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Economic Determinants of Fertility in Ghana

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Abstract

In recent past, Ghana has witnessed modest declines in total fertility rates (TFR) but still remains the second most populous country in West Africa after Nigeria. Provisional census report for 2011 reveals a reversal in trend for TFR to 4.1 and a further marginal decline to 3.9 in 2017. This presents an opportunity to research further into other determinants of fertility aside the customary proximate determinants of fertility. This study therefore attempts to investigate primarily the economic determinants of fertility in Ghana and secondly, to evaluate the inclusion of taste variables on the impact of economic variables on fertility. The data used for the study is sourced from the Ghana Living Standard Survey 7 and employed the Negative Binomial Model as the estimation technique. The study demonstrates that wage, non-labour income, money cost of child bearing, hours of work supplied by household head and spouse are significant and negatively related to fertility levels in Ghana. The educational level of spouse that was used to proxy time cost of child bearing was insignificant but negatively related to fertility. Cost of fertility control and contraceptive usage had positive influence on fertility behaviour with only the latter being significant at all levels. The introduction of taste variables into the model had a significant impact on the effect of economic variables on fertility except for wage. The educational level of household head had a significant and positive impact on fertility. In line with these findings, the study recommends a comprehensive policy measure that will include improvement in normal and overtime wages, an increase in the support of NGOs responsible for poverty reduction, and intensified communication programmes on family planning especially in rural areas.

Keywords*: Total Fertility rate, Negative Binomial Model, Ghana.*

JEL Classifications: *J10, J11, J13*

1. Introduction

Issues relating to population growth and fertility rate are widespread and a growing concern in the developing world today due to their devastating effects on the health and welfare of individuals, their family, the society they live in and the country as a whole. Globally, concerns have been raised about the trend of family sizes and its tendency for a likely world population explosion which could plunge poor developing countries like Ghana into further poverty.

Thus, many less developing countries including Ghana initiated intensive family planning programs during the 1960s but it still remains less obvious to attribute reduction in fertility rate to those programs. One school of thought confirms this argument by suggesting that it is very unlikely for family planning programs to have an effect on fertility, rather it is primarily determined by social and economic factors (Russell and Burke, 1974).

Ghana is still the most populous country in Western Africa after Nigeria. The census in 2010 recorded a population of 24. 2 million, which is four times that in 1957. The current population of Ghana is estimated to be 30.10 million. This rapid population growth has been adjudged as a major challenge to the attainment of Millenium Development Goals (MDGs) (NPC, 2006). At the societal level, rapid population growth adds to the number of people in need of healthcare, education, vulnerable employment, and other social services which, in turn, requires additional human, financial, material and natural resources. At the household level, high fertility affects the health of women, their children, and families, thereby increasing the risk of maternal, child, and infant mortality. More so, repeated pregnancies and births increase the probability of birth complications, infectious diseases among infants and maternal morbidity and mortality. Research conducted across a wide variety of populations confirms that high fertility often entails negative effects on the health (Hagen *et al*., 2006; Lawson & Mace, 2008), survival (Meij *et al.* 2009; Penn & Smith, 2007) and reproductive success of offspring (Gillespie *et al*., 2008; Low 1991; Mace, 1996; Penn & Smith, 2007).

Larger family size may cause resource dilution or reduce the average maturity level in the household (Blake, 1989). In another context, Becker (1960) stated that families with excess children than desired spend less on each child than other families with the same income and tastes. Also, most children born into large families develop a taste for fertility and anticipate life with many children (Grawe, 2005). This he believed affects their education and job choices. The end result is a negative relationship between family size and adult achievement.

Thus, in 1994, the Government of Ghana decided to reduce the total fertility rate (TFR) from the then 5.5 children per woman to 3.0 by 2020 as part of an overall plan

to reduce poverty and achieving sustainable development. These strategies resulted in the reduction of fertility to 4.6 in 1998 and 4.4 in 2003. By 2008, the TFR had reduced to 4.2 children per woman and a further reduction to 4.04 in 2015 (GSS 2010, World Bank 2016). In spite of these achievements, the current national average of 3.93 children per woman is higher than the fertility rate of other African countries and the world fertility rate of 2.44 (World Bank, 2018). In Ghana, the absence of children renders a marriage and life in general meaningless since it brings prestige to the man and emotional values to the woman. Conversely, the positive value attached to children by parents reduces as the number of children becomes many and could even trigger negative thoughts (Bleek, 1974). Besides, adhering to Namboodiri's (1972) argument that people are social animals with tastes influenced by the social groups they belong to, or aspire to belong; the problem of high fertility must attract urgent attention since future generations will be affected as well.

The role of the fertility and hence family size are central in economic analyses because they are usually the locus of joint decisions regarding consumption, production, labor force participation, savings, and capital formation (Becker ,1991; Kuznets, 1978). The social sciences, including sociology, economics, and anthropology, have long recognized the importance of families and households and there are extensive corresponding studies. However, demographers have neglected the quantitative dimensions of family size analysis (Bongaarts, 2001). Most recent studies however, have either concentrated on proximate determinates of fertility (see Amoah, 2003; Johnson, Abderrahim & Rutstein, 2011; Tey, Ng, & Yew, 2012; Laelago, Habtu & Yohannes, 2019) or on the socioeconomic determinates of fertility (see Wei, Xue & Wang, 2018;Tosun & Yang, 2018; Arthur, 2006 and Bhasin, 2009). Not only did these studies placed very little or no explicit emphasis on the economic determinants of fertility but also most variables are qualitatively analysed. Thus, they presented a bias representation of the determinants of fertility since the economic theory of fertility postulates that income and prices, broadly defined, are important determinants of family size (Mincer, 1963). Also, most fertility studies on Africa used panel data estimation techniques, where findings are generalized for individual countries on the grounds that they bear similar characteristics and therefore may lack robust policies for individual countries. This study closes these gaps in the fertility literature on Ghana by ascertaining the economic determinants of fertility in Ghana, using a nation-wide data-the Ghana Living Standards Survey (GLSS7).

The rest of the paper is organized as follows: Section II is devoted to the review of relevant literature on the subject area, whereas Section III provides an overview of fertility issues in Ghana. In Section IV the methodology of the study is provided and the main empirical findings reported. Section V outlines the relevant conclusions and recommendations.

2. Literature Review

This segment presents the literature review for the study. The importance of this review is first of all, to reveal gaps in the existing studies as a basis for situating this current study into the existing literature. It is also done to provide a strong foundation for the theoretical framework and the subsequent empirical model employed for the study. The review of the literature points to the fact that whereas some group of studies attribute fertility to proximate factors, others associate it with socioeconomic factors. Very few of them link fertility to economic factors. We hereby present the literature review in that order.

Amoah (2003) in a study of the onset of fertility transition in Ghana using the Ghana Demographic and Health Survey (DHS) conducted in 1988, 1993 and 1998, revealed that among the proximate determinants of fertility, postpartum infecundability was the most significant fertility inhibitor. However, the study acknowledged the increase in contraceptive methods to be responsible for the decline in fertility between 1988 and 1998. Results from the logit regression identify area of residence and the educational status of the respondents as the most important socio-economic predictors of fertility. According to the study, women with primary or no education had similar significant effect on fertility. Nevertheless, religion and ethnicity had no significant effect on fertility in Ghana.

The study by Tey, Ng, & Yew (2012) centered on the proximate determinants of fertility in Peninsular Malasia. By applying vital statistics, population census, and survey data, the study finds marriage postponement and contraceptive use as the two most important proximate determinants of fertility, even though the effects are not uniform across the ethnic groups. The findings from the study indicated a sharp contrast between the observed levels of total fertility rate for Chinese and Malays. Whereas the predicted fertility rates were 2.9 and 1.6, respectively, the actual levels according to the study stood at 3.0 and 1.9 respectively. Also, postpartum infecundability and abortion were also found to play important roles in explaining the ethnic fertility differentials in the region.

By using the Ethiopia Demographic Health and Survey (EDHS) data of 2011 and 2016, the study by Laelago, Habtu & Yohannes (2019) assessed the proximate determinants of fertility and the role of selected socio-economic variables in influencing fertility in Ethiopia. The Bongaart (1978) model is used to explain the observed socio-economic differentials in fertility during the two survey years. The results indicated that in 2011, index of marriage repressed fertility by 37.8%, whereas in 2016 it inhibited fertility by 34.4%. On the other hand in 2011, contraceptive use caused fertility rate to reduce by 28.5%, but in 2016 it caused a further reduction in fertility by 30.7%. The results further indicated that the index of postpartum infecundity reduced fertility by 34.7% in 2011 and by 34.5% in 2016. Foetal wastage

inhibited fertility by 9.2% in both survey years. The total fertility rate in 2016 was 4.14 whereas the projected total fertility in 2020 will be 3.2 children per woman.

In a regional study on the determinants and implications of a stall in fertility decline in Eastern African nations, Ezeh, Mberu, and Emina (2009) concludes that alterations in socioeconomic variables, the family planning program environment, and reproductive behavior models have a role to play in the fall in contraceptive usage and increases in unmet need for family planning services, tastes for larger families and adolescent fertility.

The study involving Johnson *et al*. (2011), tracks the changes in fertility and its determinants in 13 sub-Saharan African countries that have had three or more DHS surveys and show at least some evidence of beginning a fertility transition. In some of these countries, notably Namibia, there has been a consistent downward trajectory in the total fertility rate (TFR). In most countries, however, there was little change from approximately 1995-1999 to approximately 2005-2009, a pattern often described as a "stalled" fertility decline. In most of these countries, women have high levels of unplanned births, with less use of contraceptives than their preferences would imply.

By employing a multi-stage stratified cluster sampling survey with 2,516 women respondents in rural Shaanxi, the study by Wei, Xue & Wang (2018) tries to estimate desired fertility of rural women and evaluate the impact of important socioeconomic factors on their desired fertility. The results of the study indicated that the average lifetime desired fertility for rural women of childbearing age in Shaanxi is about 1.71, below the total fertility rate of the "two-child policy". The study found women's marriage age, the pecuniary costs of having children, women's income forgone for having children, and social security benefits available for rural residents at retirement age, to be significantly but negatively related to desired fertility. Rural women's cultural views towards fertility were however found to be significantly and positively correlated to their desired fertility.

In Tosun & Yang's (2018) study, the relationship between fertility and population policies and other potential determinants were examined using panel data from the United Nations World Population Policies database, Integrated Labor Market Panel Survey (ILMPS) database and the World Development Indicators. Results from the first section of the study indicated a significant negative relationship between government policy to reduce fertility, and the change in the total fertility rate. The study did not also find any significant and robust association between government policy to raise fertility, government's policy to support family planning and the change in the total fertility rate. However, the study found evidence in support of a spatial autocorrelation in the total fertility rate, and spatial spillovers from government's policy on fertility. The second part of the study focused on the determinants of

fertility using micro data on Egypt, Jordan and Tunisia. The results from the study suggested the existence of a positive and significant association between fertility and age, household size and marital status. However, the association between fertility and urban areas, education level, labor force participation and wealth was found to be negative and significant.

Jones and Tertilt (2008) provided empirical evidence to support why rich couples prefer fewer children in the United States of America. Using cross sectional data for 30 birth cohorts over the space of 130 years (1830-1960), the study confirmed the negative relationship proposed by several authors between income and fertility. The study further established that this relationship was stable overtime with the income elasticity of fertility remaining approximately constant at about negative 0.30. The study documented that around the time of the study, income elasticity of fertility had reduced to around - 0.2 for most birth cohorts due to lower fertility rate for all women. In conclusion, the authors suggested that most of the studies that report a positive relationship between income and fertility were done in agrarian economies and used farm size to proxy income (see Lee, 1987; Weir, 1995; Clark, 2005, 2007 and Clark and Hamilton, 2006).

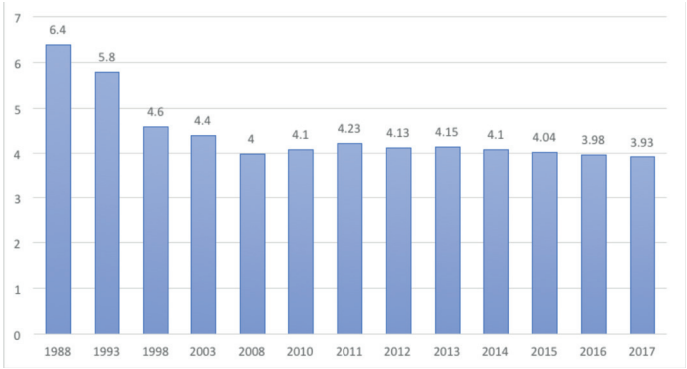
3. Overview of Fertility levels in Ghana

3.1. Fertility Trends and Levels

Fertility rate refers to the average number of children born to one woman while being of child-bearing age. A comparison of the findings from the Ghana Demographic Health and Surveys (GDHS) conducted over the past three decades indicate that total fertility rates (TFR) have been falling steadily over the past two decades from 6.4 in 1988 to 4.0 in 2008. The provisional report of the 2010 census however reveals that fertility rates increased marginally to 4.1 percent in 2010 (see Figure 1). Recent TFR for Ghana as published by the World Bank (Statistica, 2019) suggests an increase in the number of children born per women from 4.13 in 2012 to 4.15 in 2013. However, the rates have declined consistently from the 2013 levels to 3.93 in 2017. These levels notwithstanding, are higher than the world average fertility rate of 2.44.

At the regional level, TFR also differs for each region. For instance, using the total fertility rate of 2008 as a benchmark, most regions scored TFRs above the national average of 4 percent. The Western, Brong Ahafo and Upper East regions recorded 4.2, 4.1, and 4.1 percent respectively which could be regarded as being close to the national average. The Volta region was also 0.2 percentage points lower than the national average. However, the Central, Northern and Upper West regions recorded rates way above the national average (see Figure 2). This difference in fertility rates is highly linked to the differences in changes in the proximate determinants of fertility in Ghana.

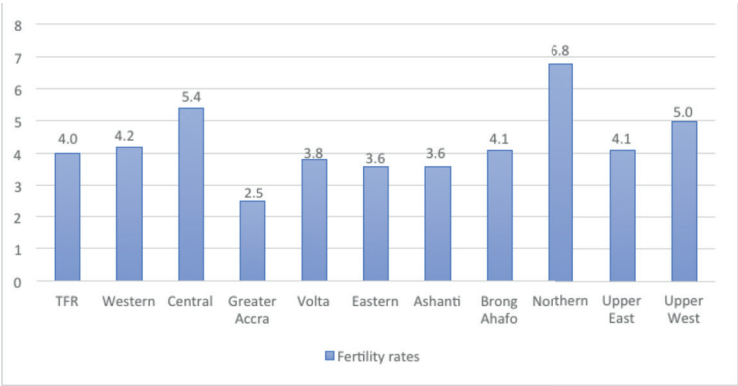
Figure 1: Trends in Total Fertility Rate (TFR) for Ghana, 1988-2017



Sources: *GDHS 1988,1993,1998,2003 and 2008; GSS, Census Provisional Report (2010), World Bank,(Statistica 2019)*

The proximate determinants discussed in the Ghana Demographic and Health Surveys (GDHS 1988, 1993, 1998, 2003 and 2008) include median age at first marriage, median age at first sexual intercourse and median age at first birth for women between the ages of 25 to 49 years. In addition, the percentage of women between the ages of 15 to 19 years who are mothers or are currently pregnant, the percentage of married women desiring no more children and percentage of women currently using family planning methods also differ by region.

Figure 2: Differences in fertility rates across regions in Ghana



Sources: *GDHS 2008*

Correspondingly, the findings from the GDHS (2008) reveal that the main childbearing years for women in Ghana are during their 20s and early 30s. Also, there exists differences in fertility rates among all age groups but especially large in the early 20s for rural and urban dwellers. The TFR for rural areas (4.9 births) far exceeds that of urban areas (3.1 births). (See Table 1). Nonetheless, the past five years have witnessed a fall in TFR in rural areas from 5.6 to 4.9 whereas that of urban areas remained constant.

Table 1: Fertility rate among women by age group and rural-urban differences

Age group	Urban	Rural
15-19	49	82
20-24	114	243
25-29	173	236
30-34	157	189
35-39	89	140
40-44	37	77
45-49	3	13
TFR (15-49)	3.1	4.9

Source: *Compiled by authors from GDHS (2008)*

4. Methodology and Analysis of Empirical Results

4.1. Theoretical Framework

Most economists worldwide are convinced that fertility behaviour of households fall within the calculus of conscious choice and as such, can be understood through the same choice-theoretic framework as any other form of constrained decision-making. As rational consumers, parents are expected to continue having large family sizes as long as the benefit from each additional child outweighs the cost. The demand for children is assumed to be a derived demand for the services children render to their parents (Snyder, 1974).

The demand for children model postulated by Becker (1991) makes use of the standard apparatus of consumer theory. In this model, the family is assumed to have a utility function that comprises of the number of children (N) and consumption goods (C). That is, $U = U(C,N)$, which is continuous and increasing in both variables (i.e. $U_C>0, U_N>0$) and strictly concave (i.e. $U_{NN}<0, U_{CC}<0$) (1)

The model assumes that all children born to the same family have the same quality and that this quality is produced by each family using its own time and market goods. The model also assumes a high elasticity of substitution between consumption goods and number of children. The maximization process is constrained by the total available time of each family member and the money income that the family can earn by devoting some of its time to market work.

The budget and time constraints are specified as follows:

$$PC + (K + tw) \leq WH + Y \quad (2)$$

$$T = H + L \quad (3)$$

where: K is the monetary cost of child bearing, tw is the time cost of child bearing, P is the price of other goods, w is the wage received by the family, T is total available

time, H is hours of work, L is leisure time and Y is non-abour income. Since our interest is on number of children (N) but not on other goods (C), P is normalized to unity.

Setting up the Lagrangian, we have:

$$L = U(C,N) + \lambda\left[wH + Y - C - (K + tw)N\right] \tag{4}$$

$F.O.Cs$

$$\frac{\partial L}{\partial C} = U_C - \lambda = 0 \tag{5}$$

$$\frac{\partial L}{\partial N} = U_N - \lambda(K + tw) = 0 \tag{6}$$

$$\frac{\partial L}{\partial \lambda} = wH + Y - C - (K + tw)N = 0 \tag{7}$$

Dividing equation (6) by (5), we have

$$\frac{U_N}{U_C} = K + tw \tag{8}$$

Equation (8) implies that the individual is in equilibrium when the marginal rate of substitution of other goods (C) for number of children is equal to the real cost of an additional child.

By substituting equation (8) into (7) and solving further gives the Marshallian demand for child bearing, which is a function of the real cost of a child ($K + tw$) and the term on the right hand side of the budget constraint ($wH + Y$).

The Marshallian demand function for child bearing is specified as:

$N^* = (y,w,H,Y)$, (9)

where: $y = K + tw$

The model predicts a negative relationship between income and demand for children. The Marshallian demand function for child bearing in equation (9) is made operational by being modeled as an econometric demand for children model. Based on the above framework, the empirical model for the study is expressed as:

$$N_i = \beta_0 + \beta_1\gamma_i + \beta_2 w_i + \beta_3 Y_i + \beta_4 H_i + \varepsilon_i \tag{10}$$

Again, this new model can be modified by adding more explanatory variables and treating the dependent variable as a count variable. Hence, equation (10) is assumed to have a Poisson distribution.

In line with the objectives of the study to test the effect of economic variables on fertility and to evaluate the effect of taste variables on fertility, and taking a cue from Snyder, (1974), the study estimate two different models. The essence is to help in confirming or disproving of the relevance of economic and/ or taste variables in fertility analysis. The first model include strictly economic variables whereas the second model controls for taste variables.

Specification of the first model:

$$N_i^F = (\tau)\beta_0 + \beta_1 w_i + \beta_2 Y_i + \beta_3 K_i + \beta_4 EDUCSP_i + \beta_5 HWKHH_i + \beta_6 HWKSP_i + \beta_7 COSTF_i + \beta_8 ATTC_i + \varepsilon_i \quad (11)$$

Specification of the second model:

$$N_i^{ET} = (\tau)\beta_0 + \beta_1 w_i + \beta_2 Y_i + \beta_3 K_i + \beta_4 EDUCSP_i + \beta_5 HWKHH_i + \beta_6 HWKSP_i + \beta_7 COSTF_i + \beta_8 CONTUS_i + \beta_9 CHDM_i + \beta_{10} EDUCHH_i + \beta_{11} PROPM_i + \beta_{12} MALE_i + \beta_{13} MARRIED_i + \beta_{14} CHRISTIAN_i + \beta_{15} MOSLEM_i + \beta_{16} COASTAL_i + \beta_{17} SAVANNA_i + \beta_{18} URBAN_i + \varepsilon_i \quad (12)$$

Where:
N = total number of children born to a particular woman in a household, w = wage(total income from employment), Y = non-labour income(all income not acquired from work), *EDUCSP* = educational level of spouse, K = money cost of raising a child(the cost of raising a child at a specified quality level), *COSTF* = cost of fertility control, *CONTUS* = contraceptive usage among males and females, *HWKHH* = hours of work supplied by the household head, *HWKSP* = hours of work supplied by the spouse, *URBAN* = urban residence, *CHDM* = child mortality, *EDUCHH* = educational level of household head, *PROPM* = proportion of males among alive children, *MALE* = male economic head, *MARRIED* = marital status of both men and women, *CHRISTIAN* = Christian household head, *MOSLEM* = Moslem household head, *COASTAL* = coastal zone and *SAVANNA* = savanna zone.

Estimation Technique

Given that the dependent variable in this study is fertility which represents a count of the number of children born to a particular woman, it will be more appropriate to use a model that deals with count data (Wooldridge, 2000 and Long, 1997). The study used the negative binomial regression model, an extension of the Poisson regression model that takes into account unobserved heterogeneity as its main estimation technique.

The Negative Binomial Model

The Negative Binomial Model (NBM) just like the Poisson regression model (PRM) derives its basis from the Poisson distribution. Assuming that the dependent variable (y) can only take numbers greater than or equal to zero, the probability that is y equal to h is given by:

$$\Pr(y = h) = \frac{\lambda^h e^{-\lambda}}{h!} \quad (13)$$

where: h = 0, 1, 2, 3, ….,n; λ is the expected value of y and h is calculated as $h(h\text{-}1)(h\text{-}2)(h\text{-}3)(h\text{-}4)$. Also, the parameter λ depends on a set of independent variables denoted as $x_1, x_2, x_3, x_4 \ldots\ldots, x_{11}$ and so the poisson model can be specified as:

$$\log \lambda_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \ldots + \beta_0 x_{ik} \quad (14)$$

This specification of the poisson model ensures that λ do not take values less than 0 for any of the x's or β's. However, the use of the PRM comes with two main disadvantages namely;

- For any given set of observations on the independent variables, the variance of the dependent variable should be equal to that of the mean before consistent and unbiased estimates could be obtained. Nevertheless, in real data, the variance of the dependent variable always turns out to be larger than the mean.
- Secondly, the Poisson regression model only takes care of observed heterogeneity leaving out the unobserved heterogeneity in the model. A likely effect of this causes "overdispersion" which tends to underestimate the standard errors thereby increasing the t-statistics and giving us inefficient but consistent results.

The NBM is not known to correct the first problem associated with the PRM but is convincingly accustomed for correcting the second problem, which is, unobserved heterogeneity. Hence, the NBM is specified with an error term to control for the unobserved heterogeneity in the model. That is,

$$\log \lambda_i = (\tau)\beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + ... + \beta_0 x_{ik} + \sigma\varepsilon_i \tag{15}$$

This specification is based primarily on the assumption that, the dependent variable y_i follows the nature of the Poisson distribution with an expected value λ_i conditional on ε_i. Besides, ε_i which have a standard gamma distribution is included to capture the effects of the unobserved variables excluded from the model (Long, 1997). However, since the dependent variable N can assume the value 0, meaning a family has no child, we cannot compute log N. Hence, we model the expected values of N as an exponential function so as to nullify the logarithm leaving us with just N on the left hand side of the equation (Wooldridge, 2000).

More so, following Bawah (2001), (τ) is included in the model as an offset variable with its coefficient constrained to 1 to adjust for exposure. In this study, current age of wife will be used as an offset variable to account for the effect of fertility and the duration of exposure. The dependent variable used for the study is fertility and the explanatory variables include wage, non-labour income, real cost of bearing a child, cost of fertility control, hours of work supplied by household head and spouse, religion of household head, educational level of the household head and spouse, sex of economic head, child mortality, household size, marital status of the household head, area of residence, ecological zone and the proportion of males among living children. The NBM can be efficiently estimated using maximum likelihood.

4.2. Data Source

The data for this study is sourced from the Ghana Living Standards Survey (GLSS7) which was conducted by the Ghana Statistical Service in 2016/17. It is a nationwide representative survey covering a sample of 15000 households in 1000 enumeration areas (EAs) consisting of 561(56.1%) rural EAs and 439(43.9%) urban EAs. The survey collected detailed information on the total number of children. In addition, it also contains information on some demographic variables like educational level, age of wife, marital status of both men and women, household size, occupation, income earnings, consumption and expenditure, migration and housing conditions. This study uses a sample of 14009 households after eliminating:

- Households with errors in reporting the dependent variable.
- Households consisting of single persons or childless couples
- Households with mean age of wives exceeding 49 years

5. Empirical findings

5.1. Descriptive Statistics

This section focuses on the summary of descriptive statistics of the count dependent variable, continuous and categorical independent variables. To start with, Table 2 presents the descriptive statistics of the count dependent variable (total number of children born to a particular woman in the household). From a total of 14009 observations sampled from households who have ever given birth, the mean number of children per household was about 5.1323 whilst the standard deviation was around 3.778. The minimum number of children was one (1) and maximum, twenty-five (25).

Table 2: Total Number of Children

Variable	Households
Number of Observation	14009
Mean	5.1323
Standard Deviation	3.778
Minimum	1
Maximum	25

Source: *Constructed by Authors from GLSS 7*

Table 3 presents a summary of descriptive on the continuous independent variables. The wage (which we proxy by total income from employment) has a mean of GH¢382.78, a minimum of GH¢0 and a maximum of GH¢41,154). Non-labour income received by the household (which is obtained by summing the income from remittances, renting of property and all other income stated in the GLSS 7 report) has

a mean of GH¢141.59, a minimum of 0 and a maximum of GH¢33,001. Besides, the average expenditure spent on raising a child or children (in the form of educational expenses) by all households amounted to GH¢1946.816, the minimum expenses been GH¢0 and maximum GH¢14100. The average amount spent on contraceptives amounted to GH¢0.40 with a minimum of GH¢0 and a maximum of GH¢25. More so, on the average, household heads supplied more hours to work than their spouses. The minimum and maximum educational attainment by household heads and their spouses were the same at 1(none) and 6(tertiary) respectively) Furthermore, the difference between the minimum and maximum age of wife is 35 years which is a year less than the mean. The number of child mortality cases also ranges from a minimum of 0 to a maximum of 6 children and an average of 0.59 children. The largest household size excluding house help recorded had 28 inhabitants, a minimum of 1 inhabitant and approximately 5 (actual figure 4.2) members on the average.

Table 3: Descriptive statistics on the continuous variables (amounts in Ghana cedis)

Variables	Observations	Mean	St. Deviation	Minimum	Maximum
Wage	14009	382.78	1,301	0	41,154
Non-labour income	14009	141.59	701.7	0	32,001
Money cost	14009	301.18	748.61	0	8,290
Hours of work supplied by household head	13981	83.5	3.11	0	195
Hours of work supplied by spouse	13990	78.5	3.43	0	254
Cost of fertility control	14009	0.40	2.35	0	25
Educational level of household head	14009	18.87	9.94	1	6
Educational level of spouse 14009	14009	14.89	8.67	1	6
Current age of wife	14009	38.61	9.56	16	65

Source: *Constructed by Authors from GLSS 7*

Table 4 presents a descriptive statistics on the categorical variables considered in this study. Firstly, from a total of 14009 observations, urban dwellers amounted to 43.9 percent whereas 56.19 percent resided in rural areas. The case of marital status of household heads was very different. Households with married heads were 77.9% compared to 22.1% of unmarried household heads. Besides, among the three most accustomed religions in Ghana, Christian household heads recorded the highest appropriately 56.14%. In addition, the difference between the number of Moslem household heads and those from other religions (including traditional religion) was 31.06% households. More so, about 67 percent of household heads and their partners

did not use contraceptives to either prevent or delay pregnancy. Last but not least, the forest zone records the highest number of inhabitants (5801 households), followed by the savanna zone with 5121 households (about 36 percent) and lastly, the coastal zone with 3,087 households (around 22 percent).

Table 4: Descriptive Statistics of categorical independent variables

Variable	Frequency	Percent	Cumulative
Area of residence			
Rural	7,845	56.1	56.1
Urban	6,164	43.9	100
Marital Status			
Unmarried	3085	22.1	22.1
Married	10,924	77.9	100
Religion			
Christian	7,865	56.14	56.14
Moslem	5248	37.46	93.6
Others	896	6.40	100
Contraceptive usage			
Yes	4623	33	33
No	9386	67	100
Ecological zones			
Coastal	3087	22.0	22.0
Forest	5801	42.0	64.0
Savanna	5121	36.0	100

Source: *Constructed by Authors from GLSS 7 (2016/17)*

5.2. Presentation and Discussion of Negative Binomial Regression Results

This section deals with an interpretation of the regression results from the negative binomial model. All estimations were carried out using Stata 14 software package. In reference to our objectives, we estimated two different models. The first model seeks to explain the impact of economic variables on fertility whereas the second model seeks to explain the impact of taste variables on fertility.

Effect of economic variables on fertility

The results from the negative binomial model as presented in Table 5 show that wage and non-labour income are inversely related to fertility and statistically significant at all levels. However, their impacts are slightly different. An increase in wage reduces fertility by 0.0019 children whereas that of non-labour income reduces fertility by 0.0021 children. This implies that, for every 1000 households, an increase in wage

or non-labour income by GH¢1 reduces expected number of children by 1.9 and 2.1 children respectively. It also implies that a reduction in non-labour income by GH¢1 will increase fertility by 0.0021 children. In sum, the empirical results for non-labour income contradict our initial expectation of a positive relationship between non-labour income and fertility whereas that of wage confirms the relationship established in most studies. It could therefore mean that, Ghanaians are moving more towards quality than quantity of children and that any additional wage or non-labour income is channeled towards making the existing children better than before. The results confirm Becker's (1960) claim that income or wage varies inversely with fertility.

Table 5: Estimates of Economic determinants on Fertility: Negative Binomial Model

Variable	Coefficients	Standard Errors	z	P > z
Wage	-0.0019	0.00067	-4.88	0.000***
Money cost	-0.0061	0.00048	-32.26	0.000***
Non-labour income	-0.0021	0.00029	-6.22	0.000***
Hours of work supplied by household head	-0.0027	0.00078	-7.40	0.001***
Hours of work supplied by spouse	-0.0189	0.00412	-2.62	0.004***
Cost of fertility control	0.0512	0.05413	0.72	0.265
Contraceptive usage	1.3242	0.16434	5.69	0.000***
Educational level of spouse	-0.0028	0.02341	-0.52	0.519
Constant	-17.8924	0.1734	-156.67	0.000***
Number of observations = 11,982				
LR chi 2(4) = 572.34				
Log likelihood = -11,914				
Prob > chi 2 = 0.0000				
Pseudo R^2 =0.0122				

Note: **** significant at 1%, ** significant at 5%, * significant at 10%*

Source: *Constructed by Authors from GLSS 7 (2016/17)*

Furthermore, it is evident from Table 4 that, an increase in money cost of child bearing reduces fertility by 0.0061 children. This implies that, parents averagely spend more on school children than other children who do not attend school. Interestingly, this result confirms Caldwell's (1967b) findings about urban Ghanaians. The study revealed that; two thirds of all respondents expressed their feelings about not been able to provide affordable adequate education for their children due to educational expenses. He argues that, this burden will not disappear even if the government assumes responsibility for such costs as school fees since education takes children

partly from the labour market and parents will have to cloth their children better to meet the requirements of the schools. Molnos (1968) also identified school expenses as the main economic drawback to a man having a large family in East Africa.

The results further show that, the impact of hours of work supplied by either the household head or spouse had a negative impact on fertility but at different magnitudes. An increase in hours of work by the household head reduces fertility by 0.0027 where as that of the spouse reduces fertility by 0.0189. Again, both impacts were significant at all levels. The impact of spouse (mostly wives) is relatively larger because in the African traditional set up, women are mostly accustomed to taking care of children. Besides, for most households, the head is expected to provide more for the family than the spouse. Hence, he spends most of his time in the labour market leaving him less time to procreate.

The sign of the coefficient for contraceptive usage did not come as expected. The results show that people who use contraceptives to either prevent or delay pregnancy rather have higher fertility levels. In particular, as people use contraceptives, we expect number of children to increase by 1.32. This result contradicts Easterlin's (1975) postulation that a negative relationship exists between contraceptive usage and fertility. This significant and positive relationship could be because of a wide gap between those who accept contraceptive usage and those who actually use it to delay or prevent pregnancy.

Cost of fertility control had a positive impact on fertility as expected. An increase in cost of fertility control increases expected number of children by 0.05 and it is statistically significant at five percent level of significance. This confirms Easterlin's (1975) postulation that, the lower the costs of fertility control, the greater the adoption of fertility regulation. Again, it reduces the gap between desired and actual number of children.

Educational level of spouse which is used to proxy the time cost of a child bearing had a negative impact on fertility. Thus, the higher the educational level of spouse (mostly wife), the higher her opportunity cost of raising children. Explicitly, the more her investment in human capital, the more she loses through depreciation of skills as she retires from active employment to take care of children in the house. This finding supports the claims by several authors like Becker (1960, 1991), Mincer (1963), Michael and Lazier (1971) and Snyder (1974) and many others that the time cost of a child bearing varies inversely with the demand for children. However, the time cost of child bearing turned out to be statistically insignificant at all levels in this study.

Effect of taste variables on fertility

This sub-section presents and discusses the effect of taste variables on fertility. From Table 6, it is evident that inclusion of taste variables into the model had an impact on the magnitude and significance of some economic variables. For instance, with regards to significance levels, cost of fertility control which was insignificant in the previous set up is significant now at five and ten percent. Nevertheless, the educational level of the spouse still remains insignificant.

The impact of wage on fertility changed to 0.0017 . However, the negative impact of money cost of child bearing on fertility reduced by 0.0036 children whereas that of non-labour income decreased by 0.0011 children. Thus, an increase in school expenses or an increase in remittances or any other incomes not accruing from work with the consideration of other taste variables reduces the impact on fertility by 0.0036 and 0.0011 children respectively. Besides, the negative impact of hours of work supplied by the spouse on fertility decreased by 0.0057 children whereas that of household head also decreased by just 0.0006 children after the inclusion of taste variables. More so, the positive impact of contraceptive usage on fertility also fell by 0.00128 children after the introduction of taste variables.

In addition, the results depict the impact of taste variables on fertility. For example, the educational level of household head was found to be significant and positively related to fertility. This finding contradicts the studies by Tawiah (1997) and Bhasin (2009) who concluded that education had a significant and negative relationship with fertility in Ghana. However, this could be true since majority of the households sampled for the study had spent some number of years in school.

A decision by the household head to get married (formally or informally) increases expected number of children born to a particular woman by 1.28 and is also significant at all levels. Probably, this happens because married household heads are more likely to make out as compared to divorced, widowed, separated or single household heads.

Moslem households had statistically significant more births than the rest of the sample. A probable reason attributed to this relationship is based on the fact that, the Moslem religion supports polygyny. On the other hand, Christian households have fewer births but were statistically insignificant to our model. This outcome is quite similar to that of Cain and Weininger (1973) who concluded that Catholics religion had no impact on fertility rate in the United States of America.

Table 6: Negative Binomial Estimates of taste variables on fertility

Variable	Coefficients	Standard Errors	Z	P > z
Wage	-0.0017	0.0013	-3.89	0.000***
Money cost	-0.0025	0.00056	-17.26	0.000***
Non-labour income	-0.0010	0.00042	-4.54	0.002***
Hours of work supplied by household head	-0.0021	0.00048	-5.11	0.001**
Hours of work supplied by spouse	-0.0132	0.00242	-3.50	0.000***
Cost of fertility control	0.00001	0.03101	1.44	0.016**
Contraceptive usage	1.3114	0.34029	4.86	0.000***
Educational level of spouse	-0.0051	0.00678	-0.53	0.466
Educational level of household head	0.1345	0.01425	6.71	0.000***
Child mortality	-0.0076	0.02425	-0.09	0.767
Married	1.2819	0.4826	5.21	0.000***
Christian	0.1462	0.95722	0.88	0.371
Moslem	2.7753	0.40847	4.86	0.000***
Coastal	0.7842	0.34785	0.52	0.711
Savanna	0.1965	0.48901	3.14	0.000***
Urban	-1.1182	0.75891	-4.78	0.000***
Male	0.6391	0.5785	2.78	0.010***
Constant	-19.7895	0.5642	-44.42	0.000***
Number of observations = 11,982				
LR chi 2(10) = 490.56				
Log likelihood = -11,914.10				
Prob > chi 2 = 0.0000				
Pseudo R^2 = 0.00141				

Note: **** significant at 1%, ** significant at 5%, * significant at 10%*

Source: *Constructed by Authors from GLSS 7 (2016/17)*

The influence of coastal settlement on fertility was negative but insignificant to our model. However, households living in savanna areas are expected to have 0.19 more children compared to their counterparts in the forest zones. This could be true since most individuals within the savanna zone practice agricultural activities and need more hands on the farm.

Besides, living in an urban area reduces household's fertility by 1.11 children. This is possible since urbanization exposes inhabitants to modern behaviour and roles which are unnoticeable but in turn reduce the demand for large families. This finding is similar to that of Garenne and Joseph (2002).

6. Conclusion and Recommendation

The study hypothesized that,economic factors influence a family's decision to demand more children. The empirical results from the first model points out that wage, non-labour income, money cost of child bearing, hours of work supplied by household head and spouse are significant and negatively related to fertility levels in Ghana. The educational level of spouse that was used to proxy time cost of child bearing was insignificant and negatively related to fertility. Cost of fertility control and contraceptive usage had positive influence on fertility behaviour with only the latter been significant at all levels. The introduction of taste variables into the model had a significant impact on the effect of economic variables on fertility except for wage. With regards to significance levels, cost of fertility control which was insignificant in the previous set up was significant after the introduction of taste variables. Nevertheless, the educational level of spouse still remained insignificant at all levels.

The educational level of household head had a significant but positive impact on fertility. Similarly, Moslem household heads, married household heads and savanna dwellers also had significant and positive influence on fertility. However, Christian household heads, urban residence and coastal settlement impacted negatively on fertility levels with only the latter been insignificant. Again, proportion of males among living children and child mortality had a negative but insignificant influence on fertility. In line with these findings, the study recommends a comprehensive policy measure that will include improvement in normal and overtime wages, an increase in support from governments for NGOs responsible for poverty reduction, and intensified communication programmes on family planning especially in rural areas.

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