COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCE

DEPARTMENT OF STATISTICS

DETERMINANTS OF HOUSEHOLDS SIZE IN RURAL ETHIOPIA

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ABSTRACT

The household, defined as a group of persons who make common provision of food, shelter and other essentials for living, is a fundamental socioeconomic unit in human societies. The main objective of this study was to identify the factors that affect determinants of household size in rural Ethiopia. The study was conducted by using secondary source of data. The data was obtained from the EDHS conducted in 2016 and methods of data analysis was frequencies tables, histogram and Poisson regression. The appropriate model used in this study was Poisson regression model and SPSS version (16) software for descriptive statistics and STATA version(SE12) software for inferential statistics used to analyze the data. The mean of number of household member of household was approximately 6. From the model the result of the study indicates that the number of household member is affected by Educational level, Occupation, Number wives, Wealth index, Ideal number children, religion, Age household member, Succeed birth interval and Number of eligible women. In this study the research concludes that among the independent variable Educational level, Occupation, Number wives, Wealth index, Ideal number children, religion, Age household member, Succeed birth interval, Number of eligible women, Region, Age of household head, Place delivery, Marital status and Family planning. The study recommends that the government, concerned institutions and other involved stakeholders should consider the identified major factors while designing policy that will impact household size decisions the most. In order to have a bearing on policy recommendations, the government should give more attention to improves the knowledge of apply wide succeed birth interval(months) to household with small succeed birth interval and giving initiative to household who practice succeed birth interval in any way were to more likely to practice.

Key words: determinants of household size, number of household member, Poisson Regression model

ACRONOMYS

CSA	Central Statistical Agency
EDHS	Ethiopian Demographic and Health Survey
DHS	Demographic and Health Survey
HH	Household
GLM	Generalized Linear Model
UN	United Nation
SNNPR	Southern Nation Nationality People Region
PHC	Population and Housing Census
CSA	Central Statistical Agency
EA	Enumeration area
AIC	Akaike information criterion
BIC	Bayesian information criterion
DIC	Deviance information criterion
UK	United Kingdom
US	United State
CPS	Current population survey
PhD	Philosophy of doctorate
SDG	Sustainable development goal
NEC	National Economic Council

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CHAPTER ONE

1. INTRODUCTION

1.1 Background of the study

The household, defined as a group of persons who make common provision of food, shelter and other essentials for living, is a fundamental socioeconomic unit in human societies. Households are the centers of demographic, social and economic processes. Decisions about childbearing, education, health care, consumption, labor force participation, migration and savings occur primarily at the household level. Understanding the trends and patterns of household size and development. Small average household sizes fewer than three persons per households are concentrated in Europe and Northern America. Large average household sizes five or more persons per households are observed across much of Africa and the middle East. Changes in the average household size tend to be gradual. In France, for example, the average household size fell from 3.1 persons per household in 1968 to 2.3 in 2011. In Kenya, it declined from 5.3 persons per household in 1969 to 4.0 in 2014 (UN population facts,2017)

the 124 countries with available data, the median proportion of two-parent households is 73 percent among households with children under 15 years of age. The median proportion of one-parent households (among those with children) is much lower, at 21 percent for lone-mother households and 3 percent for lone-father households. One-parent households are more prevalent in Africa and in Latin America and the Caribbean, and less prevalent in Asia. Lone-father households account for more than 15 percent of households with children in Sierra Leone, Côte d'Ivoire and Belgium, while lone-mother households account for more than 45 per cent in Botswana, Namibia and Swaziland (household hold data booklet, 2017). Households headed by women are most common in Northern America (with a median proportion of 47 per cent), followed by Europe (37 per cent), Latin America and the Caribbean (34 per cent) and Oceania (33 per cent). The median prevalence of female-headed households is much lower in Africa (27 per cent) and lowest in Asia (19 per cent) (UN HH Size and Composition Around the World, 2017).

Percentage of household heads who were female, latest available estimate, 1990-2015 Population ageing brings an increasing proportion of households that include older persons. In countries of

Europe and Northern America, where more than 15 per cent of the total population is aged 60 years or over, a third of the households include at least one older person among them

members. By contrast, in countries with relatively youthful populations, including many in Africa, where less than 5 per cent of the total population is aged 60 years or over, less than a quarter of the households include an older person. The percentage of households including an older person depends also on other factors such as the living arrangements of older persons. For example, a high share of households includes older persons in many countries in Africa and Asia because of the common practice of multi-generational living arrangements. The proportion of households that includes both a child under 15 years of age and an older person aged 60 years or over, is highest in Senegal, at 37 per cent and lowest in the Netherlands, at 0.2 percent (UN HH Size and Composition Around the World, 2017)

The world's population is still growing although the rate of growth has been declining since the 1960s. Global population grows each year by approximately 80 million people. Nearly all of this growth is concentrated in the developing nations of the world, in many of which fertility rates remain high. High fertility can impose costly burdens on developing nations. It may impede opportunities for economic development, increase health risks for women and children, and erode the quality of life by reducing access to education, nutrition, employment, and scarce resources such as potable water (Da Vanzo et.al. 2006).

World population is projected to grow by about 1.2 billion between 2009 and 2025— from 6.8 billion to around 8 billion people. Although the global population increase is substantial—with concomitant effects on resources—the rate of growth will be slower than it was, down from levels that added 2.4 billion persons between 1980 and today. Demographers project that Asia and Africa will account for most of the population growth out to 2025 while less than 3 percent of the growth will occur in the "West"— Europe, Japan, the United States, Canada, Australia, and New Zealand. In 2025, roughly 16 percent of humanity will live in the West, down from the 18 percent in 2009 and 24 percent in 1980 (C. Thomas Fingar,2008)

Most of Africa's population lives in the region south of the Sahara, known as sub-Saharan Africa. On the whole, Africa encompasses about 50 nations, ranging from Nigeria, a country of an estimated 136,353,130 (2004 estimate) to small island republics such as Comoros, which 8 has a

population of 651,901 (2004 estimate). Tropical Africa is amongst areas in Africa with high Some demographic factors are urgent global problem in the all developing countries, for instance countries like Ethiopia. Among this factors family size, socio-cultural, religions, level of education, age of persons or households, marital status, gender and occupational status of the households/family are most popular factors which affects the economic activities mostly in developing countries (Shirivastava, 2004).

The percentage of women with no education has decreased over the last decade, from 66% in 2005 and 51% in 2011 to 48% in 2016. The percentage of men with no education has declined as well, from 43% in 2005 to 30% in 2011 and 28% in 2016.The average household size in Ethiopia is 4.6 persons. Urban households are slightly smaller than rural households (3.5 persons versus 4.9 persons). Men head the majority of Ethiopian households (75%), with only 1 in 4 households headed by women (Final report of EDHS,2016).

The size of household was positively related and the coefficient is statistically different from zero at 1 percent significance level. Holding all other variables, as family size increase by one adult equivalent individual, the probability of a household to be poor increase by about 22.0%.This is due to the fact that the average number of children age less than 15 is 2.625) and old aged greater than 64 is 0.503 were larger in poor households than non-poor households with age less than 15 family members average size 1.0288 and age greater than 64 members 0.076.With existing high rate of fertility in rural area, less employment opportunity, weak off farm income participation, member of the family become unemployed and coupled with low rate of payment (Zegeye, 2018)

1.2 Statement of Problem

household size has effects on quality of life. These include health, nutrition, educational attainment of children, social status of families as well as their ability to adequately cater for the needs of their families. Small family size of household may enjoy higher Socio-Economic Status (SES) and invest more in education of its children (Kumasi,2017). The age distribution of the household population has not changed since 2011, when children under age 15 accounted for 47% of the population and individuals age 65 and older accounted for 4%. Average household size remained the same between 2011 and 2016 (4.6 persons in both surveys). The percentage of female-headed

households also remained essentially the same during that period (26% in 2011 versus 25% in 2016) (Final report of EDHS,2016).

On the country, a large family size of households has its own implications on the people concerned. Recent research by (Conley and Glauber, 2006) suggested that children in large families receive small educational investments and show poor educational attainment. Besides, findings on effects of siblings on educational attainment for developing and developed nations suggested that on the average, children in larger families receive less schooling, do not perform well academically and are less well-nourished. Smaller families are able to make good investment in their children. Nevertheless, parents who invest heavily in their children (child quality) have smaller families (child quantity). Family size of household in one way or the other determinants of achievement. Data from the 1980 US Census 5-percent Public Use Micro Samples record indicates that older children have opportunity to attend good schools.

An additional younger sibling reduces the likelihood that the one who comes after him or her attends college. Close birth spacing of children increases the likelihood of dropping out of high school and decreases the odds of attending tertiary level schooling (Powell, 2002). Unfortunately, no link has been established with the socio-economic determinants in the context of household size. Ethiopia seems limited data pertaining to aspects that relate to the size of households especially in rural areas. The numerous national household surveys produce aggregated data that needs more and better analysis to establish such determinants and this has not been done. There is, therefore, a need to establish the determinants of household size. This study, therefore, sought to examine the determinants of household size in Ethiopia and also establish the dominant factors that determine household size. Establishment of such factors would provide a foundation to help in especially addressing negative consequences of big household size and other problems faced by the region.

- ✓ Does occupation status of household determine the size of a household?
- ✓ To what level does age of household member determine household size?
- ✓ What is the relationship between marital status of household and household size?

1.3 Objective of study

1.3.1 General objective of study

The overall objective of the study was to examined the determinants of household size in Ethiopia.

1.3.2 Specific objective of study

- To analysis the factor most affect the household size in rural Ethiopia
- To assess the Demographic determinants of household size
- To assess the housing factors such that; Number of rooms for sleeping determine the household size

1.4 Significance of study

The result of this study was to import significant that to show the impact of large household size and set appropriate plans to recommend every householders and people to balance number of household sizes in Ethiopia. The findings will not only help the government during planning but will also help the population to comprehend and understand the root cause of the problems. This is envisaged to result into identification of better and efficient strategies for uplifting the quality of life of the concerned people and the community at large. Therefore, this study gives an information for achieving the target goals about household sizes in Ethiopia.

1.5 Scope of the study

The coverages of this study was all Ethiopian household sizes using EDHS 2016 data

1.6 Theoretical scope of the study

After we finished this study:

- ✓ we will get factors more associated with household size
- ✓ We will get in which educational status of the household is high
- ✓ We can identify the impact of household size on one country socio-economic

CHAPTER TWO

2 LITERATURE REVIEW

2.1 Definition of household size

Household consists of all the people who occupy a housing unit. A house, an apartment or other group of rooms, or a single room, is regarded as a housing unit when it is occupied or intended for occupancy as separate living quarters; that is, when the occupants do not live with any other persons in the structure and there is direct access from the outside or through a common hall. A household consists of one or several persons who live in the same dwelling and share meals. It may also consist of a single family or another group of people. The household is the basic unit of analysis in many social, microeconomic and government models, and is important to economics and inheritance. Household models include families, blended families, shared housing, group homes, boarding houses, houses of multiple occupancy (UK), and single room occupancy (US). In feudal societies, the royal household and medieval households of the wealthy included servants and other retainers.

A household includes the related family members and all the unrelated people, if any, such as lodgers, foster children, wards, or employees who share the housing unit. A person living alone in a housing unit, or a group of unrelated people sharing a housing unit such as partners or roomers, is also counted as a household. The count of households excludes group quarters. There are two major categories of households, "family" and "nonfamily". (See definitions of Family household and Nonfamily household. The term "size of household" includes all the people occupying a housing unit. "Size of family" includes the family householder and all other people in the living quarters who are related to the householder by birth, marriage, or adoption. "Size of related subfamily" includes the husband and wife or the lone parent and their never-married sons and daughters under 18 years of age. "Size of unrelated subfamily" includes the reference person and all other members related to the reference person. If a family has a related subfamily among its members, the size of the family includes the members of the related subfamily. A nonfamily household consists of a householder living alone (a one-person household) or where the householder shares the home exclusively with people to whom he/she is not related.

The householder refers to the person (or one of the people) in whose name the housing unit is owned or rented (maintained) or, if there is no such person, any adult member, excluding roomers,

boarders, or paid employees. If the house is owned or rented jointly by a married couple, the householder may be either the husband or the wife. The person designated as the householder is the "reference person" to whom the relationship of all other household members, if any, is recorded. The number of householders is equal to the number of households. Also, the number of family householders is equal to the number of families.

Head versus householder. Beginning with the 1980 CPS, the Bureau of the Census discontinued the use of the terms "head of household" and "head of family." Instead, the terms "householder" and "family householder" are used. Recent social changes have resulted in greater sharing of household responsibilities among the adult members and, therefore, have made the term "head" increasingly inappropriate in the analysis of household and family data. Specifically, beginning in 1980, the Census Bureau discontinued its longtime practice of always classifying the husband as the reference person (head) when he and his wife are living together. Among them are poor health, low levels of education, low income status, unemployment, pressure on natural resources due to over exploitation, poor childcare and nutrition (Hanushek, 2006).

2.2 Characteristics of Household Head

The marital status of the heads of the female-headed households is quite different from that of the heads of male headed households. (Pand,1997), in his study on “female headship, poverty and child welfare in rural Orissa, India” found out that, Female-headed households were less than half as likely as male-headed households to be married 35 per cent as opposed to 71 per cent. They were also three and half times as likely to be widowed 52.1 per cent as opposed to 15.5 per cent. They were also twice as likely to be divorced or separated. They were also less than half as likely to be single. Female heads of households were more than one and half times as likely as male heads of households to be over age 60 -- 40 per cent as opposed to 24 per cent. They were correspondingly one and half times less likely to be under age 40 is 23 per cent as opposed to 36 per cent. They were slightly less likely to be in the prime earning range of 40- 60. There are systematic differences in the education status of male and female heads of households. Female heads of households were half as likely as male heads of households to be literate 22 per cent as opposed to 44 per cent. They were also less than half as likely to be above the level of primary education. Thus, differential earnings are likely to be due to inferior levels of formal education on the part of the female heads.

Female heads of households were somewhat less likely to work than were male heads of household 75 per cent as opposed to 80 per cent. However, occupational structure of heads of household differed markedly by the sex of the head of the household. For instance, female heads of household were half as likely as male heads of household to be self-employed in agriculture 20 per cent as opposed to 38 per cent. They were also two and half times as likely to be agricultural wage laborers 50 per cent as opposed to 21 per cent.

Finally, they were less than one third as likely to be self-employed in non-agricultural activity and half as likely to be non-agricultural wage laborer. When working, female heads of household worked fewer days in the last year prior to survey. While 43 per cent of female heads worked for less than 3 months in a year, only 20 per cent of male heads worked for such a less period. On the contrary, at the upper end, while only 10 per cent of female heads worked for more than 9 months as high as 40 per cent male heads worked for such a lengthy period. This implies lower earnings of female heads of households partly because of more time devoted to domestic work and partly because of non-availability of work as a result of seasonal employment in agriculture. As noted, half of the female heads worked for agricultural wages, and all of them worked for a lesser period (less than six months). Moreover, earnings from agricultural wages for females were less than males. All these factors imply a markedly different level of earnings between male and female heads of households.

Smaller households tend to use more energy per capita, on average, than larger households, thus trends towards smaller household size could slow progress towards the achievement of SDG 12, to ensure sustainable consumption and production patterns (Bradbury and others, 2014)

2.2.1 Age of household heads and gender of household head

Age of a household head is also determining household size. Most of the time households with young household heads has small number of household size than old household heads. Age of gender household hold head is directly affected the number of household. That means for male biological interval of fertility time is from 15 up to the end of life and for male biological interval of fertility time is from 15 up to 45 or 49. Based on this fact female household head is less probability of increasing number household size than male household head.

2.2.2 Literacy Levels Household head

literacy levels of a household head have significant impact on the socio-economic status or welfare of the household (Word Bank, 2007; National Economic Council et al, 2001). For instance, the determinants of poverty study by (NEC et al ,2001) found that raising the education levels of a household head from primary education to Junior Certificate level, raises household incomes by 22 percent (Charles Jumbe, 2010)

2.2.3 Marital Status of Household Heads and gender of household head

Marital status of household heads has significant impact on household size. It means the household head that polygamist large number of household than household head that married only single. This has also relation with gender of household head. Male household head is most of the time polygamist, but female household head is not possible polygamist in single household.

2.3 Household Size and Household Composition Head

According to (Panda,1997), Female-headed households are smaller than male-headed households. Their household size was 3.6 members, as compared to 5.6 for the Male headed households. The smaller average size of female headed households stems partly from the lesser tendency of women to live in large size households. Of all the large size households (more than 6 members), only 5 per cent were headed by women, according to the study. These accounted for 14 per cent of female-headed households. On the other extreme, of all single person households, one half, were women and they accounted for 28 per cent of female-headed households as opposed to only 7 per cent of male-headed households. Female-headed households had relatively fewer children, both in terms of the average number of children per household and in terms of the per cent of household members who are children. There was an average of only 0.3 children aged 0-4 years in female-headed households, but 0.7 in male-headed households. Extending the range of children aged 0-9 and 0-14, doubled and tripled the numbers respectively, but nevertheless, maintaining the patterns.

2.3.1 Household Wealth

The wealth of a household can be defined as its net balance of economic assets measured at a given point in time. Household wealth affects living conditions in at least two ways. First, real capital or physical items like consumer durables, have a direct "user value" for the household members. Second, liquid assets indirectly yield welfare benefits if transformed into other living

condition components. Household wealth may be acquired through saving of income, inheritance, or appreciation of household economic assets. Apart from receipt or inheritance of gifts, the ability of a household to generate wealth depends on the size of the income, which remains after daily consumption expenditures like food and clothing have been deducted.

Wealth is a source of economic security providing an index of a household's ability to meet emergencies or absorb economic shocks such as unemployment. However, the importance of wealth as a source of economic security may vary among societies (e.g., the vast majority of people in Sweden have relatively little wealth, but the social welfare system provides the resources to absorb economic shocks). Wealth can, also, be assessed by classifying people according to household assets such as whether the family home is owned or rented, and whether there is a car or garden. In Britain, markers of low available income, such as not being a home owner or having access to a car, are strongly associated with increased mortality risk according to (Judith Stewart, 2002).

2.4 A Brief Literature Review of the Empirical Method

A big number of households fell in the 1-5 members range which was categorized as small household and constituted 46% of the entire household population. Most of the household members (54%) lived in households of more than six members. Further analysis shows that the majority of households were in rural areas compared to urban areas with 78.9% and 21.1% respectively. It can, also, be shown that households in urban areas were characterized with small household sizes compared to their rural counterparts (26.7% compared to 83.7% respectively). More than half of the heads of the households were married monogamously (53.5%). There were a small percentage of respondents who were divorced/separated or unmarried (7.1% and 4% respectively). The marital status may greatly determine the size of a household. It can be held that a big number of respondents, who were unmarried, divorced or separated belonged to small sized households. further, shows that compared to small size households, there were more respondents in big households who were in polygamous relationships (28.7%) compared to 16.1% in small households. However, the majority of the respondents whether from big or small households were married and in monogamous relationships.

A big percentage (75%) of the household heads were employed and mostly self-employed, 7.9% were involved in unpaid work while a small number of respondents (5.1%), were government

workers. Table 4.2 further shows that among the self-employed respondents, 75.8% were from big households compared to (74.2%) from small households. There was, also, a big number of respondents (11.3%) from big households involved in unpaid work compared to (3.9%) of small households (Dhabunansi Paul, 2010).

The total number of household surveyed from the five studies was 3,704 consisted of 1,662 (45%) from the urban and 2,042 (55%) from the rural areas. In terms of household size, number of children and number of children under the age of five was similar between urban and rural areas. Median number of household member was five, while median number of children and number of children under the age of five were two and one consecutively. Most of the households were headed by male (97% and 96% in urban and rural areas consecutively). In general, households in urban areas were better-off in terms of monthly income security. The proportion of those having routine income (whether fix or no fix amount) in urban areas were more than double the rural areas (54% and 21% in urban and rural consecutively). Although in both locations percentage of households having non-routine monthly income was highest, the proportion in the rural areas was double (38% in urban and 76% in rural). On the opposite, proportion of households with no income was 5% higher in the urban (Avita A Usfar Dr.sc.et al., 2007)

CHAPTER THREE

3. METHODOLOGY

3.1. Study Area

Ethiopia is one of the African countries which is located in the eastern part of Africa around the place called Horn of Africa. This place located in the north eastern extension of the continent. The country lies west of Somalia, north of Kenya, east of Sudan, south of Eretria and Djibouti with an area of 1,127,127 square kilometers (435,186 square miles). The country has 9 regional states (Oromia, Amhara, Tigray, Affar, Somalia, Benishangul-Gumuz, SNNPR, Gambela and Harari) and two city administration (Dire Dawa and Addis-Ababa). The country has about more than 80 nations and has around 112,000,000(2007, estimate) populations from this 89600000 are live in rural. The capital city is Addis Ababa and official language is Amharic.

3.2. Target Population

The target population for this study was all of households live in rural Ethiopian population

3.4. Study Design

In this study was used a cross sectional survey is taken from collected data since, 2016 EDHS make inference about population of included in our study. The sampling design that used for the 2016 EDHS is the Ethiopia Population and Housing Census (PHC), which was conducted in 2007 by the Ethiopia Central Statistical Agency (CSA).

Ethiopia is divided into nine geographical regions and two administrative cities. The sample for the 2016EDHS was designed to provide estimates of key indicators for the country as a whole, for urban and rural areas separately, and for each of the nine regions and the two administrative cities. The 2016 EDHS sample was stratified and selected in two stages. Each region was stratified into urban and rural areas, yielding 21 sampling strata.

Samples of enumeration areas were selected independently in each stratum in two stages. Implicit stratification and proportional allocation were achieved at each of the lower administrative levels by sorting the sampling frame within each sampling stratum before sample selection, according to administrative units in different levels, and by using a probability proportional to size selection at

the first stage of sampling. In the first stage, a total of 645 EAs (202 in urban areas and 443 in rural areas) were selected with probability proportional to EA size (based on the 2007 PHC) and with independent selection in each sampling stratum. In the second stage of selection, a fixed number of 28 households per cluster were selected with an equal probability systematic selection from the newly created household listing.

3.4. Data collection Method

For this study, a data was collected from secondary source information. Since we were being using secondary source of data collections method can be directly using EDHS 2016 data.

3.5 Study variable

We were used the followings variables in our study:

3.5.1 Dependent (response) variables:

Y-Number of household member

3.5.2 Independent (explanatory) variables:

- Discrete independent variable
  - ✓ Number of wives/partners
  - ✓ Age of household head
  - ✓ Number of rooms used for sleeping
  - ✓ Succeeding birth interval (months
  - ✓ Number of eligible women in household
- **Categorical Independent Variables**

✓ Educational level	occupation	age household member
✓ wealth index	region	place delivery,
✓ marital status	Ideal number children	religion

family planning the code for each category is see on appendix

3.6 Method of data analysis

3.6.1Descriptive statistics

In Descriptive statistics we were summarizing household sizes using frequency table, percentage, cumulative percentage and histogram.

3.6.2 Inferential statistics

It consists of organizing from samples to populations performing hypothesis testing determining relationships among variables and making conclusions. In the inferential statistics the method of data analysis contains a regression analysis that is Poisson regressions. It is the procedure by which we reach a conclusion about population on the information contains in the sample drawn from that population.

3.7 POISSON REGRESSION

Poisson regression is used to model response variables (Y-values) that are counts. It tells you which explanatory variables have a statistically significant effect on the response variable. In other words, it tells you which X-values work on the Y-value. It's best used for rare events, as these tend to follow a Poisson distribution (as opposed to more common events which tend to be normally distributed).

Poisson regression is used for numerical, count data. The same technique can be used for modeling categorical explanatory variables or counts in the cells of a contingency table. When used in this way, the models are called log linear models.

Count data models are models that arise in several forms to analyze nonnegative integer feature of count data depending on the types of data (Agresti, A. 2002).

3.8 Assumptions of Poisson regression

These include:

1. There is a linear relationship between the logarithm of the frequency or rate and equal increment changes in the explanatory variable.
2. Changes in the rate from combined effects of different explanatory variables are multiplicative.
3. At each level of the covariates the number of cases has variance equal to the mean (as in the Poisson distribution).
4. Observation and Errors are must be independent of each other.
5. Y-values are counts. If your response variables aren't counts, Poisson regression is not a good method to use.
6. Counts must be positive integers (i.e. whole numbers) 0 or greater (0,1,2,3…k). The technique will not work with fractions or negative numbers, because the Poisson distribution is a discrete distribution.
7. Explanatory variables must be continuous, dichotomous or ordinal

Poisson regression assumes that the mean of the Poisson random variable is a function of explanatory variables:

$$\log(\mu)=\alpha+\beta x+\mathcal{E}i$$

$$\text{hence : } \mu = e^{\alpha+\beta x+\mathcal{E}i}$$

where εi (the random variation component of Y) is Poisson distributed about variance=$_{\mu}$ with equal to mean=$_{\mu}$

As applied to the Poisson distribution of household by household size, this means:

1. Households are counted in positive integers, and there is no (official) upper limit to household size, as described in more detail below.
2. The size of any given household is independent and random. For example, if households A and B are neighbors, the number of people in household A is completely independent of the number of people in neighboring household B.
3. Each household is counted only once. It is irrelevant how many households of, for example size 8, have not occurred. It is only relevant how many have occurred.
4. As described above, it is possible to estimate and project average household Size

Methods to identify violations of assumption (3) i.e. to determine whether variances are too large or too small include plots of residuals versus the mean at different levels of the predictor variable. Recall that in the case of normal linear regression, diagnostics of the model used plots of residuals against fits (fitted values). This means that the same diagnostics can be used in the case of Poisson Regression.

$P(Y = y) = \frac{e^{-\lambda}\lambda^{y}}{y!}$, $y = 0,1,2,3,4,$……, n

Thus, given independent variables x1, x2, ……, x9

$P(y=\frac{k}{x1,x2,\ldots,x9}) = \frac{e^{-\lambda}}{k!}\lambda^{k}$ $k = 0, 1,2,3,4, 5,6,7,8,$ …….…....1

Where, the log of the mean λ is assumed a linear function of the independent variables.

That is, $\log(\lambda)=\beta o+\sum \beta i xi$……..……..2

Which implies that **λ** is the exponential function of independent variables.

$\lambda = e^{\alpha+\beta 1x1+\beta 2x2+\beta 3x3+\ldots\ldots\beta 9x9}$……3

The poison distribution depends on a single parameter **λ**. In a poison distribution, the model coefficients are estimated by the maximum likelihood method. The likelihood function L is the product of the terms in equation (1) over all n measured valuesyi . This function is viewed as a function of the parameter λ and the parametersβi. The parameters are estimated by maximizing

the likelihood, or more usually, by maximizing the logarithm of the likelihood (denoted by log likelihood).

The log likelihood is given by the equation:

Log (L) =$\sum_{i=1}^{n} yi(log\lambda) - \lambda - log(yi)$…….4

The maximum possible value for the likelihood for a given data set occurs if the model fits the data exactly. This occurs if λ replaced Yi in equation (2). The difference between the log-likelihood functions for two models is a measure of how much one model improves the fit over the other. A special case of this will be defined as the deviance. The deviance is defined as minus twice the log of the ratio of the likelihood for a model to the maximum likelihood. For the poison distribution, the deviance takes the form given in the following equation:

D = 2[$\sum_{i=1}^{n} yilog\left(\frac{yi}{\lambda}\right) - \sum_{i=1}^{n}(yi - \lambda)$]……..5

Where$\sum_{i=1}^{n}(yi - \lambda)$ if this term is identically zero the model includes a constant or intercept term. For a sample of n independent observations, the deviance for a model with p degrees of freedom (that is, p parameters estimated, including the mean or constant) has residual (n-p) degrees of freedom. Since the deviance is effectively 2 times the log of the likelihood ratio, it has an asymptotic distribution that is chi-squared with degrees of freedom equal to n-p. This result can be used to construct a goodness-of-fit test for the model. In addition, by forming the ratio of the deviance to its residual degrees of freedom, an estimate of the scale constant can be found. For the poison distribution, this should theoretically be equal to one. Values substantially in excess of one reflect over dispersion of the data. There are some empirical ways of checking for a passion distribution. The simplest way is to see if the variance is roughly equal to the mean of the data histogram of the Poisson data should be skewed to the right, though the skewed decreases as the mean increases. In order to check whether the mean and variance are equal, descriptive statistics could be used.

3.9 Interpretation of Parameter Estimate

The parameter of Poisson regression models is interpreted in terms of incidence rate ratio.

exp (β_0) =effect of the mean of y that is μ (x_i) when x_i=0exp (β) =with every unit increase in x_i the predictor variable has multiplicative effect of exp (β) on the mean of Y that is μ (x_i)

If $\beta=0$, then exp (β) =1, and the expected count, $\mu(x_i)=E(y)$ =exp (β_0) and $\mu(x_i)$and x_i are not related

If $\beta > 0$, then exp (β)> 1 and the expected count (mean) of y_i increase as x_i increase.

If $\beta < 0$, then exp (β) < 1 and the expected count(mean) of y_i decrease as x_i increase

3.10 Model selection

3.10.1. Akaike Information Criterion(AIC)

The AIC is another measure of fit that can be used to assess models. This measure also uses the log-likelihood, but add a penalizing term associated with the number of variables. It is well known that by adding variables, one can improve the fit of models. Thus, the AIC tries to balance the goodness of fit versus the inclusion of variables in the model. The AIC is computed as:

$AIC= -2\ln_L+2p$……. (6)

Where p is the number of unknown parameters included in the model (this also includes the inverse dispersion parameter.

3.10.2 Bayesian Information Criterion(BIC)

Similar to the AIC, the BIC also employs a penalty term associated with the number of parameters (p) and the sample size (n). This measure is also known as the Schwarz Information Criterion. It is computed the following way:

BIC=-2ln L + p ln(n)……(7)

Smaller values of the AIC and BIC are better fit of the model.

Similar to the AIC, the BIC also employs a penalty term associated with the number of variables.

3.10.3 Deviance Information Criterion(DIC)

When the Bayesian estimation method is used, the DIC is often used as a goodness-of-fit measure instead of the AIC or BIC. The latter ones are generally used for the maximum

Likelihood method. The DIC is defined as follows:

DID=D^+2(D^+2(D-D^) …… (8)

Where D is the average of the deviance (-2ln 2) over the posterior distribution, and Dˆ is the deviance calculated at the posterior mean parameters. As with the AIC and BIC, the DIC uses P_D=D-D (effective number of parameters) as a penalty term on the goodness of fit. Differences in DIC from 5-10 indicate that one model is clearly better (Spiegel halter et al, 2002)

$Zj=\frac{\beta j}{SE(\beta j)}$ ~N (0,1) for large sample size and $Zj^2 = \left(\frac{\beta j}{SE(\beta j)}\right)^2 \sim x^2(1)$……..()

And the likelihood ratio also apply (performed) in this case the model under null hypothesis is not null model rather the reduced model (by excluding the j^{th} explanatory variable and the likelihood ratio test statistics is

$G^2=-2\ln\left({}^{l_R}/_{l_M}\right)=-2(\ln l_{R-}\ln l_M)\sim X_2(1)$……..(9)

Where $l_{m=l(\beta o,\beta 1,\beta 2\ldots\ldots\ldots\ldots\beta j-1,,\beta j,\beta j+1\ldots\ldots\ldots\ldots\ldots,\beta k)}$ and $l_{m=l(\beta o,\beta 1,\beta 2\ldots\ldots\ldots\ldots\beta j-1,\beta j+1\ldots\ldots\ldots\ldots\ldots,\beta k)}$

3.11 Model checking

3.11.1 Goodness-of-fit

The goodness of fit of a statistical model describes how well it fits a set of observations. Measures of goodness of fit typically summarize the discrepancy between observed values and the values expected under the model in question. Model Evaluation-Residuals for any GLM, goodness-of-fit statistics only broadly summarize data. We obtain further insight by comparing observed and fitted counts individually. For observation i the residual difference$Yi - \lambda i$.between an observed and fitted count has limited usefulness.

For poison sampling, for instance the standard deviation of a count is $\sqrt{\lambda i}$so larger differences, tend to occur when λ is larger the Pearson residual = $\frac{(observed-fitted)}{\sqrt{var(obseved)}}$for poison GLMs, simplifies to ei = $\frac{yi-\lambda i}{\sqrt{\lambda i}}$ which standardizes by dividing the difference by the estimated poison standard deviation. These residuals relate to the Pearson goodness-of-fit statistic by

$\sum ei^2 = x^2$Pearson residual values fluctuate around zero, following approximately a normal distribution when μi is large. When the model holds, these residuals are less variable than standard normal, however, because the numerator must use the fitted value λi rather than the true mean λi, since the sample data determine the fitted yi-λi value, tends to be smaller than yi-λi. The Pearson

residual divided by its estimated standard error is called an adjusted residual. Adjusted residuals larger than about 2 in absolute value are worthy of attention, though one expects some values of this size by chance alone when the number of categories is large. Adjusted residuals are preferable to Pearson residuals (Agrestic, 1996).

3.10.2 Likelihood ratio test

determining the contribution of a group of variables may be an interest in such case two model are to be fitted; one with all explanatory variable s (full model) and the other without having the explanatory to be tested (reduced model). The null hypothesis that the reduced model is adequate, against the alternative hypothesis that the full model fits better, can be tested using the usual likelihood ratio test. If the model has k explanatory variables the null hypothesis of no contribution of all the k explanatory variable is

H_o: $\beta_1 = \beta_2 = ... = \beta_k = 0$.

Letl_M denotes the maximized value of the likelihood function for the fitted model M with all explanatory variables (having k+1 parameters) that is

$l_{m=l(\beta o,\beta 1,\beta 2.....,\beta k)}$ Let denotes maximized value of the likelihood function for the fitted model with no explanatory variables (having one parameters) that is L_o=L (βo) andthe likelihood ratio test statistics is given by.

$$G^2=-2\ln\left(l_o/l_M\right)=-2(\ln l_o-\ln l_M)\sim X^2_{(k)} \quad \text{.....(10)}$$

And the rejection of the null hypothesis indicates there is at least and perhaps all k parameter are different from zero.

3.11.3 Wald test for parameter

The Wald test is used to test the statistical significance of each coefficient (β_j) in the model. That is used to test the null hypothesis H_o: $\beta_j=0$ which state that factor x_i does not have significant value added to the prediction of the response given that other factor is already included in the model.

The Wald statistics denoted by Z calculates as follow.

$Zj=\frac{\beta j}{SE(\beta j)}$ ~N (0,1) for large sample size and $Zj^2 = \left(\frac{\beta j}{SE(\beta j)}\right)^2 \sim x^2(1)$……..(11)

And the likelihood ratio also apply (performed) in this case the model under null hypothesis is not null model rather the reduced model (by excluding the j^{th} explanatory variable and the likelihood ratio test statistics is

$G^2=-2\ln\left(l_R/l_M\right)=-2(\ln l_R - \ln l_M)\sim X_2(1)$……..(8)

Where $l_{m=l(\beta o,\beta 1,\beta 2\ldots\ldots\ldots\ldots\beta j-1,,\beta j,\beta j+1\ldots\ldots\ldots\ldots\ldots,\beta k)}$ and $l_{m=l(\beta o,\beta 1,\beta 2\ldots\ldots\ldots\ldots\beta j-1,\beta j+1\ldots\ldots\ldots\ldots\ldots,\beta k)}$

3.11.4. Omnibus Test

It is a likelihood ratio test of whether all the independent variables collectively improve the model over the intercept-only model (i.e., with no independent variables added). The *p*-value of .00 (i.e., $p = .00$), which is less than 0.05, and then the study has statistically significant overall model.

3.12 Over Dispersion

One of the assumption for a Poisson distribution is that $E(Y) = Var(Y) = \mu$. Sometimes, the sample variance of Y to be greater than the sample mean of Y for a data set. When the variance is larger than the mean, this is called over dispersion, and it is a violation of our model. Thus, inferences made using the model may be incorrect.

- ✓ Find more explanatory variables that help explain the variability in the response variable.
- ✓ Check if it is a zero inflation problem.
- ✓ Use quasi-Poisson regression models.
- ✓ Use negative binomial regression models.

CHAPTER FOUR

RESULT AND DISCUSSION

4.1 Descriptive Statistics

Table 4.1 Frequency Distribution for Categorical Variables

variables	categorical	Frequency	Percent	Cumulative Percent
Educational Level	No education	1704	27.7	27.7
	Primary	2500	40.7	68.5
	Secondary	1065	17.3	85.8
	Higher	872	14.2	**100.0**
	Total	**6141**	**100.0**	
Current marital status	single	2528	41.2	41.2
	Married	3428	55.8	97.0
	Widowed	26	0.4	97.4
	Divorced	159	2.6	**100.0**
	Total	**6141**	**100.0**	
Region	Tigray	594	9.7	9.7
	Afar	357	5.8	15.5
	Amhara	1251	20.4	35.9
	Oromia	1364	22.2	58.1
	Somali	499	8.1	66.2
	Benishangul-Gumuz	562	9.2	75.3
	SNNPR	857	14.0	89.3
	Gambela	332	5.4	94.7
	Harari	325	5.3	**100.0**
	Total	**6141**	**100.0**	
Wealth index	Poorest	1575	25.6	25.6
	Poorer	1040	16.9	42.6
	Middle	955	15.6	58.1
	Richer	953	15.5	73.7
	Richest	1618	26.3	**100.0**
	Total	6141	100.0	

Occupation	Not working	744	12.1	12.1
	Professional/technical/managerial	468	7.6	19.7
	Clerical	72	1.2	20.9
	Sales	417	6.8	27.7
	Agriculture - employee	3054	49.7	77.4
	Services	176	2.9	80.3
	Skilled manual	685	11.2	91.5
	Unskilled manual	163	2.7	94.1
	Others	362	5.9	**100.0**
	Total	**6141**	**100.0**	
Place of delivery	respondent home	3951	64.3	64.3
	other home	130	2.1	66.5
	Gov't health facility	1756	28.6	95.0
	private hospital	144	2.3	97.4
	private clinic	29	0.5	97.9
	NGO health facility	62	1.0	98.9
	Other	69	1.1	**100.0**
	Total	**6141**	**100.0**	
Age of household members	0-4	895	14.5	14.5
	5 - 9	986	16.1	30.6
	10 - 14	905	14.7	45.4
	15 - 19	573	9.3	54.7
	20 - 24	477	7.8	62.5
	25 - 29	445	7.2	69.7
	30 - 34	368	6.0	75.7
	35 - 39	335	5.5	81.2
	40 - 44	228	3.7	84.9
	45 - 49	152	2.5	87.3
	50 - 54	205	3.3	90.7
	55 - 59	132	2.1	92.8
	60 - 64	160	2.6	95.4
	65 - 69	86	1.4	96.8
	70 - 74	81	1.3	98.2
	75 - 79	50	0.8	99.0
	80+	63	1.0	**100.0**

	Total	**6141**	**100.0**	
Ideal number of children	no more than 2	1182	19.2	19.2
	3	718	11.7	30.9
	4	1393	22.7	53.6
	5	448	7.3	60.9
	6+	1890	30.8	91.7
	Non-numeric response	510	8.3	**100.0**
	Total	**6141**	**100.0**	
Discussed Family Planning with health worker in last few months	No	4669	76.0	76.0
	Yes	1472	24.0	**100.0**
	Total	**6141**	**100.0**	
Religion	Orthodox	2664	43.4	43.4
	Catholic	41	0.7	44.0
	Protestant	1177	19.2	63.2
	Muslim	2219	36.1	99.3
	Traditional	16	0.3	99.6
	Other	24	0.4	**100.0**
	Total	**6141**	**100.0**	

Above table 4.1 In this study, a total of 6141 household size were considered from all rural Ethiopia indicates that of respondents 2500(40.7%) were primary the education level of respondent. Similar to that the 3428(55.8%) of the respondent was married from marital status of respondent. The 1251(20.4%) and 1364(22.2%) indicate that the region of respondents were Oromia and Amhara respectively. In the above the table 1618(26.3%) and 1575(25.6%) indicates that household respondents were richest and poorest respectively. 3054(49.7%) indicates that is the agriculture employee respondent occupation. similar to 4669 (76%) indicates that no respondent from the discussed family planning with health worker in last few months. In the above table 1890(30.8%) indicate that the ideal no of children is more than six. Above result indicates that 986(16.1%) age of household member is between 5-9 age interval and 2786(45.4%) age of household member is less than 15 age respondents.

Table 4.2 Descriptive statistics for continuous variables

Continuous variables	N	Minimum	Maximum	Mean	Variance
Number of household members	6141	1	20	5.72	5.829
Number of wives/partners	6141	1	5	1.08	0.087
Age of household head	6141	15	95	42.92	197.017
Number of rooms used for sleeping	6141	1	11	1.48	0.845
Succeeding birth interval (months)	6141	8	201	42.23	665.461
Number of eligible women in household	6141	1	9	1.60	0.799

From table 4.2 In this study, a total of 6141 household size were considered from all rural Ethiopia indicate that the average number of household member is 5.72, variance of number of household member is 5.829, the highest and minimum number of household member is 20 and1 respectively. Similar that the average of the age of household head is 42.92.the highest age of the household head is 95 years, while the minimum age is 15 years. the average number of wives/partners is 1.08, the highest number of wives/partners is 5 and minimum number of wives/partners is 1. The average number of rooms used for sleeping is 1.48, highest number of rooms used for sleeping11 and minimum number of rooms used for sleeping is 1. The highest and minimum number of rooms used for sleeping is 8 and 201months respectively. The average number of eligible women in household is 1.60, the highest number of eligible women in household is 9 and minimum number of eligible women in household is 1.

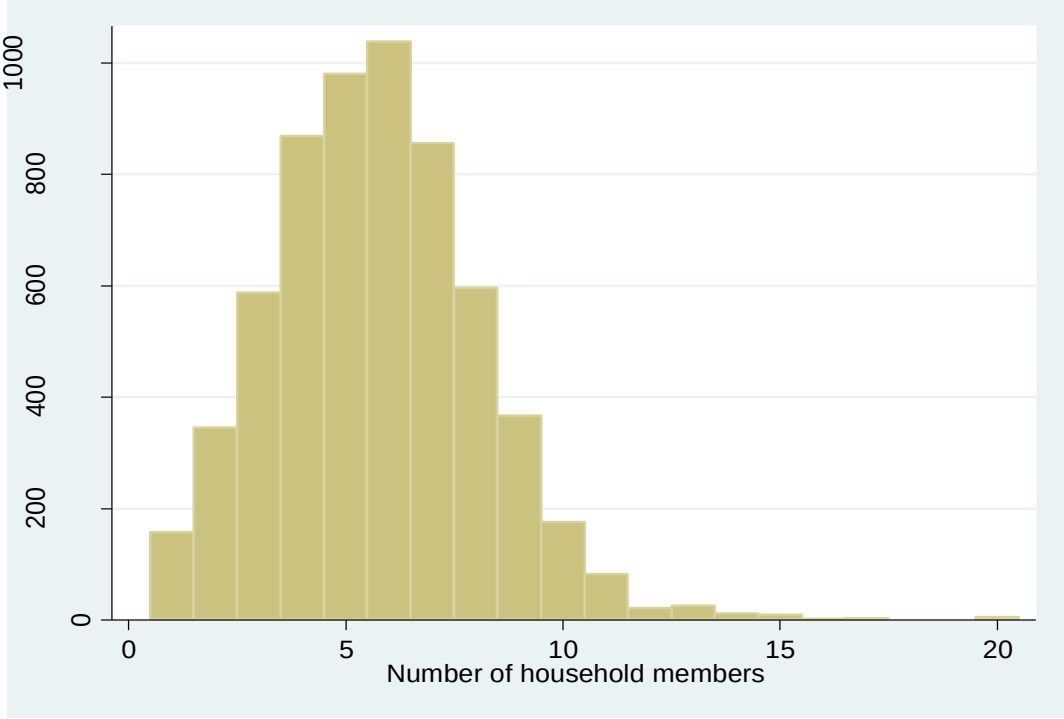

Figure 4.1 frequency of number of household member

The above figure 4.1 histogram indicate that the number of household member is strictly increase from 1 to 6 and climax point at 6 then strictly decrease after climax point.

4.2 RESULTS OF INFERENTIAL STATISTICS

4.2.1 Chi -square test of independency

Table 4.3 Test of Association of number of household member and predictor Variables.

Independent Variables	Pearson Chi-Square		
	Value	df	Asymp. Sig. (2-sided)
Succeeding birth interval(months)	3.382E3[a]	2805	0.000
No. of rooms used for sleeping	1.272E2[a]	85	0.002
Religion	1.494E2[a]	85	0.000
Age of household head	1.522E3[a]	1292	0.000
Wealth index	92.153[a]	68	0.027
Occupation	1.662E2[a]	136	0.040
Region	3.594E2[a]	170	0.000

Depend on above chi-square test analysis on SPSS software Succeeding birth interval(months), Number of rooms used for sleeping, religion, wealth index, occupation and region of respondent had statistically significant association with number of household member at 5% level of significance.

4.2.2 Test of Over dispersion

From Table 4.2 the mean and variance for the number of household member is 5.72and 5.829 respectively. The variance is similar to the mean which is not indicate of neither over dispersion nor under dispersion problem and the ratio of variance number of household member 5.829/5.72=1.0190 means is couldn't able to say greater than one. The ratio of Deviance and Pearson Chi-square value to its degrees of freedom was 1.000, and was 1.000 respectively, which indicates not different from one. Thus, it can be concluded that there is statistically insignificant over dispersion in the data that fail to the rejection of the assumption of Poisson distribution since the dispersion parameter K=0.003 is not different from zero. Therefore, no fix the problem of dispersion, a Poisson regression model was preferred.

Omnibus test

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
	35118	-81064.62	-81012.09	15	162054.2	162181.2

Note: N=Obs used in calculating BIC; see [R] BIC note

This is the LR test statistic for the omnibus test that at least one predictor variable regression coefficient is not equal to zero in the model. The degrees of freedom (the number in parenthesis) of the LR test statistic is defined by the number of predictor variables.

Goodness of fit

Deviance goodness-of-fit =32024.7 Pearson goodness-of-fit =32795.82

Prob > chi2(35102) =1.0000 Prob > chi2(35102) =1.0000

Since ratio of value of deviance and Pearson chi-square to its df is equal to 1 means the model is good fit.

Table 4.4: Analysis of model using the Poisson Regression Model.

Number hh member	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
Educational level	.0067271	.0021353	3.15	0.002	.0025421	.0109121
Marital status	-.0011793	.0031545	-0.37	0.709	-.007362	.0050034
Occupation	-.0002982	.0000901	-3.31	0.001	-.0004748	-.0001216
Family planning	.0051675	.0046011	1.12	0.261	-.0038504	.0141854
Number wives	-.016043	.0061792	-2.60	0.009	-.0281541	-.0039319
Region	-.0001624	.0007035	-0.23	0.817	-.0015412	.0012164
Wealth index	.0033687	.0013725	2.45	0.014	.0006787	.0060587
Age of hh head	-.0000924	.0001545	-0.60	0.550	-.0003952	.0002105
Ideal no. children	.0043655	.0013355	3.27	0.001	.0017479	.0069831
Place delivery	.0002794	.000262	1.07	0.286	-.0002342	.000793
religion	-.0021324	.0002581	-8.26	0.000	-.0026383	-.0016264
No. of room	.0080303	.0019082	4.21	0.000	.0042904	.0117703
Age hh member	.0011152	.0005274	2.11	0.034	.0000814	.002149
Succeed birth interval	.0002221	.0000785	2.83	0.005	.0000683	.0003759
No. of eligible women	-.0088292	.0021203	-4.16	0.000	-.012985	-.0046734
_cons	1.883119	.0152889	123.17	0.000	1.853154	1.913085

From the above table 4.4 Educational level, number of eligible women, succeed birth interval, age household member, number of room, religion, wealth index, number wives, occupation and ideal number of children are significant effects on the model, since $p\text{-}value<\alpha=0.05$. Place delivery, age of household head, region, family planning and marital status are insignificant since $p\text{-}value>\alpha=0.05$.

Table 4.5: Analysis of parameter estimates using the Poisson Regression Model

Number of household member	IRR	Std. Err.	z	P>z	[95% Conf.	Interval]
Educational level						
Primary	1.024594	.0052905	4.71	0.000	1.014277	1.035016
Secondary	1.032975	.007094	4.72	0.000	1.019165	1.046973
Higher	1.028945	.0082493	3.56	0.000	1.012903	1.045241

Occupation						
Professional/technical/managerial	.9754631	.0099803	-2.43	0.015	.9560969	.9952217
Clerical	.997775	.0195979	-0.11	0.910	.9600938	1.036935
Sales	.966132	.0091719	-3.63	0.000	.9483217	.9842768
Agriculture - employee	.9931601	.0066217	-1.03	0.303	.9802663	1.006224
Services	.9520779	.0109328	-4.28	0.000	.9308893	.9737488
Skilled manual	.9612549	.0083495	-4.55	0.000	.9450287	.9777597
Unskilled manual	1.003198	.0130888	0.24	0.807	.9778698	1.029183
Others	.9610313	.0096015	-3.98	0.000	.9423958	.9800354
Number wives	.9799568	.0059446	-3.34	0.001	.9683747	.9916775
Wealth index						
Poorer	1.001795	.006122	0.29	0.769	.989868	1.013866
Middle	1.022214	.0065658	3.42	0.001	1.009426	1.035164
Richer	1.036837	.0068676	5.46	0.000	1.023464	1.050385
Richest	1.002134	.0060752	0.35	0.725	.9902976	1.014113
Ideal number children						
3	1.017839	.0072851	2.47	0.013	1.00366	1.032218
4	1.002252	.0060874	0.37	0.711	.9903915	1.014254
5	1.009536	.0084895	1.13	0.259	.9930329	1.026313
6+	1.011895	.0062217	1.92	0.054	.9997738	1.024163
Non-numeric response	1.052675	.009669	5.59	0.000	1.033894	1.071797
religion						
Catholic	1.000814	.021523	0.04	0.970	.9595064	1.0439
Protestant	1.072979	.0062435	12.11	0.000	1.060811	1.085286
Muslim	1.008004	.0043545	1.85	0.065	.9995055	1.016575
Traditional	1.190606	.0381388	5.45	0.000	1.118154	1.267754
Other	.7780393	.0206322	-9.46	0.000	.7386337	.8195471
Number of room for sleeping	1.008593	.0018949	4.55	0.000	1.004886	1.012314
Age of household member						
5 - 9	1.013424	.0073401	1.84	0.066	.9991393	1.027913
10 - 14	1.038973	.0074901	5.30	0.000	1.024396	1.053757
15 - 19	.9823659	.008036	-2.17	0.030	.9667412	.9982432
20 - 24	.9974717	.0087401	-0.29	0.773	.9804878	1.01475
25 - 29	1.02843	.009655	2.99	0.003	1.009679	1.047529
30 - 34	1.044854	.0100377	4.57	0.000	1.025365	1.064714
35 - 39	1.014709	.0093767	1.58	0.114	.9964964	1.033254

40 - 44	1.033252	.0106516	3.17	0.002	1.012585	1.054341
45 - 49	.980952	.0129217	-1.46	0.144	.95595	1.006608
50 - 54	1.009729	.0128024	0.76	0.445	.9849458	1.035136
55 - 59	1.030274	.0142492	2.16	0.031	1.002721	1.058584
60 - 64	1.02343	.0139971	1.69	0.090	.9963607	1.051235
65 - 69	.9414452	.0154931	-3.67	0.000	.9115639	.9723061
70 - 74	1.143471	.0257276	5.96	0.000	1.094142	1.195025
75 - 79	1.032058	.0236386	1.38	0.168	.986752	1.079445
80+	.9832854	.0193452	-0.86	0.392	.9460912	1.021942
Succeed birth interval	1.000252	.0000765	3.29	0.001	1.000102	1.000401
Number of eligible women	.9908816	.002136	-4.25	0.000	.9867039	.9950769
_cons	6.431497	.1030814	116.13	0.000	6.232602	6.63674

In this study Poisson regression model was employed to select the significant determinants of household in rural Ethiopia. From the above table 4.5 the analysis was performed to select predictor variables and those having significant relationship at 95% level of significance were considered in Poisson regression model.

4.3 Discussion and interpretation of the results

This study was an attempt to identify determinants of household size based on Ethiopian Demographic and Health Survey (EDHS 2016) data. The study included fifteen (15) predictor variables. Accordingly, descriptive analysis and count model techniques were used. Poisson Regression Model was employed to identify the associated factors on number of household member. Descriptive statistics analysis in this study, a total of 6141 household size were considered from all rural Ethiopia indicates that of respondents 2500(40.7%) were primary, 1704(27%) no education,1065(17.3%) were secondary and 872(14.2%) were higher the education level of respondents some similarity with research done (the determinants of poverty study by NEC et al (2001) found that raising the education levels of a household from primary education to Junior Certificate level, raises household incomes by 22 percent (Charles Jumbe, 2010).

succeed birth interval(months) and number of eligible women of households was also found to be statistically significant factor for household live rural in Ethiopia since p-value=0.001 and *p-value*=0.000<α=0.05 respectively.

Among the martial status of households 3428(55.8%) of the respondent was married ,2528(41.2%) was single, 159(2.6%) and 26(0.4%) respondent was divorced. This result has some difference with paper (PAUL,2010) even if both are small in percent. there were a small percentage of respondents who were divorced/separated or unmarried (7.1% and 4% respectively) (PAUL, 2010). In the above the table 1618(26.3%) and 1575(25.6%) indicates that household respondents were richest and poorest respectively. From occupation status of household 3054(49.7%) indicates that is the agriculture employee respondents. this half of households live in rural Ethiopian occupation status is agriculture employee. similar to 4669 (76%) indicates that number of respondents that not discussed on family planning with health worker in last few months and 1472(24%) number of respondents that discussed on family planning with health worker in last few months. The 1890(30.8%) indicate that the ideal no of children is more than six. In the above the table 4.1 1618(26.3%) and 1575(25.6%) indicates that household respondents were richest and poorest respectively similar sequence to research done in Uganda (Determinants of Household size: a case study of Eastern Uganda (PAUL,2010). Among age of household's result indicates that 986(16.1%) age of household member is between 5-9 age interval, 2786(45.4%) age of household member is less than 15 age and 180(4.6%) age of household member is greater than 64. Inferential statistics analysis in this study show that the factors which were statistically significant, associated with number of household member were primary level of Educational respondent (IRR=1.024594,95%CI = 1.014277, 1.035016, P = 0.000), Services type of respondent's occupation (IRR =0.966132, 95% CI =0.9483217 - 0.9842768, P = 0.000), among wealth index types, middle and richer (IRR = 1.022214, 95% CI = 1.009426- 1.035164, P = 0.001 and IRR = 1.036837, 95 % CI = 1.023464-1.050385, P=0.000)) respectively.

Among number of household member 47.9% is 1-5 members. It is more similar with paper done (PAUL,2010) A big number of households fell in the 1-5 members range which was categorized as small household and constituted 46% of the entire household population and (52.1%) number of household size live with more than 6. Is also similar with paper done in Uganda (PAUL,2010) Most of the household members (54%) lived in households of more than six members

Among ideal number of children type 3 and non-numeric response (IRR = 1.017839, 95% CI = 1.00366- 1.032218, P = 0. 0.011 and IRR = 1.052675, 95% CI = 1.033894-1.071797, P = 0. 0.000) respectively, among the religion of respondent type, protestant, traditional and other (IRR =

1.072979, 95% CI = 1.060811-1.085286, P=0.000, IRR=1.190606, 95%CI=1.118154-1.267754, P=0.000 and IRR=0.7780393,95%CI=0.7386337-0.8195471, P=0.000) respectively.

Among age of household member interval (10-14) (IRR=1.038973, 95%CI= (1.024396-1.053757, P=0.00) are statistically significant on household size live in rural Ethiopia.

Number of room for sleeping positive rate of increase(IRR=1.008593) similar with paper done (PAUL,2010) Big households were more likely to use more than six rooms and the likelihood increased as did the number of rooms

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1. CONCLUSION

The descriptive results show that the mean number of household member 5.72 means approximately 6 live in rural Ethiopia. From Pearson chi-square test of association; number of household member highly associated with Succeeding birth interval(months), Number of rooms used for sleeping, Religion, Wealth index, Occupation and Region. The inferential result shows that variables Educational level, Number of eligible women, succeed birth interval, Age household member, Number of room, religion, Wealth index, Number wives, Occupation and ideal number of children were significant predictors for number of household member (household size). We conclude that not educated and primary educational level of household greater than household size than secondary and higher status of educational level, were more than 4649(75.7%) age interval of household member is less than 35 age. Place of delivery, Age of household head, Region, Family planning and Marital status are not significant effect on the response variable.

5.2. RECOMMENDATIONS

Based on the findings the following are recommended in order to decrease household size:

- The government should give more attention to improves the knowledge of apply wide succeed birth interval(months) to household with small succeed birth interval and giving initiative to household who practice succeed birth interval in any way were to more likely to practice.
- The government should access education for every household at least secondary education.
- The government should encourage the attitude of society on deciding ideal number of children to households
- The government, concerned institutions and other involved stakeholders should consider the identified major factors while designing policy that will impact household size decisions the most.

5.3 Limitation the study

There was some limitation in our research

- The data used in this study were from the EDHS 2016. Thus, the results may not necessarily reflect the current situation in Ethiopia.
- The another limitation of this study was important variables included in the analysis of this study have missing values and data redundant.

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APPENDIX

Table for categorical variable and its code

variables	categorical	Code
Educational Level	No education	0
	Primary	1
	Secondary	2
	Higher	3
Current marital status	single	0
	Married	2
	Widowed	3
	Divorced	4
Region	Tigray	1
	Afar	2
	Amhara	3
	Oromia	4
	Somali	5
	Benishangul-Gumuz	6
	SNNPR	7
	Gambela	8
	Harari	9
Wealth index	Poorest	1
	Poorer	2
	Middle	3
	Richer	4
	Richest	5
Occupation	Not working	0
	Professional/technical/managerial	1

	Clerical	2
	Sales	3
	Agriculture - employee	5
	Services	7
	Skilled manual	8
	Unskilled manual	9
	Others	96
Place of delivery	respondent home	11
	other home	12
	Gov't health facility	21
	private hospital	31
	private clinic	30
	NGO health facility	41
	Other	50
Age of household members	0-4	1
	5 - 9	2
	10 - 14	3
	15 - 19	4
	20 - 24	5
	25 - 29	6
	30 - 34	7
	35 - 39	8
	40 - 44	9
	45 - 49	10
	50 - 54	11
	55 - 59	12
	60 - 64	13
	65 - 69	14
	70 - 74	15
	75 - 79	16

	80+	17
Ideal number of children	no more than 2	2
	3	3
	4	4
	5	5
	6+	6
	Non-numeric response	7
Discussed Family Planning with health worker in last few months	No	0
	Yes	1
Religion	Orthodox	1
	Catholic	2
	Protestant	3
	Muslim	4
	Traditional	5
	Other	6