence rate or risk of a new occurrence of *y* per unit of time *ti* (Time, distance, volume, or population size). When no exposure is given, it is assumed to be one. The functional distribution is thus estimated using the method of maximum likelihood (MLE) technique in Stata.

4. Data Source and Definition of Variables

The study used secondary data drawn from the 2014 Ghana Demographic and Health Survey (GDHS). Two staged sampling method was adopted. In the first stage, the survey divided all enumeration areas in Ghana into 427 clusters with approximately 30 households each comprising 216 urban areas and 211 rural areas. In the second stage, 4,134 women were drawn from the women birth record questionnaire (BR) to include only women who had at least one birth. This was divided into 1,479 urban women and 2555 rural women. The main dependent variable is fertility proxied as the number of children ever born to a woman. The independent variables are grouped into woman demographic characteristic, income variables, child mortality and policy variables. The demographic variables includes; the current age of the woman and age at first birth is captured in continuous years. The woman's education was measured in years of schooling. Marital Status, a dummy as married/living with partner and not married or living elsewhere. Religious Affiliation was categorized as Orthodox Christians, Charismatic, Islamic and traditional. Number of Unions is labeled one or more. Fertility preference is coded as; wants another, undecided and no more want children. Type of place of residence-is dummy for urban and rural. Wealth quintiles is categorized in five scales as; poorest, poorer, middle, richer and richest. Woman's occupation was captured as employed all year or seasonally while partner's occupation not employed, professional and manual. Decision maker on contraceptive use was grouped as mainly respondents, mainly partner and jointly. Contraceptive use and intention to use was coded using any method and not using any method. Child Sex was grouped as male or female. Woman's experienced of death of a son and/or daughter was coded yes or no for each.

4.1 Descriptive Statistic

The statistics revealed the mean number of children ever born at 4.83. In respect of women number of year of education. The years of schooling also ranged 1-18years. The data further indicated that 47.52% were affiliated to the Pentecostal religion, 23.63% with orthodox/Roman catholic faith while 19.57% and 9.28% were affiliated with the Islamic religion and traditional religion respectively. About 75.32% of the women had only one union while the remaining 24.68% had more than one union. About their fertility preference, 51.92% want no more children whereas, 39.42% wants to have another child. Only 8.65% were undecided about wanting or no wanting another child. Majority (61.05%) of the women resided in rural areas compared with 38.97% in urban areas. It was also found that 33.44% of the women were in the poorest wealth index while 22.81%, 19.26%, 13.825 and 10.66% were categorized within poorer, middle, richer and richest wealth index respectively. 78.05% of the women in employed all years while only 21.05 were employed seasonally. About 61.7% of the respondents jointly made decisions on using contraception while 27.28% and 11% of the decision making on contraception were made solely by the women and partners respectively. Another 26.27% had six or more children living with them with 73.4 living with between one and five children. Only 0.33% had no child living with them. This implies that there are women who have ever given birth but are not living with their children or they have probably experienced child death.68.64% of the women were married while 3.35% never had a union, 15.52% are living with their partners, 4.8% are widowed while 3.42% and 4.27% are divorced and separated respectively. It was also recorded that 51.51% of the children were male while the remaining 48.49% female. Only 23.1% and 20.18% of these women had experienced the death of a son and daughter respectively.

4.2 Result from Negative Binomial Regression

The empirical results were estimated from the negative binomial regression with robust standard errors for total, urban and rural samples and are presented in table 1.

Table 1. Negative Binomial Regression for Total, Urban and rural samples

Dependent Variable: Fertility (Total number of children ever born)

	Eqn. 1	**Eqn. 2**	**Eqn. 3**
Independent Variables	**Total Fertility**	**Urban Fertility**	**Rural Fertility**
Woman Current Age	0.0707***	0.0695***	0.0644***

	-0.004	-0.006	-0.004
Woman Age squared	-0.000875***	-0.000869***	-0.000798***
	0.000	0.000	0.000
Woman Age @ First Birth	-0.00616***	-0.00644***	-0.00419***
	-0.001	-0.001	-0.001
Woman education (in years)	-0.00146***	-0.001	-0.00121**
	0.000	-0.001	-0.001
Religion (Orthodox/Catholic)			
Charismatic/Pentecost	-0.0161***	0.0242***	-0.0249***
	-0.004	-0.005	-0.004
Islamic	-0.00929**	0.011	-0.0156***
	-0.005	-0.008	-0.005
Traditional	0.0225***	0.0653***	0.0203**
	-0.007	-0.014	-0.008
Number of Unions (Once)			
More Than Once	-0.003	-0.0176***	-0.001
	-0.004	-0.006	-0.005
Fertility Preference (Want Another)			
Undecided	0.00868*	0.0500***	-0.005
	-0.005	-0.010	-0.006
Want no More	0.0283***	0.0313***	0.0190***
	-0.003	-0.007	-0.004
Place of Residence (Urban)			
Rural	0.002		
	-0.004		
Wealth Index(Poorest)			
Poorer	0.00944**	0.0521***	0.005
	-0.005	-0.012	-0.005
Middle	-0.0106**	0.0528***	-0.0187***
	-0.005	-0.012	-0.006
Richer	-0.0296***	0.0458***	-0.0893***
	-0.007	-0.012	-0.015
Richest	-0.0456***	0.0449***	-0.0490**
	-0.010	-0.014	-0.024
Woman Occupation (All Year)			
Seasonal	-0.00958**	-0.0203***	-0.0169***
	-0.004	-0.007	-0.005
Partner Occupation(Professional)			
Sales	-0.010	0.0157*	-0.0439***
	-0.009	-0.009	-0.016
Agricultural	-0.003	-0.0317***	0.005

	-0.008	-0.009	-0.014
Manual	-0.003	0.010	-0.005
	-0.007	-0.007	-0.015
Partners Education (No Education)			
Primary	0.005	-0.003	0.007
	-0.004	-0.006	-0.004
Secondary or Higher	-0.0268***	-0.009	-0.004
	-0.008	-0.009	-0.011
Decision Maker (Mainly Woman)			
Mainly Partner	0.006	-0.0230***	0.0177***
	-0.005	-0.007	-0.006
Jointly	0.00591*	0.001	0.00726*
	-0.004	-0.006	-0.004
Contraceptive Use (Not Using)			
Using any Method	-0.0269***	0.007	-0.0265***
	-0.007	-0.007	-0.009
Number of Living Children	0.173***	0.227***	0.165***
	-0.002	-0.003	-0.002
Marital Status (No married)			
Married/Living with Partner	-0.0246***	-0.0353***	-0.0239***
	-0.006	-0.009	-0.007
Child Sex (Male)			
Female	0.003	-0.00910**	0.007
	-0.003	-0.005	-0.004
Experience Son Death (No)			
Yes	0.194***	0.235***	0.189***
	-0.005	-0.008	-0.006
Experience Daughters Death (No)			
Yes	0.215***	0.212***	0.221***
	-0.005	-0.007	-0.006
Constant	-0.576***	-0.865***	-0.440***
	-0.071	-0.098	-0.080
Number of observations	**4134**	**1479**	**2655**

*Robust standard errors in parentheses and *** p<0.01, ** p<0.05, * p<0.1*

Eqn.1. Negative binomial regression for Total sample

Eqn.1. Negative binomial regression for Urban sample

Eqn.1. Negative binomial regression for Rural sample

Source: Authors own computation

4.3 Results and Discussion

The results showed that the current age women is significant and positively associated with the number of children ever born with a probability of 0.07 in both total and urban samples and 0.06 in rural sample. This implies that, as the year of

a women increases, she is would more likely to demand more children. To check for non-linearity in the effect of women age on fertility, the age was squared and it was found to be highly significant and negatively associated with fertility in all samples with probabilities 0.000875, 0.000860 and 0.000798 in total, urban and rural samples respectively. This therefore suggests as a woman increases in her reproductive age beyond certain level, fertility will begin to decline as she may desire less children. The study also found the age of the woman at first birth to be significant and negatively associated with fertility level in all samples. This suggests that as a woman begin to give birth in early years, fertility is likely to increase. This might imply that, to control fertility, policy should be targeted at discouraging teenage pregnancies, while encouraging the use of contraceptives to prevent births in early years. Mother education is used to measure the opportunity cost of child bearing and also as a proxy for the price of a child. This is estimated to be negatively associated with the number of children ever born in all sample. It is statistically significant in only total and rural samples but insignificant in urban sample. This implying that increasing the years of mother education increases the opportunity cost of raising children and thus the household prefer less children. In this case, households prefer to choose quality of children to quantity of children (the quality-quantity tradeoff). The finding supports the neoclassical theory of demand for children based on quality-quantity framework (Becker, 1981; Becker & Lewis, 1973). It also support the finding by Arthur (2012) which found that improving mothers education should be encourage as it has direct impact on antennal care usage and subsequent child birth. This is also consistent with the study by Barber et al. (2002) in Peru that investigated the effects of average length of the woman's education on fertility and concluded that women who spend a long time getting education are likely to have fewer numbers of children than those who spend less or no time at all. Similar results were presented by Amin and Behrman 2004; Grepin and Bharaway 2015; Isreal, Lavy and Zablotsky 2015; Handa, 2000; Ayuob, 2004; Sulemana, et al., 2018. This implies that interventions aimed to ensuring women access to secondary education or higher such as the Girl child educational policy and the Free Senior High School Policy recently introduced in Ghana if well implemented could play significant role in reducing fertility rates in Ghana.

Religious affiliation equally place important role in controlling fertility. Women who were affiliated to the charismatic or Pentecostal and the Islamic religious denominations were found to varied levels of significant associated with the number of children ever born in all samples. However, it is surprising that Islamic religion is found to significant and negatively associated with number of children ever born in the both total and rural as Islam compared to the Catholics as Islam is largely associated with polygamous marriages and large family size. This could possibly implies that faith based initiative aim at controlling births could play key policy role in reducing fertility particularly among rural population with many Islam based believers reside. It is also not surprising that Traditional religion is significant and positively associated with fertility in all samples. Traditional religion believe in larges families, Polygamous marriages with the idea that when one give birth to more children than they desire, they are able to hoard or provide social security against the death of a child (Hoarding Effect). The religious affiliation is thus identified to have varying significance and effects in all samples. Also. The effect of a women who have had more than one union is found to be negatively associated with the number of children ever born in all samples compared with women who have had only one union. However, it is only significant in only the urban sample. Fertility preferences of the woman is statistically significant and positively associated with the number of children ever born except women who are undecided whether they want more children in rural sample. Examining the effects of fertility preference on number of child ever born, the study estimated that women who wanted no more children were significant and positively associated with the number of children ever born with probabilities of 0.0283, 0.0313 and 0.0190 in total, urban and rural samples respectively compared to women wanted more children. It was also found that women who are undecided were significant and positively associated with number of children ever born with probabilities of 0.00868 in total sample and 0.0500 in urban sample. However, it is insignificant and negatively associated with children ever born in rural sample. Compared with those who wanted more children in the reference group. Though insignificant, the results is consistent with White et al. (2008) who found that rural women exhibit fertility rates that are much higher than fertility in urban population. This finding is also consistent with all waves of the GDHS surveys reports. Wealth index also have varying association with the number of children ever born. Wealth was found to be statistically significant and negatively associated with the number of children ever born in both total and rural sample but positive and significant for the poorer group in total and urban sample though it is insignificant for poorer households in rural sample. This does not implies that children in poorer households are inferior goods. It possibly suggested that as the wealth index of a household increased in Ghana, household would prefer to choose quality children over quantity of children by reducing child birth. They tradeoff quality for quantity of children (Berker; 1960) so as to enjoy the child labour services. Also, in the urban sample, a significantly positive association was found to exist between wealth index and fertility. This could imply that inorder reduce fertility in Ghana, policies should be design to reduce the inequality gap between the rural and urban population. This finding is also consistnet with Boldrin at al. 2005; Rommonhan 2001) that fertility can be higher for families with low income as additional children may be needed to provide services in the labour market in order to generate

additional income.

It was also found that woman who were employed seasonally were significantly negatively associated with fertility in all samples compared with women who were employed all year. Controlling for Partners occupation, the study found all occupations to have negative and insignificant association with the number of children ever born in total sample. The results however indicated a negative and significant association among partners who were employed in agriculture for urban sample and those engaged in sales for rural samples compared to partners who were professional employed. Partner's education was also found to have varying and insignificant association with the number of children ever born in all samples. Importantly, among partners that had secondary or higher, a negatively significant associated was found. The results further suggest that households after attaining a higher income level, the effect of education and employment will usually offset the income effect making the fertility to decline. The results was mixed for decision making on contraceptive use. It was found that, partners taking decision on contraceptive use was found to be insignificant and positively associated with number of children ever born in rural sample but significantly and negatively associated with fertility in urban samples compared with situation where the women were mainly the decision makers. Where joint decision were made on contraceptive use, the study found a significantly positive association with the number of children ever born in total and rural samples but insignificant in urban samples compared to instances where women were the main decision makers. This implies that policy could should ensure that women decision making on contracepetive use should be prioritised in order to reduce fertility particularly in rural samples.

The use of any method of contraception was also estimated to have significantly negative association with the number of children ever born in total sample and rural samples but with insignificantly positive effect in urban sample compared with women not using any method. This is similar to the results of Kamarudin and Khalili, 2015; Angeles et al., 1998; and Bailey, 2012, who emphasize that improving access to and use of family planning is important among measures aimed at reducing fertility thus increasing access to and use of contraceptives can lower fertility. Therefore, the use of contraceptive particularly modern contraceptives should be prioritised and made accessible to women particularly among rural population. The number of living children in a household was also found to be significantly and positively associated with the number of children ever born in all samples. The results further indicates that women who were living with their partners were statistically significant and negatively associated with the number of children ever born in all samples with probabilities higher in urban samples than in total sample and rural sample compared with women who were living elsewhere. This implies that woman who are living with their partners are much more likely to have control over births than those not living with their partners or not married but sexually active. We also found that the birth of a female child was positively but insignificantly associated with number of children ever born in total and rural sample but was significant and negatively associated with fertility in only urban sample compared to situation where the children were males. This might not be surprising as many household in rural samples has high preference for male children. Interestingly, the negative association in urban sample also suggests that urban setting, households do not care so much about child sex particularly after having a boy and girl.

The experienced of child mortality is an important associates with fertility rates in Ghana. The estimates indicated that women or households who have experience the death of at least a child is highly significant and positively associated with the total number of children compared to circumstances where they do not experience child mortalities. Undoubtedly, this supports the neoclassical theory of fertility that women will always like to replace lost children more especially if they lost their only child, and sometimes a particular sex group. Surprisingly, the probabilities of association is much higher for the experience of the death of a daughter than a son particularly in total and rural sample. This is consistent with many other studies; Herzer et al. 2010; Boldrin and Jones 2002; Ferna ́ndez-Villaverde 2001; Bongaarts 1994, Miller 2010a, who found that a decrease in mortality leads to decline fertility by lowering the cost of having another surviving child and vice versa. Similar findings were also reported by Bhalotra and Sorest 2005 that increases in child death lead in increases in fertility.

5. Conclusion and Recommendation

The main objective of the study is to analyze the effects of child mortality and income on fertility among Ghanaian women of reproductive age 15-49 while controlling for individual and community level demographic characteristics. Data for the study was mainly drawn from the 2014 Ghana Demographic and Health Survey which contains key information on the number of children ever born as well other useful health and demographic data of Ghana women. Using a negative binomial regression, we predicted a possibility of a hoarding and/or replacement effect on the experience of a child death in a household as child mortality was found to have a significant and positive effect on the number of children ever born (Fertility). The number of years of women education was found to be a key in fertility reduction in Ghana. The study therefore revealed that, an increase in years of education of women reduces the woman's expected number of children as more educated women are more likely to use modern contraceptive methods and

antennal care than women with lower levels of education. The study also found that the effects of mother's age, women place of residence, number of living children and child sex were consistently positively associated with in with number of children ever born. Importantly, some socio-economic and demographic characteristics of the woman were also found to be negatively associated with the expected number of children ever born. The woman age at first births, women occupation was found to have a negative association with the number of children. The negative effect of agesquared, suggest that as more matured, they prefer more children but after some age, they turn to prefer fewer children. Wealth index, religious affiliation, partners education, contraceptive use were found to be variedly associated with the number of children ever born. Particularly, the varying effects of wealth as a proxy for household income suggests some implications for the quality-quantity tradeoff as in Berker, 1960. Based on these findings, the study makes insightful suggestion for governments and policy makers. Firstly, we recommend that policy efforts should harness toward key action and strategies aimed to increasing women access to education. Furthermore, policy makers should as well promote health initiatives aimed at reducing child mortality. This is important particularly among rural women. Undoubtedly, policy should target reducing income inequality through initiative that will provide employment opportunities for in rural Ghana.

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