CHAPTER 1: INTRODUCTION

1.1. Background of the study

Fertility analysis is important in understanding past, current and future trends of population size, composition and growth. Information on fertility levels, patterns and trends experienced by a country is important for socio-economic planning, monitoring and evaluating programs. In Europe, the declining population growth and the ageing population causes concern about the future of the welfare states, while the same trend in developing countries is regarded as good news because high population growth usually is seen as closely linked with low economic and human development (Gudbrandsen, 2010). Fertility rate is highest in sub-Saharan Africa (SSA) than any parts of the world, mainly due to strong kinship networks and high economic and social values attached to children (Romaniuk, 1980; Caldwell and Caldwell, 1987; Hinde and Mturi, 2000). The low level of economic development contributing to high infant and child morality in the region is also another factor contributing to high fertility resulting in a rapid rate of population growth (Lindistorm and Berhanu, 1999).

According to classical economic theory, population growth and economic development are closely linked. Malthus (1798b) claimed in the eighteenth century that the size of a nation's population always will be limited by economic resources and possibilities. Becker (1960) argues on the other hand that economic development will reduce the number of children ever born. When a country gets richer, women will get better income possibilities and the cost of raising children (lost income) will increase. This and the fact that improved economic conditions also implies that better schools and a better health system may induce families to reduce the number of children and use more resources on each child. Household members may, however, have different preferences over this *Quantity - Quality trade-off.*[1]

High fertility rates could be one of the major deterrents to sustained economic growth in Sub Saharan African (SSA) countries. The ill-effects of population growth can be examined at macro and micro levels. At a macro level, high population growth combined with stagnant income can result in growing income inequalities,

[1]This theory argues that while an overall increase in household income may be expected to increase the demand for children (i.e. the quantity of children), it may instead lead to an increase in the cost of children (i.e. the quality of children) Thus, parents should choose between a large number of children and a smaller number of children of better 'quality'.

lack of economic opportunities and high level of unemployment (Acsadi, 1990). In SSA countries where productivity level is low, food production cannot keep up with population growth, which leads to food insecurity. SSA countries are predominantly agricultural based which also puts pressure on land use. Densely populated areas result in limited arable land for production and consumption.

Another problem created by high population growth is congestion and rapid depletion of resources, especially in developing countries where property rights governing access to the resources are not well-defined. This leads to overexploitation of resources, pollution, and degradation of the environment. Moreover, pressure on limited land in the rural areas due to high population growth has contributed to a massive migration of peasants to urban centers (Acsadi, 1990). Indeed, migration to the city has led to the mushrooming of slums in the cities, which has exacerbated the problems of unemployment, lack of proper hygiene, and education opportunities.

At the micro level, high population growth leads to a more serious issue of poverty. Poorer families, especially women and marginalized groups, bear the burden of a large number of children with fewer resources per child, further adding to the spiral of poverty and deterioration in the status of women. Low levels of income among the poorer families with many children lead to inadequate food availability, which perpetuates malnutrition, which in turn accelerates high levels of infant and maternal morbidity and mortality (Acsadi, 1990). SSA has, until very recently, been characterized by high population growth rates and high levels of fertility. Fortunately, new evidence suggests that fertility levels have begun to decline in the region. However, the pace and intensity of such change among the countries of the region, has by no means been uniform (Palamuleni, 2010).

The Zambia Demographic and Health Survey (ZDHS, 2007) results show that fertility levels have declined slightly from 7.2 in 1980 to 6.7 in 1990 and 6.2 births per woman in 2007, with only Copperbelt, Lusaka and Western provinces experiencing Total Fertility Rates[2] (TFRs) below the national average. The decline in fertility seems to be concentrated in urban areas, while fertility in rural areas has remained almost constant. Different fertility regulation mechanisms such as use of modern contraceptives, termination of pregnancies and delayed marriages that have contributed much towards fertility reduction in urban areas are not available in rural

[2] **Total Fertility Rate (TFR):** is the number of children that a woman would have by the end of her childbearing period if she lived through all her fertile years.

areas to play similar roles in most SSA countries (Markos, 1997). The fertility levels and trends in Zambia in the past decades need to be carefully examined in order to ascertain the influential factors that are responsible for the current fertility trend in the country.

The level of current fertility is one of the most important topics because of its direct relevance to population policies and programs. Current fertility rates for the three years preceding the 2007 survey are presented in Table 1 for the country as a whole and by urban-rural residence. The results indicate that the TFR is 6.2 births per woman. This means that, on average, a Zambian woman will give birth to 6.2 children by the end of her childbearing years. The current TFR is a slight increase from the 2001-2002 TFR of 5.9.[3] Rural areas have a much higher TFR than urban areas (7.5 and 4.3, respectively). Table 1 also shows that there are large urban-rural differences in ASFRs[4] for all age groups. The table also shows ASFRs for the various age groups. The largest variations are in age groups 20-24 and 25-29 in which the rates among rural women exceed 300 births per thousand women, compared with urban rates of 201 and 190 births per thousand women, respectively.

Table 1: Current Fertility

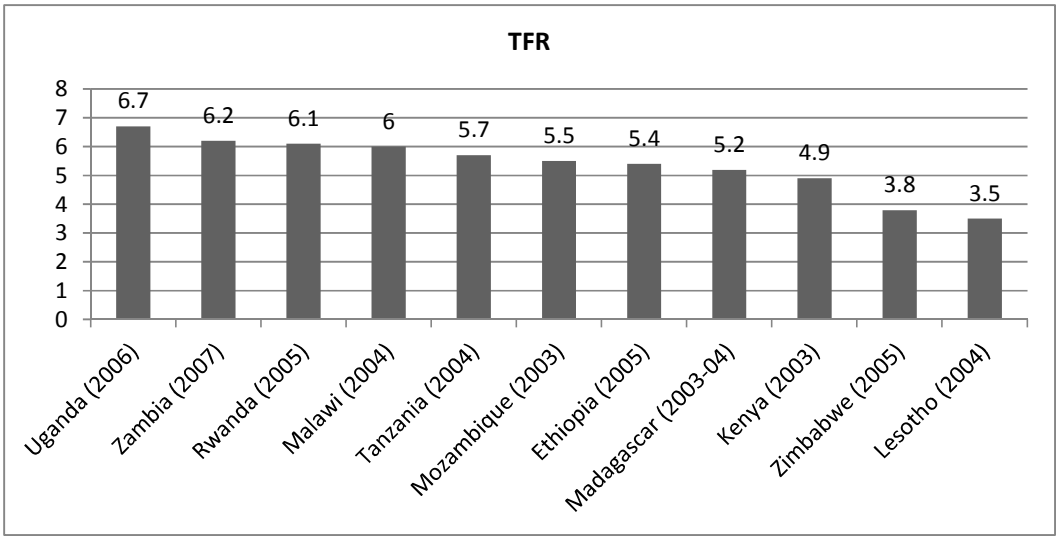
	Residence		
Age – group	**Urban**	**Rural**	**Total**
15 – 19	99	189	146
20 – 24	201	329	274
25 – 29	190	314	263
30 – 34	181	277	240
35 – 39	127	228	191
40 – 44	52	114	90
45 – 49	5	44	29
TFR	4.3	7.5	6.2

Source: ZDHS, 2007 Report.

[3] See earlier versions of the ZDHS Reports for the years 1992, 1996 and 2001-2002 for a complete review of this information.

[4] **Age Specific Fertility Rate (ASFR):** is the number of live births per thousand women of a specific age group

Figure 1: Total Fertility Rates of Various Countries in Sub-Saharan Africa



Source: ZDHS Report, 2007.

The reproductive behaviour of women in a given society is affected not only by their physiological structure and biological makeup but also by a number of socio-economic and demographic factors. Differences in age at entry into marriage, access to family planning services and the economic status of the household appear to play significant roles in creating variations in the level of fertility.

Table 2 indicates that there are variations in the TFR by residence, education, and wealth quintile. The TFR decreases with increasing level of education. Women in the highest wealth quintile have an average of five children fewer than women in the lowest quintile (3.4 and 8.4 births per woman, respectively). The mean number of births to women age 40-49 provides a basis for inferring long-term trends in fertility by allowing for the comparison of the TFR with the mean number of births to women age 40-49. The latter indicator takes into account the fertility behaviour among older women who are nearing the end of their reproductive period; thus, it serves as an indicator for average completed fertility among women who began childbearing during the three decades preceding the survey. If fertility is stable over time in a population, the TFR and the mean number of children ever born (CEB) for women age 40-49 will be similar. If fertility levels have been falling, the TFR will be lower than the mean CEB among women age 40-49.

Table 2: Fertility by Background Characteristics

Background Characteristics	Total fertility rate	Mean number of children ever born to women age 40-49
Residence		
Urban	4.3	6.0
Rural	7.5	6.8
Education		
No education	8.2	6.8
Primary	7.1	6.9
Secondary	5.2	5.8
More than secondary	2.4	3.8
Wealth quintile		
Lowest	8.4	7.0
Second	7.6	7.0
Middle	7.2	6.5
Fourth	5.2	6.7
Highest	3.4	5.3
National	**6.2**	**6.5**

Source: ZDHS Report, 2007.

Table 3 shows estimates of ASFRs from a series of surveys and censuses conducted in Zambia since 1980. In addition to the 2007 ZDHS, these sources include the 1980, 1990 and 2000 censuses and the earlier rounds of the ZDHS in 1992, 1996 and 2001-02. Before 1992, the peak Age-specific fertility rates *(*ASFR) was in age group 25-29. Results from 1992, 1996, 2001-2002 and 2007 ZDHS surveys, as well as the 2000 Census, show that the peak has shifted to the 20-24 age group.

Table 3: Trends in Age-Specific and Total Fertility Rates

Age – group	Census 1980	Census 1990	ZDHS 1992	ZDHS 1996	Census 2000	ZDHS 2001 – 02	ZDHS 2007
15 – 19	153	94	156	158	141	160	146
20 – 24	318	267	294	280	277	266	274
25 – 29	323	294	271	274	269	249	263
30 – 34	289	272	242	229	232	218	240
35 – 39	225	226	194	175	175	172	191
40 – 44	115	129	105	77	83	79	90
45 – 49	17	59	31	24	30	30	29
TFR 15 - 49	**7.2**	**6.7**	**6.5**	**6.1**	**6.0**	**5.9**	**6.2**

Source: ZDHS Report, 2007.

1.2. Problem statement

Zambia faces high levels of fertility compared to other countries in the region. On average, rural women are having three children more than urban women (7.5 and 4.3 children, respectively, ZDHS, 2007). Though Zambia's fertility has been declining, the rate of decline has been rather slow (Census Report, 2000). High fertility rate is one of the fundamental causes of relative underdevelopment in any developing country. This is because it reduces resources by drawing upon the limited government revenues that would otherwise have been used to provide rudimentary economic, health and social services for everybody in the country, especially for the poor and vulnerable persons; and which could have otherwise been used for increased production and development.

High household fertility level also has numerous consequences on the household level such as women not having enough time to give proper care to their young children. Women also become less productive economically if they have more children than they should as they are unable to have enough time for their own schooling and this exacerbates the problem of poverty. High fertility is also one of the causes of maternal mortality. Therefore, as a goal of development, countries seek to reduce fertility especially in Zambia where fertility is among the highest in the world.

High fertility rates could be one of the major deterrents to sustained economic growth in Sub Saharan African countries. This creates the problem of congestion and rapid depletion of resources and also leads to overexploitation of resources, pollution, and degradation of the environment. High population growth combined with stagnant income can result in growing income inequalities, high unemployment, lack of economic opportunities and proper hygiene (Acsadi, 1990).

Since 1992, the government, through The National Health Policies and Strategies (Health Reforms), has invested a lot in resources and made tremendous efforts to reduce fertility through the family planning programme (child spacing) by making it more available, accessible, and affordable. However, the decline has been low in Zambia and is still among the highest in the region (Lesotho 3.5, Zimbabwe 3.8, Kenya 4.9, and Mozambique 5.2, (ZDHS, 2007)).[5]

[5] For a detailed analysis of the fertility rates in the region, see Figure 1: Total Fertility Rates of Various Countries in Sub-Saharan Africa.

If we are to achieve the desired level of fertility, we need to understand the drivers of high levels of fertility in Zambia, including institutional variables such as access to family planning. The application of the Poisson regression model has not yet been attempted in the Zambian context though may provide more insights into the determinants of fertility. This is one of the few studies done on determinants of fertility in Zambia. No published study exists on Zambia.

1.3. Objectives of the study

The main objective of this study is to explore, describe and explain the socioeconomic determinants affecting fertility among women in Zambia. Specifically, the objectives are to:

- Identify the major factors which determine fertility among women by applying the Poisson regression model;
- Suggest appropriate policy measures to be taken in achieving the stipulated goals in the sphere of reproductive health outcomes and implementation of population programs in Zambia.

1.4. Hypothesis

The hypotheses to be tested in this study are the following:

- The income/wealth of the female is expected to be negatively related to her fertility decision.
- The educational attainment of the female is negatively related to her fertility decision.
- A female's participation in the labor force is expected to be negatively related to fertility.
- The ever use of contraceptives by the female is expected to be negatively related to fertility.
- Women in urban areas have a lower fertility level than women in rural areas.

1.5. Significance of the study

In contributing to the existing literature, the purpose of the analysis is to extend our understanding of the potential determinants, demographic and economic, of fertility choice by examining empirically the validity of the proposition that fertility is a function of economic and demographic variables. Several studies have

been conducted both in developed and developing countries on the socioeconomic determinants of fertility, including most SSA countries. This is one of the few studies done on determinants of fertility in Zambia. No published study exists on Zambia. This study therefore will contribute to the literature using recent cross sectional data from the Zambia Demographic and Health Survey.

In addition, factors that determine fertility are measured as count data (i.e. children ever born to a woman by the time of the survey) and are assessed using the recently developed count data modeling; namely, the Poisson regression model. It is a recently adopted model used to investigate the relation between the number of children ever born and the socio-economic and demographic variables of women obtained from a given survey (Winkelmann and Zimmermann, 1997). Poisson regression is one of the robust models for the analysis of discrete data that are based on the assumption that the dependent variable (number of live births to a woman) is distributed as Poisson, and its logarithm is a linear function of the independent variables.

Finally, it is our considered view that the results of this study could be useful in policy formulation that will go towards strengthening the family planning program and implementation of population programs in Zambia.

CHAPTER 2: LITERATURE REVIEW

2.1. Empirical literature

Vigorous scholarly investigation of the determinants of fertility in low-income settings extends back to the 1960s, and this has produced a rich theoretical and empirical literature. For the purpose of developing policies and programs to reduce fertility in the remaining high fertility societies, one can reasonably protest that while the amount of knowledge about fertility determinants is extensive it is undifferentiated. It is a challenge to distill a few key lessons from this overwhelming body of research.

On the African continent, Ayebale (2005) examined the determinants of cohort fertility in Uganda. The study utilized three datasets from the Uganda Demographic and Health Surveys (UDHS) carried out in 1988/89, 1995 and 2001. These datasets were combined to form four cohorts. To establish the determinants of cohort fertility preference, a Poisson regression model was used. The study found that women in the rural areas had higher fertility preferences than their counter parts in urban areas. Women who had attained secondary level of education and above had lower fertility preference than those with no education at all. In the study, increasing age of mother was associated with increasing fertility preference. Increasing age at first birth was associated with decreasing fertility preference.

Bhasin (1999) assesses the determinants of fertility in Ghana using the Ghana Living Standards Survey data for 1998-1999 and control function approach. The determinants of fertility considered in this study were the use of contraceptives by the mother and father, hours spent by the mother in taking care of children and personal characteristics of household members, such as the age of the mother, age square of the mother and education of the mother; age of the father, age square of the father and education of the father; consumption expenditure per adult, and the variables that correct for endogeneity and heteroscedasticity such as the fitted residuals for the logarithm of consumption expenditure per adult, and the interaction term between the fitted residuals and the logarithm of consumption per adult.

It was observed that when consumption expenditure per adult is treated as endogenous, the significant determinants of the number of children observed for households are the logarithmic of consumption expenditure per adult, the quadratic functions in age of the women and her husband, mother's and father's schooling, the number of hours spent by the women in taking care of children, contraceptive use,

fitted residuals for the logarithm of consumption expenditure per adult, and interaction term between the fitted residuals and the logarithm of consumption expenditure per adult.

El Lahga and Olfa (2008) assess the main socioeconomic determinants of the household fertility decision in Tunisia, referring to Becker and Lewis hypothesis (1973). A count data model, which reasonably describes observed completed fertility patterns, is used. A Poisson regression model of household fertility decision is applied. To accommodate the under-dispersion exhibited in the sample a model based on squared polynomial expansion of Poisson density is also used. They find that a husband's characteristics are almost as important as those of wives in determining fertility decision. Both women and men's education have an important impact on completed fertility. But the role of women in Tunisian families is dominant.

Tsegaye (2010) assesses the association between employment status and fertility behavior of married women in the context of Ethiopia. The analysis was made based on the 2000 and 2005 Ethiopian Demographic and Health Survey data. The findings showed that there was an insignificant relationship between women employment status and fertility behavior at a country level. However, this relationship turned and got significantly negative in the urban areas of Ethiopia. And it is was also found that there was no significant variation in the association between women employment and fertility level among the two cross sectional years (2000 and 2005) under consideration. The potential endogeneity of labor force participation is not taken into account. Instead, the author minimizes the potential endogeneity bias by running multiple regression models.

Tadesse (2010) examines the socioeconomic determinants of fertility in Ethiopia. The EDHS of 2005 and the Poisson regression model are used. Dependent variable of interest is the number of children ever born by a woman - a non-negative integer or count. In the model, wealth is considered to be endogenous and access to a financial institution is used as an instrument. The paper concludes that urbanization plays a key role in reducing fertility. Improving economic status of women leads to lower fertility. Education of women beyond primary level has a strong effect in reducing fertility. Lowering child mortality through better access to health services could reduces fertility.

Experiences from Latin America (Guzman, 1994), East as well as South East Asia (Casterline, 1994), in general, showed that fertility decline is the outcome of modernization factors and social transformations that are expressed in rapid falls in persons engaged in agriculture, the growth of market economy along with expansion of the wage earning sector, the steady rise in schooling, active participation of women in production activities, and wider access to family planning information and services. Rapid decline in fertility was possible in these parts of the world due to the integration of three key elements required for change in family size: modernization of the economy, diffusion of new family ideals and active government policies favouring family planning programs (Klerman and Willis, 1997).

In Europe, Hondroyiannis (2009) examined the determinants of fertility using panel data for twenty-seven European countries. The study employed panel co-integration to estimate fertility as a function of demographic and economic variables. He found that low fertility in most industrialized countries in Europe is due to low infant mortality rates, high female employment, low nuptiality rate (frequency of being married) and high opportunity cost of having children. Using two measures of economic uncertainty, which are associated with labor market decisions - a production (an output) volatility measure and the unemployment rate – the paper also examined to what extent economic insecurities affect fertility decisions. The empirical results show that both measures of economic uncertainty have a significant negative impact on fertility implying that labor market insecurities might be a significant factor affecting fertility decisions.

Aldieri and Vinci (2007) assessed the impact of the level of education on the number of children in Italy. They selected 1,490 families from the 1997- 2005 Longitudinal Investigation on Italian Families (ILFI) dataset. The dependent variable is number of children ever born to each respondent (and to his partner). Since the number of Children Ever Born (CEB) is a count variable, they implemented three empirical models: Poisson, Zero-Truncated Poisson and an Instrumental Variable Poisson, where grandparents' education is exerted as an instrument of parents' education. In particular, they considered two stages for each model: in the first stage, they estimated the impact of female's education on her number of children, and in the second one, they used also partner's education to identify the previous effect. From the empirical results, they observe a significant negative effect of the level of education on the number of children. To account for the potential endogeneity of

education, they also estimated an Instrumental Variable Poisson model (IVPOIS), a Generalized Method of Moments (GMM) estimator of Poisson regression which allows endogenous variables to be instrumented by excluded instruments. In this case, grandparents' education was applied as an instrument of parents' education.

Bratti (2002) uses data from the 1993 Survey of Household Income and Wealth conducted by the Bank of Italy in order to estimate a reduced form purist model of female marital fertility and labor force participation. It focuses in particular on the effect of formal education on both fertility and labor force participation, and accounts for the potential endogeneity of education. After estimating an education regression and testing for weak exogeneity of education and controlling for a wide range of characteristics of a woman's family and marital background he did not find any residual evidence of endogeneity of education with labor force participation and fertility. Estimates showed that increasing education up to the upper secondary level exerted ceteris paribus a positive effect on marital fertility at ages 21–39 and that highly educated women postponed fertility and had a higher labor market attachment.

In the Middle East, Khraif (2001) assesses determinants of fertility in Saudi Arabia, using a regression analysis. He found that age at marriage and woman's education are apparently the most important determinants of fertility behavior. He also found that some variables, specifically "children death", "son preference", and the geographic region, are significant determinants of fertility. On the contrary, the analysis showed that living within an extended family setting is associated with low fertility levels. Also surprisingly, woman's participation in the labor force and husband's educational attainment were not among the significant fertility determinants in Saudi Arabia.

Chartouni and Al Awad (2010) examine the factors that have contributed to the decline in fertility in the Gulf Cooperation Council countries in recent years, Employing data from the 2008 U.A.E. Household Expenditure Survey, this paper analyzes the determinants of fertility using a Poisson fertility count model. The results show that economic factors, in terms of the costs and benefits that families derive from children in the U.A.E. are not important determinants of fertility due to the large size of social insurance provided by the U.A.E. government. Moreover, labor market participation by either males or females do not play a critical role in determining fertility in the U.A.E. The two primary causes of declines in fertility are

a) late marriages or late first births, and b) higher levels of female education. Other contributors to drops in fertility are marriages between U.A.E. national males and foreign females and increases in child birth intervals. Conversely, the size of household residences and the number of domestic workers working in a household contribute positively to fertility.

As indicated above, there is no single factor responsible for explaining fertility transition. Depending on the prevailing situation of a given country, the rationale behind fertility decline could be attributed to changes in socio-economic conditions as well as cultural transformation. Fundamental issues and approaches used in each of the theories mentioned above could thus be taken into account while assessing the determinants of fertility in Zambia.

CHAPTER 3: METHODOLOGY AND ANALYTICAL FRAMEWORK

3.1. Empirical model and estimation procedure

Individual household fertility decisions are modeled in various ways in the literature. Barmby and Cigno (1990) estimate fertility patterns using a sequential probability model. Sobel and Arminger (1992) use a non-linear simultaneous probit model. In recent years, the modeling of household fertility decisions has utilized Poisson type models. In many empirical studies of fertility, the number of children in a household is modeled as a function of other social and economic variables, such as a female's education level and family income. So this study estimates a reduced form equation for the number of children ever born, an approach generally in line with other economics based estimation (Winkelmann and Zimmermann; 1994 and Schultz and Zeng; 1995).

Factors determining fertility measured as count data (i.e. children ever born to a woman by the time of the survey) are assessed using the recently developed count data modeling; namely, the Poisson regression model. It is a recently adopted model used to investigate the relation between the number of children ever born and the socioeconomic and demographic variables of women obtained from a given survey (Winkelmann and Zimmermann, 1995; Long, 1997). Poisson regression is one of the robust models for the analysis of discrete data that are based on the assumption that the dependent variable (number of live births to a woman) is distributed as Poisson, and its logarithm is a linear function of the independent variables.

A Poisson regression specification has two advantages. First, it captures the discrete and non-negative nature of the data, and second, it allows inference to be drawn on the probability of event occurrence. Therefore, the model accounts for the heteroscedastic and skewed distribution inherent in non-negative data, and attributes a non-negligible probability to the outcome zero (Winkelmann and Zimmermann 1995). An important feature of this model is that the heterogeneity of y is modeled as a deterministic function of the explanatory variables, therefore the randomness is intrinsic and not due to other factors as in the classical regression model. Given the discrete and non negative nature of our dependent variable, the OLS model is clearly inappropriate as it specifies a conditional mean function $x'\beta$ that may take negative values and a variance function that is homoscedastic. If the conditional mean function is in fact exp ($x'\beta$), the OLS estimator is inconsistent for β and the

computed OLS output gives the wrong asymptotic variance matrix (El Lahga and Olfa, 2008).

Under the Poisson regression model, the conditional mean and variance of the dependent variable are constrained to be equal for each observation. This is sometimes referred to as equi–dispersion. In practice, this assumption is not satisfied, because the variance can be either larger or smaller than the mean. If the variance is not equal to the mean, the estimates in Poisson regression models are still consistent but inefficient. Its consequence for parameter estimates in Poisson regression models is like the problem of heteroscedasticity in linear models. The regression parameters are consistently estimated, but the standard errors are biased downward leading to the rejection of too many false null hypotheses (Winkelmann and Zimmermann, 1994). Therefore, an inference based on the estimated standard errors is no longer valid. The negative binomial regression model is more flexible than the standard Poisson model and is frequently used to study count data with over–dispersion.

Therefore, to model fertility behavior using the standard Poisson regression model seems a good starting point. However, assessing the validity of equi-dispersion is necessary to account for either over or under-dispersion. If the model is overdispersed, the Negative binomial regression model is an option. We ran a Negative Binomial Regression model to compare the results with those of the Poisson regression. There are no signs that the Negative Binomial Model should be preferred over the Poisson, in fact, since equidispersion is present, the Negative Binomial *is* an ordinary Poisson regression, as seen from equal coefficients and standard errors.[6]

The Poisson model

The dependent variable is a count variable denoting the number of children ever born to a spouse which takes on non negative integer values. The expected value of the count variable (***y***) conditional on a set of explanatory variables x is modeled as:

$$\mathrm{E}\left(y \middle/ x\right) = e^{(x'\beta)} \qquad (1)$$

[6] See the results in the appendix table 1B.

The specification above insures that $E\left(\frac{y}{x}\right) > 0$ Thus, the number of children ever born to a spouse conditional on x is the Poisson distribution with the probability density of

$$P(Y = y/x) = \frac{e^{-e(x'\beta)} e^{(x'\beta)^y}}{y!} \quad \text{Where } y=0, 1, 2,....N \quad (2)$$

The maximum likelihood Poisson fertility equation is then specified as:

$$L(\beta) = \sum_{i=1} \left\{ y_i x_i \beta - e^{x_i \beta} \right\} \quad (3)$$

The explanatory variables $x_i's$ in the fertility equation refer to socioeconomic variables describing household and women's characteristics.

The full model is therefore given as:

$$\mu_i = e^{\beta_0 + \sum_{j=i}^{k} \beta_j x_j} \quad (4)$$

Where;

μ_i = the expected number of children per woman i;

e = the base of natural logarithms;

β_0 = the intercept;

$\beta_j's$ = regression coefficients;

$x_j's$ = explanatory variables.

3.2. Data sources and variable definitions

3.2.1. Data sources

The study employs cross sectional data from the Zambia Demographic and Health survey, 2007. The ZDHS 2007 is a nationally representative sample of 7,146 women age 15-49 and 6,500 men age 15-49 who were interviewed. This sample provides estimates for Zambia as a whole, for urban and rural areas, and, for most indicators, an estimate for each of the nine provinces.

Sample Design

The DHS data is usually weighted. We used STATA's svy (survey) commands to take into account the complex survey design of the DHS by incorporating women's sampling weights and adjusting the standard errors for the cluster sampling of primary sampling units. Thus, population-based estimates take into account the differential probability of selection into the survey. Survey data analysis method (svy) is usually employed to analyze the survey data with unequal weight for the given sample data.

3.2.2. Variable definition

The number of total children ever born is modeled as a function of socio-economic and demographic variables. These include the following independent variables. Table 4 shows the variable definitions.

Income / wealth

It is expected that wealthier families will have fewer children. There are no income-variables in the dataset, but there is a wealth indicator. In the DHS, wealth is used as a proxy for income. The literature suggests that it is very difficult to measure income directly in many low income countries (Deaton, 2005). In some cases, expenditure is used as a proxy for income. In the DHS, wealth is measured using household ownership of and access to basic amenities (CSO, 2009).

Schooling

Schooling is included in this section with the expected view that more schooling leads to better knowledge about contraception and better ability to get hold off and understand issues related to family planning. It is defined as a categorical variable.

Age

A female's age is included as an explanatory variable, because age (*Age*) reflects characteristics of the life cycle and can, therefore, condition some of the explanatory variables mentioned above. In the model, age is a continuous variable with a minimum of 15 years and a maximum of 45 years.

Female autonomy

Female autonomy in this model is defined as the freedom and authority that a woman to make her own decisions regarding the number of children she wants to have. As a measurement of female autonomy, we have chosen the variable labeled

"Final say on deciding what to do with money husband earns". Since we are only interested in the autonomy of the female, we created a dummy for this response. In the model, 1 = female respondent has the final say on deciding what to do with money husband ears, 0 = other.

Rural

The place of residence generally tends to have a notable impact on fertility, as it reflects major differences in a series of economic conditions faced by families. For instance, urban families will have fewer children than rural families, because it costs less to raise children on a farm. Also, rural communities lag behind urban centers in the distribution of contraceptive knowledge.

Work status

In the neoclassical framework, labor activities of the interviewed females (work) are expected to be related to fertility decisions. In the model, work status is defined as a dummy variable, 1= respondent working, 0 = respondent not working.

Access to media

The influence of the media was measured as whether the woman listened to the radio or not and also whether they read the newspaper or not. These variables were included on the assumption that greater information about contraceptive technology would be available to the woman if she listened to the radio or read the newspaper. These variables are expected to have a negative effect on fertility. In the model, they are defined as dummies. See table 4.

Contraceptive use

Another important determinant of fertility decision is the contraceptive use. The variable considered is the ever use of contraceptive by the female respondent. The variable is a dummy with 1 = ever used contraceptive and 0 = never used any contraceptive.

Table 4: Variable Definitions

Variable	Description
Total Children Ever Born (CEB)	Total number of children ever born to female respondents between age 15 – 49 years – Dependent variable
Age	Age of the female
Age squared	Age squared of the female.
Schooling	The educational attainment of the female 0=No education 1=Incomplete primary 2=Complete primary 3=Incomplete secondary 4=Complete secondary 5=Higher
Female autonomy	Final say on deciding what to do with money husband earns. Dummy variable. 1 = female respondent alone, 0 otherwise.
Age at marriage	The age at which ever married women aged between 15 – 49 years get married.
Wealth index	The index is based on assets, housing characteristics, sanitation and water facilities. This variable is the Proxy for income. Wealth quintile1=Poorest Wealth quintile 2=Poorer Wealth quintile 3=Middle Wealth quintile 4=Richer Wealth quintile 5=Richest
Rural	Type of place of residence. Dummy variable. 1 = rural, 0 otherwise.
Ruralage	Interactive coefficients of rural and age
Province	Regions of the country
Work status	Work status. Dummy variable. 1 = employed, 0 otherwise.
Ever use of contraceptives	Female's ever use of any form of contraception. Dummy variable. 1= Ever used any contraception method, 0 otherwise.
Sex of household head	Sex of the household head. Dummy variable. 1 = male, 0 otherwise.
Reads newspapers	Frequency of reading the newspaper, Dummy variable. 1 = respondent ever reads, 0 otherwise.
Listens to Radio	Frequency of listening to the radio, Dummy variable. 1= respondent ever listens to radio, 0 otherwise.
Number of children at first use	Number of children the female respondent had before they first ever used any form of contraceptives.

3.3. A discussion about causality and endogeneity

In this model, endogeneity issues can arise. How is income affected by family-size? Do women choose not to get further educated as a consequence of pregnancy? The dependent variable can have an effect on the independent variable and in this case reverse causality is said to be present. The problem that might arise is known as simultaneity, the dependent variable and the independent variable being jointly determined. Examples of variables which stand in a relation of mutual interdependence with fertility (or are jointly determined) are infant mortality and female labor force participation. There are good reasons for infant mortality to affect fertility. Parents may have more children than they ultimately desire in anticipation of losing some (so-called 'hoarding' behavior). They may also replace lost children.

At the same time, high fertility itself is likely to raise infant mortality, due to both biological and behavioral reasons. When explanatory variables are influenced by the 'dependent variable' (in this case fertility), or when both are influenced by the same unobserved variables, standard estimators are biased and inconsistent. Unbiased estimation (e.g. using two-stage techniques) is possible if adequate 'instruments' can be found for the endogenous variables, but credible instruments are hard to find in this context. In the case of infant mortality, for instance, this would require specifying an exogenous factor which affects infant mortality but is not otherwise correlated with fertility.

An econometric problem arises if schooling is endogenous to fertility (e.g. Sander 1992). The reasoning is that mothers with children at home have fewer resources (both in terms of time and finance) to invest in their own schooling, while there may also be unobserved characteristics (such as ability) causing a selection into schooling that may also determine fertility. It is also correct to assume that women might end their education if they get pregnant. This is, however, not necessarily a widespread issue. Some women might also go back to school. Even though the causality could work in the opposite direction, I believe that in most cases, level of education is a determinant for fertility decisions, not the other way around. Similar to research conducted in other developing countries characterized with low levels of education (e.g. Ainsworth, et al. 1996), education is considered to be exogenous to fertility in this analysis. In general, the coefficients should be thought of as relationships, and not causes, as the causality in some respect is difficult to establish.

CHAPTER 4: EMPIRICAL ANALYSIS

4.1. Descriptive statistics of the sample

Table 5: Characteristics of the Respondents

Variable	Statistic	
Children Ever Born (CEB); mean (standard deviation)	3.99	2.80
Age in years; mean (standard deviation)	31.21	9.22
Level of education (%)		
no education	10.37	
incomplete primary	34.68	
complete primary	18.57	
incomplete secondary	25.36	
complete secondary	6.02	
Tertiary	5.01	
Total	**100**	
Female autonomy; mean (standard deviation)	0.99	0.26
Age at marriage; mean (standard deviation)	17.84	3.50
Wealth index; mean (standard deviation)	3.02	1.39
Rural (%)	55.53	
% of women who have ever used contraceptives	62.76	
% of women who are working	48.36	
Sex of household head (% male)	74.59	
% of women who read newspapers	35.54	
% of women who listen to radio	70.21	
% of women who had children at first use of contraceptives	62.76	

Table 5 shows the characteristics of the respondents of the sample which is representative of the Zambian women population aged 15-49 years. The table shows that the average woman has 3.99 children, with a standard deviation of 2.8. About 10 percent of the women have no formal schooling, while about 34.7 percent have incomplete primary with about 18.6 percent having completed primary. In addition, about 6 percent have completed secondary education with 5 percent having completed tertiary education.

The table also shows that the average age at marriage is 17.84 years, with about 55.5 percent of the population living in the rural area, while the other 44.6 percent lives in the urban area. About 63 percent of the female respondents have used some form of contraceptive before. Further, the table shows that about 43.8 percent of the women are working while 74.6 percent of the household heads are male. About 35.5 percent of the women have access to media through reading newspapers while about 70.2 percent have access to media through listening to radio. Finally, the table also shows that about 63 percent of the women who used contraceptives had children at their first ever use.

4.2. Results from the multivariate analysis

The Poisson table of results is presented in Table 6. Individual-level controls include the age of the woman measured in years and an age squared variable accounting for the non-linearity associated with age-related variables. The study found that the coefficients have the correct signs, indicating that the number of children increases with age.

Table 6: Poisson Regression Output

Dependent variable – Children Ever Born (CEB)

Variable	Coefficient	Linearized standard error
Age	.2168039***	.0071796
Age squared	-.0023413***	.0001034
No education (reference)		
Incomplete primary	-.0036028	.0176182
Complete primary	-.0418568**	.0204621
Incomplete secondary	-.0650916***	.0241347
Complete secondary	-.171326***	.0463957
Higher	-.2857603***	.0486499
Female autonomy	-.0238123	.018425
Age at marriage	-.0407652***	.0021983
Wealth quintile 1 (Poorest, ref.)		
Wealth quintile 2 (poorer)	.0200405	.0175337
Wealth quintile 3 (middle)	-.0525027***	.0185794
Wealth quintile 4 (richer)	-.112399***	.0234494
Wealth quintile 5 (richest)	-.1840651***	.0309043
Rural (rural=1; urban =0)	.2287094***	.057998
Rural x Age	-.0064212***	.0016785
Central (reference)		
Copperbelt	0.0002095	.0245556
Eastern	-.0749794***	.0286666
Luapula	.0479734*	.0258237
Lusaka	-.0604075**	.0269949
Northern	-.0399795	.0278766
Northwestern	.0202667	.0307031
Southern	.0011673	.0278842
Western	-.0122616	.0319176
Ever use of contraceptives	-.2849672***	.0613797
Work status	-.03406**	.0135323
Sex of household head	-.1444317***	.016764
Reads newspaper	-.0287172*	.0163072
Listens to radio	-.0334054**	.0129519
Children at first use (0, ref.)		
Children at first use (1)	.5110359***	.0573764
Children at first use (2)	.5491325***	.058719
Children at first use (3)	.6244543***	0.59972
Children at first use (4+)	.702797***	.0593313
Constant	-2.452259***	.1225767

Log likelihood = -9449.8933
Pseudo R2 = 0.2460
LR $\chi^2(33) = 6167.61$,
Prob > $\chi^2 = 0.0000$
* p<0.1, ** p<0.05, *** p<0.01

Wealth/Income

Following the results of the analysis, taking the poorest as our reference, being poorer increases fertility by 2% ($e^{0.02}$=1.02), holding all other variables in the model constant. Compared to the poorest females, respondents in the middle category have a lower fertility by 5% ($e^{-0.05}$=0.95), keeping all other variables in the model constant. For those women in the richer category compared to the poorest, there is a further decline in fertility. Fertility is lower by 11% ($e^{-0.11}$=0.89), all other aspects being equal. The richest have the furthest decrease in fertility, according to our results. Taking the poorest as our reference, being richest is found to have the lowest decline in fertility by 16.5% ($e^{-0.18}$=0.835), keeping all other factors in the model constant. Wealth is highly significant in explaining fertility.

Schooling

Compared to those women respondents with no education, women who have incomplete primary education have fertility lower by 0.4% ($e^{-0.004}$=0.996), holding all other variables in the model constant. Compared to not being educated, having completed primary is found to lower fertility by 4.2% ($e^{-0.042}$=0.958), holding all other variables in the model constant. Again compared to no education, having incomplete secondary is found to lower fertility further by 6.3% ($e^{-0.065}$=0.937), all other factors being equal. For those women with complete secondary compared to those with no education, their fertility is much lower by 15.6% ($e^{-0.17}$=0.844), holding all other variables in the model constant. In the same line, those women with higher education compared to those with no education, their fertility decreases furthest by 25.2% ($e^{-0.29}$=0.748), all other factors being equal. These coefficients are highly significant.

Female autonomy

Compared to the case where other respondents besides the female have the final say on deciding what to do with money husband earns, cases where only the female respondent has the final say, fertility is lower by 2% ($e^{-0.02}$=0.98), holding all other variables in the model constant.

Rural

Findings indicate that fertility is much higher in the rural areas than in the urban. For women living in the rural area compared to those living in the urban area,

their fertility is higher by 25% ($e^{0.22}$=1.25), holding all other variables in the model constant. This coefficient is highly significant in explaining fertility.

Province

Compared to Central province, fertility on the Copperbelt is lower by 2% ($e^{-0.02}$=0.98), holding all other variables in the model constant. In Eastern, compared to Central province fertility is lower by 7.2% ($e^{-0.075}$=0.928), all other factors being equal. In Luapula compared to Central province, fertility is higher by 5% ($e^{0.05}$=1.05), all aspects being equal. Female residents living in Lusaka Province have a lower fertility by 5.8% ($e^{-0.06}$=0.942), compared to those in Central province. In Northern Province, the fertility is 4% ($e^{-0.04}$=0.96) lower compared to that in Central Province. In Northwestern Province fertility is 2% ($e^{0.02}$=1.02) higher with reference to that in Central Province. Southern Province female respondents have a higher fertility by 0.1% ($e^{0.001}$=1.001) compared to those in Central Province. In Western Province, fertility is 1% ($e^{-0.01}$=0.99) lower compared to that in Central Province, all other variables in the model kept constant.

Ever use of contraceptives

Regarding ever use of contraceptives, the women who have ever used any form of contraception, compared to those who have never used, have a lower fertility by 24.8% ($e^{-0.285}$=0.752), holding all other variables in the model constant. This coefficient is highly significant in explaining fertility behaviour.

Work status

Compared to those women who are not working, those who are working have their fertility lower by 3.3% ($e^{-0.034}$=0.967), all other factors kept constant. Although the coefficient could be undermined by high unemployment in the country, it supports the quality-quantity-tradeoff and is considered as one of the factors influencing fertility in the nation. This coefficient is significant at 5%.

Sex of household head

Compared to being male, if the head of the household is female, fertility is lower by 13.5% ($e^{-0.1444}$=0.865), holding all other variables in the model constant.

Number of children at first use

This variable concerns the number of children each female respondent had at the moment of their first ever use of any form of contraceptive. Compared to those respondents who had no children, those who had one child had their fertility higher by 66% ($e^{0.511}$=1.66), holding all other variables constant. Again, compared to those who had no children, those who had two children, had their fertility higher by 73.3% ($e^{0.55}$=1.733), holding all other factors constant in the model. Furthermore, those women who had three children compared to those who had none, their fertility was high by 86% ($e^{0.62}$=1.858), holding all other factors constant. Finally, those women who had four plus children compared to those who had none, their fertility was highest by 101.3% ($e^{0.702}$=2.013), holding all other factors constant.

Access to media

Access to media also turned out to be a crucial determinant of fertility. For those respondents who read the newspaper compared to those that did not read at all, their fertility was found to be lower by 3.1% ($e^{-0.029}$=0.971), holding all other variables constant. This coefficient is significant at 10%. In addition, listening to the radio is found to reduce fertility. Female respondents who listen to the radio compared to those women that do not at all listen, have their fertility lower by 3% ($e^{-0.0334}$=0.967), holding all other variables constant in the model. This coefficient is significant at 5%. These variables have a negative effect on fertility.

4.3. Summary of the findings

Several woman's characteristics and familial attributes were found to be related to fertility levels. More importantly, woman's age at marriage, educational attainment, income/wealth, place of residence, ever use of contraceptives, work status, and access to the media, were found to be strongly related to fertility.

The Poisson regression results presented confirm all the hypotheses that were laid out. These hypotheses stated that the income/wealth of the female, her educational attainment, her work status and the ever use of contraceptives by the female are negatively related to a woman's fertility decision. These findings indicate that income/wealth, education, work status, use of contraceptives and place of residence among others are significant predictors of fertility.

The results from the multivariate analysis show that a woman's age at marriage, income/wealth, educational attainment, place of residence, ever use of contraceptives, work status, access to the media and sex of the house hold head, are significant at the 0.10 level or better. The coefficient of each of the highly significant variables has the predicted sign.

The negative effect of wealth on fertility is observed with the richest having the least magnitude in the coefficients. Regarding the relationship between education and fertility, the negative effect between fertility and education increases as the female's educational attainment increases. In addition, place of residence generally tends to have a notable impact on fertility, as it reflects major differences in a series of economic conditions faced by families. In this regard, fertility is found to be much higher in the rural areas than in the urban.

As observed from the data, families with low levels of female autonomy get more children than the others. This is indeed an interesting finding, and level of autonomy could be used as an instrument to decrease fertility. Finally, results from the multivariate analysis also indicate that increased access to the media through listening to the radio and/or reading the newspaper reduces fertility.

CHAPTER 5: DISCUSSION

5.1. Interpretation of the results

As the analysis indicates, household wealth is highly and negatively correlated with the number of children ever born. Higher income can make the preferences change towards spending more on each child. Even though demand for all goods increases with increased wage, if the price of quality is sufficiently high, higher income can lead to fewer children. One explanation why households with higher wealth tend to get fewer children is that they can afford to invest in their children and therefore prefer to have few children with high quality and education, rather than many children. As family income increases, households prefer to have less but higher quality children. This could also be interpreted in the direction than the poorest are unable to invest money in their children, hence demanding a high number, but as soon as a certain living standard is met, being able to invest just something in the children, largely affects demand for quantity.

According to Becker (1992) women's education raises their labor participation which in turn raises their earnings, "and hence greater investment in market-oriented skills" which increases women's time value. Educated women are more likely to exercise the "quality-quantity trade-off" of their children. Education increases awareness of possible negative consequences of having large families. More education to leads to better knowledge about contraception and better ability to get hold of and understand information about issues related to family planning.

In addition, increased education for women does not always leads to greater participation in the labor market (thereby reducing fertility) but can lead to greater productivity at home through higher human capital investment in their children in the form of more schooling and better health. This higher investment (quality) increases the cost of having an additional child and may leads to a fall in the demand for children (quantity).

Findings indicate a negative relationship between fertility and female autonomy and the main reasoning is that autonomous females are likely to have more bargaining power in issues regarding family size and contraception and also other decisions affecting fertility. It is believed that more autonomous women are more likely to i) use contraception (i.e. get sterilized) without the husband's knowledge or ii) pursue the husband to agree that one of them use contraception. Female autonomy

will also in our opinion increase the age at which women get married hence reducing fertility.

Fertility is found to be much higher in the rural areas than in the urban. In the rural area, children can help on the farm and this will reduce their cost and increase their quantity demanded and therefore families in rural areas should have higher fertility since farming is the main economic activity. Also, rural communities lag behind urban centers in the distribution of contraceptive knowledge. For urban areas, earning higher wages raises the opportunity cost of children and this should reduce fertility.

It is believed that the use of contraceptives will play an important role in controlling fertility in the country going forward. The use of contraceptive may help in avoiding pregnancies for women who want to limit their birth, space their birth or to avoid bearing children.

An increase in female labor force participation leads to lower fertility. This implies that the opportunity cost of time devoted to childcare increases and consequently fertility has declines. This result is consistent with the theoretical explanations provided by Becker and Lewis (1973). A negative substitution effect is reinforced by the increase in female employment. Hence the opportunity cost of time devoted to childcare increases as a result of increasing real wage and female labor force participation and consequently fertility declines. According to neoclassical theory (Becker 1981), working wives have a higher opportunity cost of time than non-working wives. Therefore, Households with working females have fewer children than those with non-working females.

Access to media also reduces fertility and one explanation for this is that increased access to media makes information about contraceptive technology available to the woman, which helps in reducing fertility.

5.2. Limitations of the study

This study has a number of limitations. The first limitation is that the data set used does not contain some important variables which are used for more detailed analysis of the relationship between fertility and female employment. Amount of earnings of individuals and part time or full time working groups in the employment of women are not included in the data sets. Regarding earnings, this variable would be useful in determining the individual's income differential and their reaction

towards fertility preferences. The same is true for part time and full time employment schemes. Scholars argue that women who are hired in part time jobs will have a better opportunity and time to have more children. Thus the absence of these important variables affects our study in some manner.

The second limitation is that because this study was based on cross-sectional data we are unable to detect causality but only association between the dependent variable and the included explanatory variables. However the results do show the predictors of fertility among Zambian women.

CHAPTER 6: CONCLUSIONS AND POLICY RECOMMENDATIONS

6.1. Conclusions

Zambia faces high levels of fertility compared to other countries in the region. High levels of fertility have implications for social and economic development in any given country. High fertility can undermine the economic potential of women and is also associated with high maternal mortality. Information on fertility levels, patterns and trends experienced by a country is important for socio-economic planning, monitoring and evaluating programs. This study analyzed the socioeconomic determinants of fertility in Zambia. The Poisson regression model is used. The dependent variable is a count variable denoting the number of Children Ever Born (CEB) to a spouse which takes on non negative integer values. Analysis of this study is based on the 2007 cross sectional data from the Zambian Demographic and Health Survey (ZDHS) collected by the Central Statistical Office and Macro International Inc.

Results of the analysis have shown that household wealth is highly correlated with the number of children ever born. The negative effect of wealth on fertility is observed with the richest having the least magnitude in the coefficients. One explanation why households with higher wealth tend to get fewer children is that they can afford to invest in their children and therefore prefer to have few children with high quality and education, rather than many children. As family income increases, households prefer to have less but higher quality children. The negative effect of wealth on fertility is observed with the richest having the least magnitude in the coefficients. This could also be interpreted in the direction than the poorest are unable to invest money in their children, hence demanding a higher number, but as soon as a certain living standard is met, being able to invest just something in the children, largely affects demand for quantity.

Regarding schooling, a negative effect between fertility and schooling is observed. The negativity increases with the educational attainment of the female. Educated women are more likely to exercise the “quality-quantity trade-off” of their children. Education increases awareness of possible negative consequences of having large families. More education to leads to better knowledge about contraception and better ability to get hold of and understand information about issues related to family planning.

Female autonomy is found to be negatively related to fertility and the main reason is that early marriage can be associated with high fertility and female autonomy is likely to decrease the relative importance of early marriage. The fertility rate is also much lower in the urban areas than in rural areas because it costs less to raise children in a rural area and also rural communities lag behind urban centers in the distribution of contraceptive knowledge.

An increase in female labor force participation leads to lower fertility. This implies that the opportunity cost of time devoted to childcare has increased and consequently fertility has declined. This result is consistent with the theoretical explanations provided by Becker and Lewis (1973). Increasing access to media has also been found to reduce fertility. One explanation for this is that increased access to media makes information about contraceptive technology available to the woman, which helps in reducing fertility.

In line with our expectations, a negative relationship is found to exist between ever use of contraceptive and the level of fertility. We believe that the use of contraceptives will play an important role in controlling fertility in the country going forward. The use of contraceptive may help in avoiding pregnancies for women who want to limit their birth, space their birth or to avoid bearing children. This coefficient is highly significant in explaining fertility behaviour.

6.2. Policy recommendations

Improving the economic status of the women through increased education will help to reduce fertility. Investment in primary education is necessary, but the model shows that the impact (magnitude) of education on fertility increases with the education level. Therefore, the Zambian government should also invest heavily on women schooling beyond primary school. Investment in females' education in secondary and higher education will foster economic growth and also promote smaller families, increase modern contraceptive use, and improve child health.

Policies that encourage female labor force participation should be implemented as a female's employment status is a significant determinant of fertility in Zambia. The women's labor force participation increases the opportunity cost of having children and diminishes fertility. Increased access to media will also help to reduce fertility.

Programs need to be implemented to increase women's autonomy in the fertility decision-making process. These programs need to provide women with a permanent income that will make them economically independent of their husbands, and that will compensate them for the loss of status from having fewer children. Urbanization equally plays a key role in reducing fertility. This includes taking development to the rural areas by way of building infrastructure, improving health care service delivery and sanitation among others.

Use of contraceptives was highly significant in explaining fertility behavior and will therefore play a crucial role in reducing fertility. Furthermore, the promotion and the improvement of contraceptive methods should be constructed to focus more in helping the women achieve the desired level of fertility.

6.3. Areas of further research

A more sophisticated analysis of the relationships between fertility behavior, education and labor market participation would be of interest. This could give more insight into the relations between men and women's decisions regarding education, work and family formation, including power relations within the households. Lack of data on income for each household member is a weakness in this dissertation. More detailed data would therefore enable a more in depth analysis on these questions.

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APPENDIX

Table 1A: A Tabulation of the Dependent Variable

Total Children Ever Born (CEB)	Frequency	Percentage	Cumulative
0	1736	24.29	24.29
1	1034	14.47	38.76
2	906	12.68	51.44
3	822	11.50	62.94
4	735	10.29	73.23
5	559	7.82	81.05
6	421	5.89	86.94
7	334	4.67	91.62
8	245	3.43	95.05
9	176	2.46	97.51
10	90	1.26	98.77
11	53	0.74	99.51
12	31	0.43	99.94
13	1	0.01	99.96
14	2	0.03	99.99
15	1	0.01	**100**
Total	**7146**	**100**	

Table 1B: Negative Binomial Regression Output

Dependent variable – Children Ever Born (CEB)

Variable	Coefficient	Linearized standard error
Age	.2168039***	.0071796
Age squared	-.0023413***	.0001034
No education (reference)		
Incomplete primary	-.0036028	.0176182
Complete primary	-.0418568**	.0204621
Incomplete secondary	-.0650916***	.0241347
Complete secondary	-.171326***	.0463957
Higher	-.2857603***	.0486499
Female autonomy	-.0238123	.018425
Age at marriage	-.0407652***	.0021983
Wealth quintile 1 (poorest, ref.)		
Wealth quintile 2 (poorer)	.0200405	.0175337
Wealth quintile 3 (middle)	-.0525027***	.0185794
Wealth quintile 4 (richer)	-.112399***	.0234494
Wealth quintile 5 (richest)	-.1840651***	.0309043
Rural (rural=1; urban=0)	.2287094***	.057998
Rural x Age	-.0064212***	.0016785
Central (reference)		
Copperbelt	0.0002095	.0245556
Eastern	-.0749794***	.0286666
Luapula	.0479734*	.0258237
Lusaka	-.0604075**	.0269949
Northern	-.0399795	.0278766
Northwestern	.0202667	.0307031
Southern	.0011673	.0278842
Western	-.0122616	.0319176
Ever use of contraceptives	-.2849672***	.0613797
Work status	-.03406**	.0135323
Sex of household head	-.1444317***	.016764
Reads newspaper	-.0287172*	.0163072
Listens to radio	-.0334054**	.0129519
Children at first use (0, ref.)		
Children at first use (1)	.5110359***	.0573764
Children at first use (2)	.5491325***	.058719
Children at first use (3)	.6244543***	0.59972
Children at first use (4+)	.702797***	.0593313
Constant	-2.452259***	.1225767

Log likelihood = -9449.8934
Pseudo R2 = 0.2147
LR χ^2 (33) = 5165.89
Prob > χ^2 = 0.0000
* p<0.1, ** p<0.05, *** p<0.01