ASSESSING THE EFFECTS OF OCCUPATION ON FERTILITY IN MALAWI

MASTER OF ARTS (ECONOMICS) THESIS

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ASSESSING THE EFFECTS OF OCCUPATION ON FERTILITY IN MALAWI

MA (ECONOMICS) THESIS

By

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DECLARATION

I, the undersigned, hereby declare that this Thesis is my original work which has not been submitted to any other institution for a similar purpose. Where other people’s work has been used acknowledgements have been made.

CERTIFICATE OF APPROVAL

The undersigned certify that this thesis represents the student's work and effort. Where he has used other sources of information, it has been duly acknowledged.

This Thesis has been submitted with our approval.

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Second supervisor

DEDICATION

To my mother, my family and myself for the continuous and consistent effort.

ACKNOWLEDGEMENT

Thanks, Praise and Glory to God for everything. Heartfelt gratitude to my supervisors, Dr Jacob Mazalale, PhD, and Emmillian Kasililika-Mlagha, Msc, including 2022 Master's classmates. This work would not have progressed successfully without your time, efforts and guidance.

ABSTRACT

This paper aims to assess the disaggregated effects of occupation categories on fertility in Malawi. The interplay between intermediate and proximate determinants of fertility provides variation of fertility levels among women in various occupation categories. A Negative Binomial Regression model is thus applied to the 2015-16 Malawi Demographic and Health Survey (MDHS) data to obtain empirical results. This was followed by the Instrumental Variable and the Two Stage Least Squares (2SLS) regressions to address endogeneity in the model. The findings indicate that women in occupational categories such as professional, technical, managerial, and clerical tend to statistically have fewer logs of expected counts for the total number of children ever born compared to women who are not working. This implies that women in these occupations often prioritize their careers and may delay childbearing or choose to have fewer children with the intention of focusing on their professional aspirations, hence, having an effect on reducing population growth. The results further reveal that women in occupational categories such as sales and services, agricultural–self–employed, agricultural-employee, skilled manual and unskilled manual tend to statistically have more logs of counts of children ever born just like women who are not working. This means that women in these occupational categories have effects to increase population growth. The study further reveals that women in occupational categories such as sales and services and household and domestic are statistically not significant to have an effect on fertility. This infers that women in these occupational categories have no effect to increase or reduce population. Other covariates that were included in the study and were found to be statistically significant in influencing fertility were: age, marital status, place of residence, wealth index, contraceptive use, desire for more children as well as education. Accordingly, the study recommends that the government of Malawi, Banja La Mtsogolo and Family Health Services should critically continue to encourage access to family planning services to women whose occupation categories contribute to higher fertility levels for population control.

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LIST OF ABBREVIATIONS AND ACRONYMS

AIC	Akaike's Information Criteria
BIC	Bayesian Information Criteria
CEB	Children Ever Born
DTT	Demographic Transition Theory
FR	Fertility Rate
IRR	Incident Rate Rations
IVREG	Instrumental Variable Regression
LDC	Least Developed Countries
MDHS	Malawi Demographic and Health Surveys
MOHO	Model of Human Occupation
NSO	National Statistical Office
NBREG	Negative Binomial Regression
SSA	Sub-Sahara African
SDGs	Sustainable Development Goals
TFR	Total Fertility Rate
UN	United Nations
WB	World Bank
WHO	World Health Organization
2SLS	Two Stage Least Square

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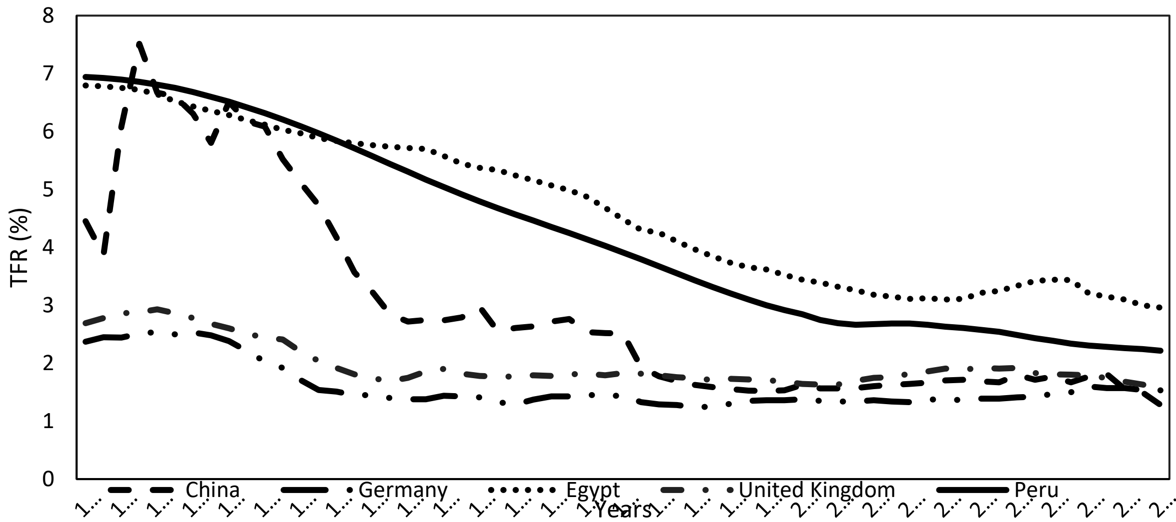
CHAPTER 1

INTRODUCTION

1.1 Background

Worldwide, countries have experienced a decrease in their national-level total fertility rates (TFR) over the past 60 years (Finlay et al., 2018). According to Giuntella et al (2022), the major determinant of the population growth rate is the fertility rate (FR). The FR, at a given age, measures the number of children born alive to women of that age during the year as a proportion of the average annual population of women of the same age (Giuntella et al., 2022). According to Aldo et al (2022), FR indicates the ratio between the number of live births in a year and the whole female population of childbearing age. In contrast, TFR measures the average number of births a group of women would have by the time they reach age of 50 if they were to give birth at the current age-specific fertility rates (Malawi National Statistical Office-DHS, 2017)**.**

Figure 1: provides an overview of countries such as Germany and the United Kingdom that experienced a moderate decrease in TFR. In Figure 1**,** it is evident that China, Egypt and Peru experienced a sharp decrease in TFR in the same period. The World TFR as of 2022 was at 2.43 births per woman, a 0.41% decline from 2021. In comparison, the World TFR in 2021 was 2.23 births per woman, a 0.41% decline from 2020 (Tesfa et al., 2022). According to the United Nations (UN), the global fertility rate is expected to continue to fall from 2.5 live births per woman to 2.2 by 2050 and further to 1.9 by 2100. However, the United Nations (UN) projected that the global human population would increase from 7.8 billion in 2020 to 10.9 billion by 2100 (UN-Report, 2020).



According to Giuntella et al (2022), the major determinant of the population growth rate is the fertility rate (FR). The FR, at a given age, measures the number of children born alive to women of that age during the year as a proportion of the average annual population of women of the same age (Giuntella et al., 2022). According to Aldo et al (2022), FR indicates the ratio between the number of live births in a year and the whole female population of childbearing age. In contrast, TFR measures the average number of births a group of women would have by the time they reach age of 50 if they were to give birth at the current age-specific fertility rates (Malawi National Statistical Office-DHS, 2017)**.**

Figure 1: Overview of fertility rates Worldwide

Source: World Bank Population Estimates & Projections (2021)

In the Sub-Saharan African (SSA) countries, a steady decrease in fertility rates emerged around the 1960s (Götmark & Andersson, 2020). According to the UN, the SSA would take 34 years, from 1995 to 2029, for fertility to decline from 6 to 4 live births per woman. Nevertheless, the SSA TFR projection by the UN indicated that the TFR would fall from 4.6 live births per woman to 3.1 by 2050 and further to 2.1 by 2100.

Malawi has not been spared to the decrease in TFR. According to 2015-16 MDHS report, the current average TFR per woman was 4.4. Besides, the 2008 TFR was 5.7. Since 1992, the TFR has dwindled from 6.7 children per woman to the current level (i.e. 4.4) (Malawi National

Statistical Office-DHS, 2017). This demonstrates a dramatic reduction of 2.3 children per woman. Figure 2: below shows that Malawi's TFR as of 2021 was at 4.048 births per woman, a 1.63% decline from 2020. On the same, the 2020 TFR in Malawi was 4.115 births per woman, a 1.63% decline from 2019 (UN-Report-World-Population-Prospects, 2022). However, the Worldometer (2023) indicated that the 2023 Malawi TFR stood at 3.913 births per woman, a 1.68% decline from 2022. While in 2022, the TFR was 3.980 births per woman, a 1.68% decline from 2021.

Figure 2: further displays a sharp decrease in Malawi population growth rate between 1987 to 1994 period. According to Jain et al. (2014) this sharp decrease in population growth was attributed to a significant increase in the availability and use of contraceptives. It was argued that programs aimed at promoting family planning and reproductive health were implemented, leading to a higher uptake of birth control methods. On the same, efforts to educate the population about the benefits of smaller family sizes and the importance of spacing births contributed to the decline in population growth during this period. Besides, awareness campaigns and community outreach programs played a crucial role in changing reproductive behaviors (Jain et al., 2014). However, societal norms and cultural attitudes towards family planning, size and childbearing reduced the uptake of family planning programs that led to a rapid population growth rate from 1995 to 1997.

Figure 2: TFR and Population Growth Rates in Malawi

Source: UN Report World Population Prospects (2022)

Lewis (2019) linked this decrease in TFR to the socio-demographic literature based on the maternal role incompatibility hypothesis. The hypothesis suggests that the clash between traditional gender roles and the demands of motherhood may create challenges for women who strive to balance multiple roles, particularly when those roles are perceived as conflicting or incompatible (Lewis, 2019). The challenges arise from societal expectations and gender norms rather than inherent limitations or deficiencies of women (Teshale et al., 2022). Unlike the economic approach, the socio-demographic approach does not focus on female wages, which represent the opportunity cost of childbearing, as a determinant of fertility (Bongaarts et al., 2019). This implies that the conflict between the roles of a mother and a career-oriented individual stems from cultural beliefs about gender roles, which place a heavier burden on women to prioritize caregiving responsibilities.

In Malawi, fertility reduction remains a key target of developmental goals, as high fertility rates hampers the economic and health prosperity of low and middle-income countries (Rogers & Stephenson, 2018). **Error! Reference source not found.** shows that population in Malawi increased from 3.62 million in 1960 to 19.9 million people in 2021 (World-Bank, 2021)**.** This population increase contributed to social, economic and demographic challenges (Palamuleni, 2023).

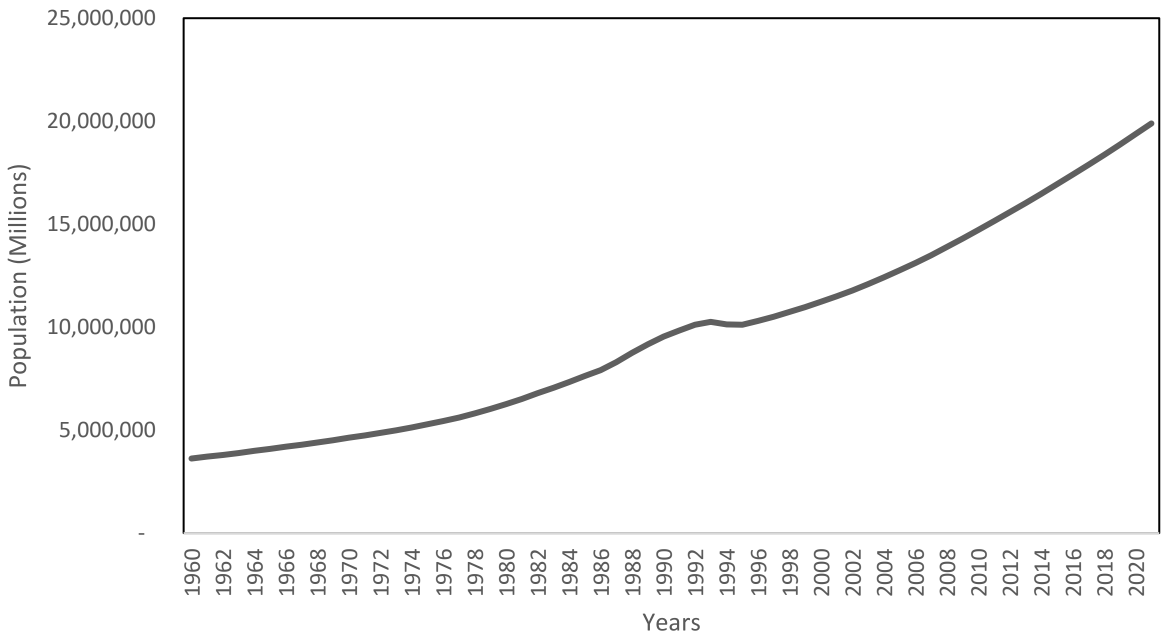


Figure 3: Population trend in Malawi (1960-2021)

Source: World Bank Population Estimates & Projections (2021)

In an effort to explore the effects of occupation categories on fertility in Malawi, during a period of both tremendous increase in population and a significant decrease in TFR, the study adopts the definition of occupation by Brown & Hollis (2013) as the day-to-day activities that enable people to sustain themselves, to contribute to the livelihood of their family, and to participate in the economic activities of broader society. Occupations are fundamental to human health and well-being because they provide meaning, identity, and structure to people's lives and reflect society's values and culture (Brown & Hollis, 2013). In the context of this study, further broader definition of occupation was embraced from the 2015-16 MDHS, as classified into professional/technical/managerial, sales and services, skilled manual, unskilled manual, domestic service, and agriculture.

Oppong (2023) observed that the participation of women in various occupations was presumed to compete with their family obligations since mothers are usually primarily responsible for household duties in many cultures. It was argued that while a consistent negative relationship between women's paid work (occupation) and fertility has been found at the micro level in developed countries, no clear pattern has emerged in developing countries (Bongaarts et al., 2019). In particular, in Sub-Saharan Africa, it has been advocated that no relationship should exist between occupation and fertility because of limited wage employment, extended family networking, and cheap domestic labour as well as traditional social norms regarding gender roles and the division of household duties between men and women (Oppong, 2023). However, these mediating factors vary across different settings in SSA, including Malawi, thereby resulting in the discrepancy in the female occupation and fertility relationship in this region (Bras & Smits, 2022).

Abdoli et al (2022) argue that different occupation categories can impact fertility due to various factors, including exposure to environmental toxins, physical strain, and irregular working hours (Abdoli et al., 2022). According to Abdoli et al (2022), certain jobs expose individuals to harmful chemicals, such as pesticides, heavy metals, and solvents, which can negatively affect reproductive health. For example, agricultural workers may be exposed to pesticides that can disrupt hormone function and reduce fertility. Besides, high-stress jobs can lead to increased levels of stress hormones, which can interfere with reproductive hormones and reduce fertility. This is common in high-pressure professions like finance or law. This is also evident in shift work and irregular working hours disrupting the body's natural circadian rhythm, leading to hormonal imbalances that can affect fertility (Abdoli et al., 2022). This is particularly relevant for healthcare workers and those in the service industry who often work night shifts.

1.2 Problem Statement

Regardless of the decline in TFR, Malawi is still experiencing rapid population growth and the fertility rate remains higher compared to other countries in the SSA region (Palamuleni, 2023). These demographic trends are harbingers of future challenges to achieving both the 2030 Agenda for Sustainable Development and the Sustainable Development Goals (SDGs) as they may trigger poverty, especially in Least Developed Countries (LDC) such as Malawi. Chemhaka (2018) observed that high fertility leads to high rates of population growth resulting in stifling socioeconomic development or progress at individual, family, and community levels due to rivalry for access to resources that are currently inadequate.

In Malawi, there exists a gap in understanding fertility behavior with regard to levels, proximate and intermediate determinants (such as occupation categories) of fertility (Chemhaka, 2018). A fundamental question in a modified Bongaarts framework (1982) arose on how the proximate and intermediate determinants interact to influence fertility. Stover (1998) postulated that proximate determinants influence fertility directly while intermediate determinants affect fertility indirectly by modifying the proximate determinants. Unlike Nahar & Zahangir (2019), Araban et al (2020) and Hossain & Majumder (2019) who used occupation without specifying the occupation categories, this study focused on the specific occupation categories to ensure that the disaggregated contribution of each occupation category was well investigated in terms of its effect on fertility.

Khraif et al (2019) in their study of the fertility behaviour of working women in Saudi Arabia found that proximate factors were significant in predicting fertility behaviour whereas occupation was insignificant. Similar results were found by Raharjo et ala (2019) in their study on the proximate determinants of adolescent fertility in Central Java. The study found that proximate determinants were significantly associated with fertility while factors such as occupation, wealth, type of residential area, insurance ownership, duration of abstinence, partner's age, partner's level of education, and partner's occupation were statistically not significant to adolescent fertility.

Empirical evidence from a cross-sectional study conducted by Odusina et al. (2020) and Njuguna (2020) found similar results to that of Nahar et al. (2019). Odusina et al. (2020), applied a binary logistic regression model on the association between fertility and other explanatory variables including occupation and found that occupation was statistically and significantly associated with fertility. Njuguna (2020) conducted a qualitative cross-sectional study in Gatanga Sub-County, Muranga County in Kenya and found that occupation was directly associated with the desire for additional children (Njuguna, 2020). However, these results could not be perfectly applied in Malawi due to differences in the influence of various socioeconomic, socio-demographic, and cultural factors. As such there was a need for further study to explore the same association in Malawi perspectives using different data sets and approaches.

The current 2015-16 MHDS report focused only on the proximate or the background characteristics linked to fertility behaviour changes. However, these factors were not enough to explain the emerging pattern of fertility due to its complexity. As such, to fully understand fertility variations, there was a need to scrutinize how socio-economic factors (such as occupation categories) affect fertility through proximate determinants and their association with rapid population growth using econometrics fundamentals in Malawi. Kisato (2021) found that socioeconomic (intermediate) factors could affect fertility depending on the contribution of the proximate determinants leading to positive, or negative or insignificant results (Kisato, 2021).

Common to the studies reviewed above was the lack of focus on the disaggregated effects of various categories of occupation on fertility in Malawi. In a nutshell, this study focused on the various occupational categories to assess their individual and disaggregated contribution to fertility levels in Malawi using Negative Binomial regression model followed by Instrumental Variable and Two Stage Least Squares regressions to address endogeneity problems. The study filled this literature gap by focusing on occupation categories, a factor that policymakers could influence. It is also a factor with other important implications, including, poverty reduction and improved living standards.

1.3 Objectives

The main objective of this study was to assess the effects of occupation on fertility in Malawi.

1.3.1 Specific Objective:

To determine the disaggregated effects of occupation categories on fertility.

1.4 Hypotheses

Based on the study objective, the following hypotheses were tested:

- Null Hypothesis (H_0): There are no significant disaggregated effects of occupation categories on fertility.
- Alternative Hypothesis (H_1): There are significant disaggregated effects of occupation categories on fertility.

1.5 Significance of the Study

One key significance of this study lies in its potential to inform policymakers and government agencies about the implications of occupational choices on fertility. By identifying the specific occupations associated with higher or lower fertility, policymakers can design targeted interventions and policies to address population concerns and promote reproductive health. This information could help guide the development of workplace regulations and guidelines that promote safe working conditions for all workers, including those who are trying to conceive. Besides, by unravelling the complex interplay between occupation choices and fertility decisions, this study has contributed to evidence-based economic planning, and academic discourse surrounding population dynamics and labour-market dynamics in Malawi. Furthermore, this study contributed an add-on to the existing literature on fertility intermediate determinants, particularly in the context of sub-Saharan Africa. While studies exploring the influence of occupation on fertility exist in various countries, a dearth of research focuses specifically on Malawi. By filling this research gap, the study has enhanced the understanding of the uniqueness of various occupation categories as one of the socioeconomic factors that shape fertility decisions in the country. The study has also provided a comparative insight among occupational categories, allowing researchers to draw parallels and contrasts with similar studies conducted in other contexts.

1.6 Organization of the Study

The paper was organized as follows: Chapter One introduced the study's background, problem statement, objectives, hypotheses and significance of the study. Chapter Two covered in-depth of both theoretical and empirical literature review and research. The methodology and research design were discussed in Chapter Three. Chapter four presented results and discussions of key findings. Finally, chapter five concludes with policy implications, study limitations and areas for further study.

1.7 Chapter Summary

This chapter has established that there is a tremendous decrease in total fertility rates both worldwide and at regional levels (i.e. Sub-Saharan African countries) including Malawi. Besides, there is also rapid population increase that need to be controlled to avoid socioeconomic challenges. The chapter has also found that there is a scholarly gap with respect to the effects of occupation categories on fertility in Malawi. Specifically, most studies had hardly focused on disaggregated effects of various occupational categories on fertility. It is against this motive that the objective of this study was to determine the individual and disaggregated contribution effects of each occupation categories on fertility in Malawi to inform the potential policy makers and government officials about the implications of occupational categories on fertility.

CHAPTER 2

LITERATURE REVIEW

2.1 The Concept of Fertility in Demography

Aldo et al (2022) defined fertility as the actual production of offspring and not the biological potential to reproduce. Fertility is rooted in the biological sequence of conception, gestation and birth (Aldo-Campana-GFMER-O-Frank, 2022). Opposite to fertility is infertility which refers to a disease of the male or female reproductive system defined by the failure to achieve a pregnancy after 12 months or more of regular unprotected sexual intercourse(WHO-Report, 2023). According to World Health Organization (WHO), globally, one in six people experience infertility in their lifetime.

2.2 The Concept of Occupation

Based on the Model of Human Occupation (MOHO) developed by Gary Kielhofner (1980), occupation refers to human activity or job, or a person's role in society, often performed for payment. This framework argues that occupational participation is chosen, patterned and performed through volition (values, interests and personal causation), habituation (habits and roles) as well as performance capacity (the mental and physical attributes and lived experiences). This means that people's motivation to choose or to engage in occupations is influenced by values, beliefs, ability and significance attached to activity and capabilities (Taylor et al., 2023).

2.3 The Conceptual Framework

Guided by the Bongaarts framework (1984),

Figure 4: illustrates the interplay of TFR, intermediate and proximate determinants. In this framework, the moderating variables (such as marriage patterns, frequency of sexual activity, and access to and use of contraceptives) facilitates the interaction between the intermediate and proximate determinants towards TFR. According to Bongaarts (1984), the moderating

variables have the potential of influencing the intermediate determinants via the proximate determinants and cause an effect on TFR which would not be directly attributed to these intermediate factors such as occupation categories.

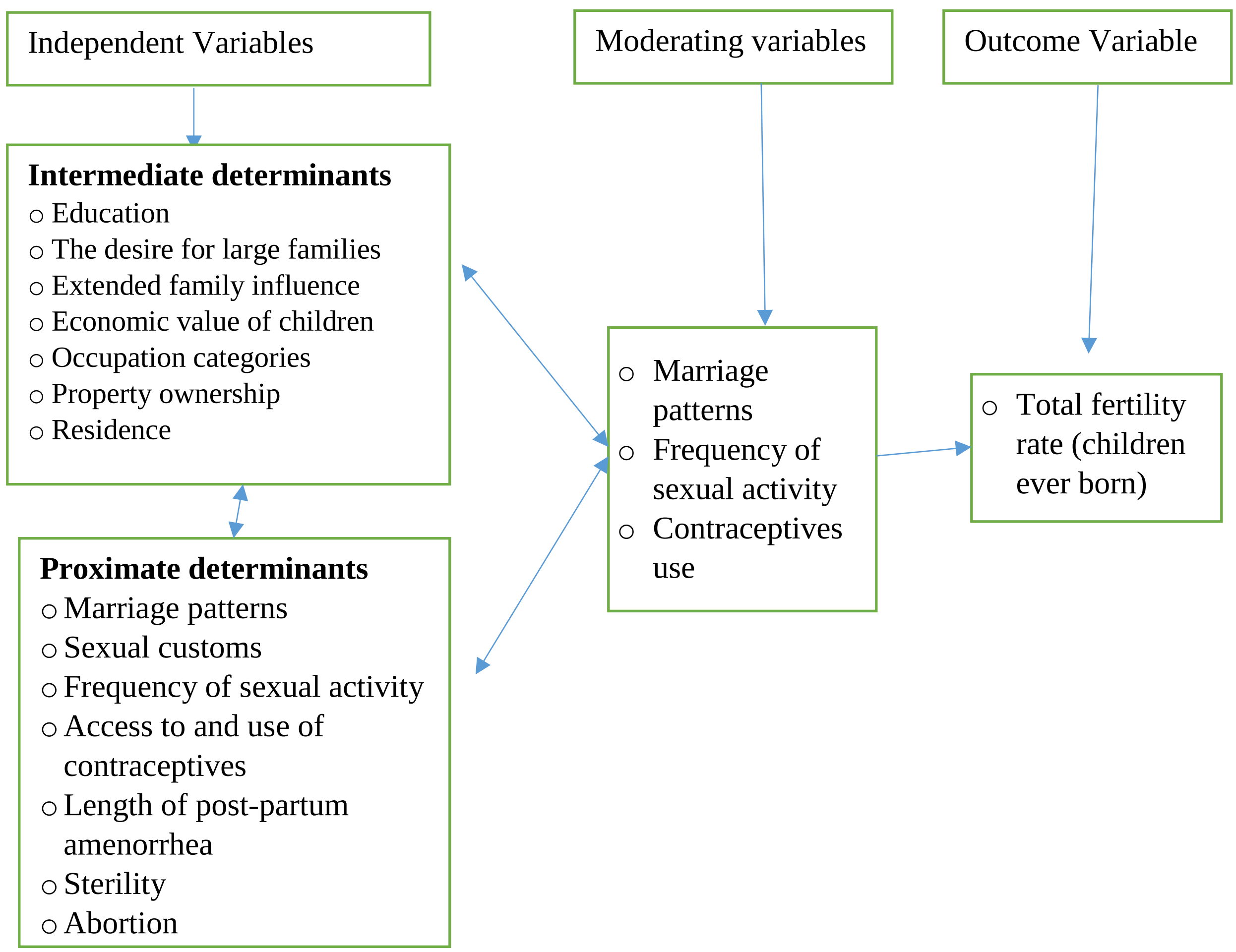


Figure 4: The Conceptual Framework

Source: adapted from Njuguna (2020)

2.4 Theoretical Framework

Theoretical framework underpinning this study was based on Andersen Behavioral Model of Health Service use (1968), Neoclassical Labour Supply Theory of Labour-Leisure Choice (1965), and Goode’s role strain theory (1960).

2.4.1 Andersen Behavioral Model of Health Service use (1968)

Ronald M. Andersen (1968) and James F. Newman (1973) postulates that predisposing, enabling and need factors determine the usage of health services. The predisposing factors or the pre-existing individual characteristics include educational level, marital status, gender, occupation, and health beliefs (i.e. attitudes, awareness of oral health care delivery systems). Besides, enabling factors include income and social or community networks. On the other hand, factors linked to need include the severity of the illness necessitating care and perceived health status (Babitsch et al., 2012). This theory argues that the element of occupation categories and fertility is linked to predisposing factors.

With respect to fertility, the predisposing factors include individual characteristics that influence the decision to seek fertility-related healthcare. These may include age, gender, education level, cultural beliefs, and attitudes towards family planning. With regards to enabling factors, this encompasses the resources and opportunities that facilitate fertility-related healthcare utilization. Fertility is linked to enabling factors by looking at access to reproductive health services, health insurance coverage for fertility treatments, availability of fertility clinics, and financial resources to afford fertility treatments. An expansion to the need factor touches on the individual's perceived need for fertility-related healthcare. In this case, need factors might include components such as infertility, previous reproductive health issues, and desire to have children.

In the context of occupation, this theory contended that the predisposing factors might include occupational hazards, stress levels, and work-related health beliefs. For instance, individuals working in high-stress occupations may be more likely to seek healthcare services due to the impact of occupational stress on their health. Besides, enabling factors, in the context of occupation might include access to occupational healthcare services, availability of health insurance through employment, and workplace wellness programs. These factors can influence an individual's ability to access healthcare services related to their occupation (Oppong, 2023). Linking the need factors to occupation includes features such as work-related injuries or illnesses, exposure to occupational hazards, and the need for preventive healthcare services. Occupation-specific healthcare utilization can also be influenced by the individual's perception of the severity of work-related health issues.

Based on this theory, the utility function was derived with respect to occupation and fertility. The analysis represented an individual's preferences over different combinations of goods or variables (in this case, having children) by quantifying the satisfaction or utility that an individual derives from consuming goods or experiencing certain conditions (i.e. the number of children an individual wishes to have). The derivation of the utility function assumed the presence of two variables: "occupation categories" (O) and "fertility" (F). An individual's utility was represented as *U(O, F),* where *O* and *F* are the levels of occupation and fertility, respectively.

In the utility function derivation, the study considered the preferences and trade-offs an individual would make between occupation and fertility. For example, some individuals may prioritize career advancement and choose occupations that require long working hours, which could potentially affect their fertility. Others may prioritize family and opt for occupations that offer more flexible schedules.

A simple utility function that captures this trade-off could be of the form:

$$U(O,F) = a \times U(O) + b \times U(F) \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots . (1)$$

Where, $U(O)$ represents the utility derived from the level of occupation (e.g., job satisfaction, income, career advancement opportunities), and $U(F)$ represents the utility derived from the level of fertility (e.g., having children, family satisfaction, personal fulfilment).

The coefficients 'a' and 'b' measures the weights or importance an individual assigns to each component. These weights would depend on individual preferences, societal norms, and other factors. The relative magnitude of 'a' and 'b' would determine how much importance was given to occupation versus fertility in the overall utility function (Mbalinda et al., 2020).

2.4.2 Neoclassical Labour Supply Theory of Labour-Leisure Choice

This theory was developed by Gary S. Becker (1965) and provided an extension of the fertility maximization problem of consumer theory. It analyses how individuals make choices in deciding how they would spend a fixed amount of time. It postulates that, an individual has two uses of their time; either having an occupation i.e. working in the labour market at a real wage rate of W per hour or enjoying leisure**.** According to this theory, individuals wishes to maximize their utility by purchasing consumption goods in the market place and by consuming time in leisure activities, conditional on an individual's market wage, personal preferences and non-labour (occupation) income (Vercherand, 2014).

This study used this theory to explain occupation and family-size decisions. Based on this theory, households were perceived to maximize their welfare by making choices between having children and other consumer goods. In this case, children were treated as a special type of good from which utility was derived and the cost of which was the time required to raise them.

Aligned with this theory, the utility maximization function of occupation-leisure choice was derived by considering an individual's preferences, budget constraints, and the production function. The model assumed that individuals made decisions to maximize their utility, given their limited time between occupation and leisure. The utility function was formed as follows:

$$u = u(c, l, k) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots . (2)$$

Where *u* represents utility, *c* is consumption, *l* is leisure, and *k* is the number of children.

The budget constraint was expressed as:

$$w(t - l) = c \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots . (3)$$

Where *w* is the wage rate, *t* is the total time available, and *t* - *l* represents the time spent on work.

The production function for children was represented as:

$$k = f(t - l) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots . (4)$$

Where f(.) is a function that determines the number of children born based on the time spent on work.

To maximize utility, the Lagrangian function was expressed as follows:

$$l = u(c, l, k) + \lambda[w(t - l) - c - l(f(t - l))] \dots\dots\dots\dots\dots\dots\dots . (5)$$

Where; λ is the Lagrange multiplier and *l(.)* represents the inverse of the production function *f(.)*.

The first-order condition was achieved by taking partial derivatives of the equation (5) above with respect to $c, l\ k$ and λ and setting them equal to zero and the study got;

$$\frac{\partial l}{\partial c} = \frac{\partial u}{\partial c} - \lambda = 0 \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots . (6)$$

$$\frac{\partial l}{\partial l} = \frac{\partial u}{\partial l} - \lambda w + \lambda l(f(t - l)) = 0 \dots\dots\dots\dots (7)$$

$$\frac{\partial l}{\partial k} = \frac{\partial u}{\partial k} - \lambda l'\big(f(t - l)\big) = 0 \dots\dots\dots\dots\dots\dots . (8)$$

$$w(t - l) - c - l(f(t - l) = 0 \dots\dots\dots\dots\dots .. (9)$$

These first-order conditions represented the optimal allocation of time between work and leisure, as well as the desired number of children (fertility) that maximize individual utility.

2.4.3 Goode's Role strain Theory (1960)

The theoretical basis of the role incompatibility argument was based on Goode's (1960) role strain theory. According to this theory, if women's roles in the family, workplace, and other social institutions compete and are very demanding, she might feel role strain while trying to satisfy the demands of all these roles (Goode, 1960). In order to reduce this feeling of role strain, the woman would continuously got engaged in a process of role decisions and bargains in which she selects among role behaviors (Lewis, 2019). This theory proposed some of the mechanisms that a woman would use in order to reduce the role strain, also known as "scaling back strategies" which include: (1) compartmentalization, in which a woman would maintain a full separation between work (occupation) and family life in order to avoid a spillover between the two spheres, (2) the delegation, in which a woman would outsource some of the domestic tasks, such as the household chores and some of the childcare responsibilities, to a service provider or to other people, thus making her role as a mother less demanding, (3) the elimination or reduction of role relationships, i.e., in order to reduce the role strain which would result from her roles in the family and in the workplace, the woman could choose either to remain childless or to not have additional children, or to fully withdraw from the labor market (occupation) or quit her demanding job and find a more family-friendly job; and (4) extension, in which a woman expands her role relations and finds a job which allows her to work for a salary while she is taking care of her child (working from home, for example). All of these strain-reduction techniques suggested different strategies for allocating the women's commitments in a way that would produce a minimum level of strain. Thus, these aspects of Goode's theory mostly referred to the role strain which arose due to the inappropriate allocation of commitment and time.

However, according to Goode, an individual’s ability to manipulate his or her role structure is dependent on the social structure and the prevailing norms in society. For instance, the societal hierarchy of values indicates which domestic or childcare tasks could be delegated or outsourced by mothers. Goode (1960) further suggested that family relations are a set of role obligations which are less prone to bargaining. Moreover, a withdrawal from family roles is difficult, as doing so might inspire guilt feelings in the individual, and lead to social pressure on the individual to fulfil her (or his) family roles.

Nevertheless, this theory was criticized for its assumptions regarding the allocation of role strain. It resisted Goode’s assumption that human energy, time and commitment were limited goods and suggested that these goods could be expanded or contracted according to the systems of commitments that determine their availability. It was suggested that the role accumulation might be more gratifying than stressful (Götmark & Andersson, 2020).

2.5 Empirical Literature Review

Studies on the effects of occupation categories on fertility are dearth worldwide. However, closer studies have been conducted both globally and in SSA Countries including Malawi. These studies have shown mixed evidence of a possible association between fertility and occupation categories as presented below.

Luppi et al (2022) in Italy, conducted a study on fertility plans in the early times of the COVID-19 pandemic in which they focused on the role of occupational and financial uncertainty. Using a pooled sample size data of 13,184 from a cross-section survey, they implemented two distinct modelling strategies and applied generalized ordered logit models to contrast fertility intentions before and after the pandemic including the occupational status as the main explanatory variable by exploiting data in the regular waves (2016–2020) and in the COVID waves (March and October 2020). They found that individuals with more vulnerable occupations showed a lower probability of intending to have a child or another child in the short-term and a higher probability of abandoning their pre-COVID fertility plan. The results also showed that in October 2020 changes in fertility plans did not vary by employment condition. The results further showed that those who suffered from a negative income shock and those with negative expectations of their future income and occupation were more likely to abandon their pre-pandemic fertility plan compared to their better-off counterparts. Luppi (2020) concluded that having children implied substantial financial efforts, thus, job and income loss induces people to delay or withdraw their fertility plans. The situation was worse in periods of economic recessions in which increased economic uncertainty was shown to have detrimental consequences on fertility (Luppi et al., 2022).

A study conducted in Burundi by Nibaruta et al (2021) assessed the determinants of fertility differentials using the 2016-17 Burundi Demographic and Health Survey with a sample size of 17,269 women aged 15-49 years. Nibaruta (2021) applied Univariable and Multivariable Poisson regression analysis to identify the most factors influencing fertility differentials in Burundi. The one-way analysis of variance was also performed to describe variations in mean number of children ever born ranged from 0 to 15 children by women across categories of correlate variables. The results were found that factors such as urban residence, increase in the level of education of both women and husbands, no history of infant mortality experience, and increase in age at first marriage or first birth, were associated with a low fertility rate while factors such as residence especially in Southern region of Burundi, women and husband´s agricultural profession (as an occupation), lack of knowledge of any contraceptive method, household poverty, and non-use of modern contraceptive methods were associated with a high fertility rate (Nibaruta et al., 2021).

Okui et al (2022) examined the association between preterm birth rates and socioeconomic factors in Japan using nationwide statistical data. Specifically, they analyzed the association between preterm birth rates and household occupation from 2007 to 2019 using a sample size of 12, 282 797 births. Variables such as the number of births according to year, age group, gestational period, number of pregnancies, and household occupation were used in their study.

They applied Poisson regression analysis to their study to evaluate the association between household occupation and preterm births. The results from the Poisson regression analysis revealed that unemployed households were statistically significantly associated with a higher rate of preterm births and that households with a classification of full-time workers had the lowest preterm birth rate throughout the study period. In addition, Okui et al (2022) found the preterm birth rate adjusted for maternal age did not increase over the study period regardless of household occupation. Okui et al (2022) concluded that further studies would be required to investigate the reasons for the high preterm birth rate (or the disparities) associated with unemployed households than other household occupations.(Okui & Nakashima, 2022).

In Turkey, Ozgoren et al (2018), investigated the birth and employment transitions of women with focus on the emergence of the maternal role incompatibility hypothesis and the societal response hypothesis as a framework to examine the relationship between fertility and employment (occupation) among women. Despite the fact that societal response hypothesis applies to industrialized countries, Ozgoren et al (2018) tried to find an explanation for the negative to positive change in the relationship between fertility and female employment after the 1980s. Their study adopted piecewise constant exponential event history modeling using data from the 2008 Turkey Demographic and Health Survey. The results were found that there was a two-way negative association between fertility and employment (occupation) among women in Turkey. Ozgoren et al (2018) established that the characteristics of jobs that favor compatibility between worker and mother roles increased the risk of conception. However, it was further found that fertility in all its dimensions decreased the risk of entry into employment. Ozgoren (2018) proved that the contextual changes related to the incompatibility of the roles of mother and worker have transformed the fertility–employment (occupation) relationship in Turkey from being insignificant to being strongly negative, in line with the role incompatibility hypothesis (Özgören et al., 2018).

Forty et al (2022) investigated the determinants of fertility in Malawi with a focus on women's autonomy. Forty (2022) used the 2015-16 MDHS data with a sub-sample size of 15,952 women and applied a multivariable Poisson regression model. Fertility, as a dependent variable, was measured by children ever born. Forty (2022), applied demographic transition theory which was linked to modernization-related theories to elaborate on the determinants of fertility in Malawi. After Controlling for covariates, the study found no significant association between women's autonomy dimensions in the household and the number of children ever born (Forty et al., 2022). However, other variables such as education level of a woman and her partner, urban-rural residence, ethnicity, religion, household income, woman's occupation, age of a woman, and contraceptive use were significantly associated with fertility. As opposed to Forty (2022) study that applied a multivariable Poisson regression model, this study applied Negative Binomial Regression model with a focus on occupation categories.

Bwalya et al (2022) used Poisson regression model to the 2018 Zambia Demographic and Health Survey in their study to establish factors associated with fertility preferences as well as associated demographic and socio-economic characteristics. They found that covariates such as contraception, age, type of place of residence, wealth quintile, religion (Protestant or Muslim), media exposure and family planning were associated with fertility (Bwalya et al., 2022).

Cherie et al (2023) applied Poisson regression model to 2019 Ethiopian Demography and Health Survey datasets in modeling the number of children ever born and its determinants. The study found that education, occupation (employment), and wealth index contributed to the reduction of children ever born and this was important in balancing population growth with natural capacity and the country's economic development (Cherie et al., 2023).

A study on the impact of women education on fertility by Jammeh (2020) concluded that education was negatively related to fertility. Jammeh (2020) applied negative binomial regression model to 2013 wave of Demographic and Health Survey of the Gambia cross-sectional data in an attempt to further understand the pre-modern era in which the number of children born per woman was high and the only thing that kept population growth low was the high death rate (Jammeh, 2020).

Lai et al (2022) applied a bivariate analysis and negative binomial regression to their study on the fertility differentials in Bangladesh and Pakistan using the multiple waves of the Demographic and Health Surveys. The results showed that the differences in socio-economic conditions, cultural practices such as childbearing norms, and access to family planning between the two countries were plausible reasons for the fertility variations (Lai, 2022).

A study conducted by Masanja (2020) investigated the factors influencing the Western Tanzania fertility. Masanja (2020) applied negative binomial regression model which accounted better for dispersion and produced robust estimates for predicting the average number of children ever born to women in Western Tanzania. Masanja (2020) used a cross-sectional data set of children ever born (CEB) i.e. a measure of fertility to women aged 15-49 in Western Tanzania with a sample of 836 from the Tanzania Demographic and Health Survey and Malaria Indicator Survey (TDHS-MIS) 2015-16. The study concluded that age of women, age at first birth, age at first marriage, wealth, women‟ s education, work status, marital status, breastfeeding, knowledge of contraceptives and place of residence were found to be significant determinants of fertility while age at first sex, region of residence, husband’s occupation, and abstinence and insusceptibility were statistically insignificant (Masanja, 2020).

Nyarko (2021) examined the socioeconomic associated with cumulative fertility in Ghana using data from the Ghana Demographic and Health Surveys of 2003, 2008, and 2014. Using the Negative binomial regression model, the study found that socioeconomic disparities in educational attainment, household wealth, employment, and employer status were significantly associated with cumulative fertility risks in Ghana. Other covariates such as the current age of women, age at sexual debut, and marital status, among others, were also linked to cumulative fertility levels. It was further revealed that place and region of residence were also linked to fertility in Ghana (Nyarko, 2021).

Pandey et al (2015) modeled the fertility behavior based on religious, educational, economic, and occupational characteristics. Pandey et al (2015) used both Poisson regression model (PRM) and multinomial regression model (MRM) in order to link fertility with various socioeconomic indicators responsible for fertility variation based on the National Family Health Survey -3 dataset. The study found that that religion, caste, wealth, female education, and occupation were the dominant factors shaping the observed birth process i.e. fertility (Pandey & Kaur, 2015).

2.6 Chapter Summary

This chapter has reviewed the concepts of fertility in demography and the concepts of occupation in which definitions were plenary discussed. In addition, the conceptual framework was presented using the Bongaarts Framework (1984) whereby the interplay of total fertility, intermediate and proximate determinants were illustrated. Besides, the theoretical and empirical literature review were presented in detail showing a gap that necessitated the need for this study. Some of the theories that were reviewed include Andersen Behavioral of Health Service Utilization, Neoclassical Labour Supply Theory of Labour-Leisure Choice (1965), and Goode's role strain theory (1960).

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter covers the data sources, description and measurement of variables, empirical model, data analysis technique and diagnostic tests.

3.2 Data Sources

The study has used secondary cross-sectional data from the 2015-16 Malawi Demographic and Health Survey (2015-16 MDHS). The 2015-16 MDHS is the most recent and was collected by the Malawi National Statistics Office (NSO) between October 2015 and February 2016 covering 26, 361 households. The survey included 24,562 female respondents and 7,478 male respondents. However, this study focused on female respondents only with a total sample size of 24,562. The target age group for this study was 15–49 justified based on the ability to have children and the capacity to join any category of occupations.

3.3 Description and Measurement of Variables

The outcome variable is the total fertility rate (TFR). This variable was measured by the total number of Children Ever Born (CEB) for women aged 15 to 49. According to the 2015-16 MDHS, CEB was referred to as a measure of the average number of births a group of women would have by the time they reach the age of 50 if they were to give birth at the current age-specific fertility rates (Malawi National Statistical Office-DHS, 2017).

The focus variable was occupation categories**.** This was measured as a categorical variable in which dummy variables were generated. These variables were professional/technical/managerial, clerical, sales and services, skilled manual, unskilled manual, domestic service, agriculture self-employed and agricultural employee. Other covariates that were included based on the literature were: age, marital status, place of residence, wealth index, contraceptive use, desire for more children and education status.

3.4 Empirical Model

The analysis and the model used in this study was based on the neoclassical labour supply model of labour-leisure choice which was used to analyze occupation choices. Fertility choices were explored using the Andersen-Behavioral model of health service use which is further supported by Bongaarts framework for examining the proximate determinants of fertility as well as the Demographic Transition Theory (DTT).

The DTT was developed by Thompson (1929) and Notestein (1945) to assess the effects of occupation on fertility linked through modernization-related theories. The DTT attributed the fertility decline to changes concomitant with the characteristics of modernization. Modernization is referred to as a model of a progressive transition from a 'pre-modern' or 'traditional' to a 'modern' society (Forty et al., 2022). DTT looks at the internal factors of a country while assuming that with assistance, "traditional" countries can be brought to development in the same manner more developed countries have been (Lesthaeghe, 2020). The idea underlying this approach was that women's occupation could radically transform their options for economic survival and their bargaining power within families, including the ability to advocate for their fertility desires.

On the other hand, the neoclassical labour supply model of labour-leisure choice argues that an individual's decision to select one of the occupational categories is a voluntary self-selection (Aaronson et al., 2021). This implies that individuals who select a specific occupational category have systematically different characteristics from those individuals who do not select a certain occupation (Wasserman, 2019). The fact that individuals who select a particular occupation are not a random sample of the population as the study was not based on a controlled experiment but observational data, the decision is likely to be influenced by variables which are unobservable or impossible to quantify using standard household surveys (such as managerial skills, expectations, and motivation etc.) and these unobservable variables could be correlated with the fertility (Sheiner et al., 2003). This necessitated a selection correction estimation method. In response, this study adopted the maximum simulated likelihood estimation of the negative binomial regression model to account for count data variables; observed and unobserved heterogeneity and then the Instrumental Variable (V) and Two Stage Least Squares (2SLS) to address endogeneity problem.

3.5 The Negative Binomial Regression Model

According to Cameron, Trivedi, Favero and Belfiore (1986), the effect of each occupation category on fertility is estimated using the Negative Binomial Regression (NBREG) model due to its less restrictive property which states that the variance is not equal to the mean.
Guided by Rabe-Hesketh and Skrondal (2012), a general NBREG model is expressed as below:

$$\ln(\hat{u}_i) = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \ldots + \beta_k X_{ji} \quad \ldots\ldots\ldots\ldots\ldots(10)$$

where β_0 represents the constant, β_k $(1,2,\ldots,k)$ are the estimated parameters for each X_j explanatory variable, $\hat{u}_i$ is the expected number of occurrences or the estimated incidence rate ratio for the phenomenon under study for a given exposition (i.e. CEB) and for a determined observation i $(i = 1,2,\ldots,n)$ and n is the sample size.

The probability function for a NBREG distribution (also known as Poisson-Gamma distribution), which permits the study to calculate the occurrence probability for a count m (i.e. CEB), given a determined exposition, is expressed as:

$$p(y_i = m) = \left(\frac{m + \alpha^{-1} - 1}{\psi - 1}\right) . \left(\frac{\alpha^{-1}}{\hat{u}_i + \alpha^{-1}}\right)^{\alpha^{-1}} . \left(\frac{\hat{u}_i}{\hat{u}_i + \alpha^{-1}}\right)^{m} \ldots\ldots\ldots(11)$$

Where α is the inverse of the form parameter of the Gamma distribution ($\alpha > 0$). So, in the existence of overdispersion, the mean and variances are presented as below:

• Mean:

$$\mathrm{E}(\mathrm{y}|\mathrm{X}) = \hat{u} \qquad \ldots\ldots\ldots\ldots\ldots\ldots(12)$$

• Variance:

$$Var(\text{y}|\text{X}) = \hat{\text{u}} + \alpha.\hat{\text{u}}^2 \;\dots\dots\dots\dots..\dots..(13)$$

According to Favero et al. (2020), the second term of the negative binomial distribution expression of the variance (i.e. equation number 13) represents overdispersion. If α is equal to zero, this phenomenon will not be present in the data, permitting the estimation using the Poisson regression model. However, if α is statistically greater than zero, there is overdispersion in the CEB (the dependent variable), conditional on explanatory variables, recommending the adoption of the negative binomial regression (Fávero et al., 2020).

Favero et al. (2020), defined overdispersion as a great variability (statistical dispersion) that occurs in a variable in comparison with its mean. The high variation in the data is due to heterogeneous or non-uniform samples, presence of relevant outliers as well as high levels of expositions for a quantitative variable with discrete and non-negative values. The estimation of the parameters of equation (1), in the presence of overdispersion, is also estimated by maximum likelihood and the log likelihood (LL) function for negative binomial regression model as presented below:

$$LL = \sum_{i=1}^{n}\left[y_i \;\ln\left(\frac{\alpha.\hat{\text{u}}_i}{1+\alpha.\hat{\text{u}}_i}\right) - \frac{\ln(1+\alpha.\hat{\text{u}}_i)}{\alpha} + ln\Gamma(y_i\; + \alpha^{-1}) \right.$$
$$\left. - \ln\Gamma(y_i\; + 1) - \; ln\Gamma(\alpha^{-1})\right] \dots\dots(14)$$

The functional form of equation number 14 above is expressed as follows;

$$ceb = g\;(occ, age, mast, res, educ, wq, con, dech,)\;\dots\dots(15)$$

Equation number 6 is estimated as follows:

$$\ln\left(\widehat{ceb}\right) = \beta_0 + \beta_1 occ_{1i} + \beta_2 age_{2i} + \beta_3 mast_{3i} + \beta_4 res_{4i} + \beta_5 educ_{5i} + \beta_6 wq_{2i} + \beta_7 con_{7i}$$
$$+ \beta_8 dech_{8i} \dots..(16)$$

Where: ceb is children ever born, occ is occupational categories, age is age groups, mast is marital status, res is place of residence educ is educational status, wq is wealth index, con is contraceptive use, and dech is desire for more children, *g* is the function of ceb.

3.6 A priori Expectations

Based on demographic transition theory (DTT) and other theories reviewed under chapter two of this study on literature review, specifically on the Neoclassical labour supply theory of labour-leisure choice and Goode's (1960) role strain theory, it was expected that the sign of the coefficients on occupation categories, education and contraceptive use with respect to total number of CEB would be negative. These expected signs of the coefficients reflect a trade-off between gains from the market earnings and the opportunity costs of forgone household production in childbearing and other activities for a given level of the household.

Based on the theory of Andersen's Behavioral Model of health service use which captures the predisposing, enabling and need factors as reviewed in chapter two of this study, it was expected that signs of the coefficients on marital status (married couples), residence (rural areas), and wealth quintiles (especially low socioeconomic status) in relation to total number of CEB would be positive.

3.7 Overdispersion Test

The formal test of the null hypothesis of equidispersion, $Var(y|X) = E(y|X)$, against the alternative of overdispersion, was first introduced by Cameron and Trivedi (1986) based on the succeeding equation:

$$Var(y|X) = E(y|X) + \alpha.[E(y|X)]^2 \dots\dots\dots\dots\dots\dots (17)$$

The equation number 17 shows the variance function for the negative binomial distribution. The study tested the significance of the parameter α ($H_1 : \alpha > 0$) against the null hypothesis ($H_0 : \alpha = 0$). According to Cameron and Trivedi (1986), to implement the test, firstly a new variable y^* is generated, as below:

$$y^* = [(y - \hat{u})^2 - y]/\hat{u} \dots\dots\dots\dots (18)$$

Where û = exp($X'\widehat{\beta}$); $\widehat{\beta}$ represents the vector of parameters to be estimated by the model presented in equation (10).

The test is implemented by regressing y^* on û, without an intercept term.

The *t* test of the coefficient of û indicates the presence of significant overdispersion. The hypothesis testing is as follows:

The $H_0 : p > |t| >$ significant level → equidispersion, i.e. no significant overdispersion, indicating the use of Poisson estimation.

However, if the $H_1 : p > |t| \leq$ significance level → significant overdispersion and this requires negative binomial estimation.

3.8 Chapter Summary

This chapter has covered the main data source, measurement of focus variables, empirical model, a priori expectations, and various diagnostic tests. On data sources, the study has used the secondary cross-sectional data from the 2015-16 Malawi Demographic and Health Surveys targeting female respondents only with a total sample size of 24,562. The target age was 15–49 justified based on the ability to have children and the capacity to join any category of occupations. On measurement of focus variables, based on literature review, the total fertility rate was measured as a count variable using the total number of Children Ever Born (CEB) while occupation categories were measured as dummy variables. On empirical model, the study found that the closest model was Poisson Regression. However, the data displayed overdispersion in which variance was not equal to the mean. As such, a Negative Binomial Regression (NBREG) was adopted. The diagnostic tests reviewed that the NBREG model had endogenety problem which directed the need to use the Two Stage Least Sqaure Regression and the Instrumentental Variable Regression models.

CHAPTER 4

RESULTS OF ESTIMATION AND INTERPRETATION

4.1 Introduction

This chapter discusses the empirical estimation findings of the study. The descriptive statistics were discussed first, followed by the diagnostic tests and then regression estimations.

4.2 Descriptive Statistics

Error! Reference source not found. shows the descriptive statistics for the variables under study. The results show that, on average, women in the sample had 2.77 total number of children ever born. Besides, 34.3% of women were not working. On the other hand, 78.3% of the women were married. The results further reveal that 46.2% of the women were considered not poor. Remarkably, 88.7% of women had at least various levels of formal education that ranged from primary, secondary and higher. The results also show that 54.4% of women were using contraceptives as a way of family planning. Furthermore, most women were agricultural self-employed (37.2%) compared to the rest of the occupational categories. However, only 5.4% of women in the sample were in the professional/technical/managerial occupational category.

The standard deviations in the variables (except the total number of CEB) have values of less than one, indicating that the data deviates with a smaller margin from the mean.

Table 1: Descriptive statistics for variables

Variables	Obs	Mean	Std. Dev.	Min	Max
Total number of CEB	24,562	2.7715	2.4572	0	15
Professional/technical/managerial	24,562	0.0545	0.2270	0	1
Sales and services	24,562	0.0552	0.2283	0	1
Clerical	24,562	0.0104	0.1016	0	1
Agriculture self-employed	24,562	0.3722	0.4834	0	1
Agriculture employee	24,562	0.0095	0.0969	0	1
Household domestic	24,562	0.0142	0.1185	0	1
Skilled manual	24,562	0.0147	0.1205	0	1
Unskilled manual	24,562	0.1264	0.3323	0	1
Aged 20-49 (above teenage)	24,562	0.7853	0.4106	0	1
Not poor (wealth index)	24,562	0.4619	0.4986	0	1
Educated	24,562	0.8869	0.3168	0	1
Married	24,562	0.7832	0.4121	0	1
Contraceptive use	24,562	0.5443	0.4980	0	1
Religion	24,562	0.9939	0.0782	0	1
Rural	24,562	0.7864	0.4099	0	1
Wants more children	24,562	0.4953	0.5000	0	1
Not working	24,562	0.3429	0.4747	0	1

Source: Author's estimation

A comprehensive view of the total number of CEB was also presented in Figure 5:5.

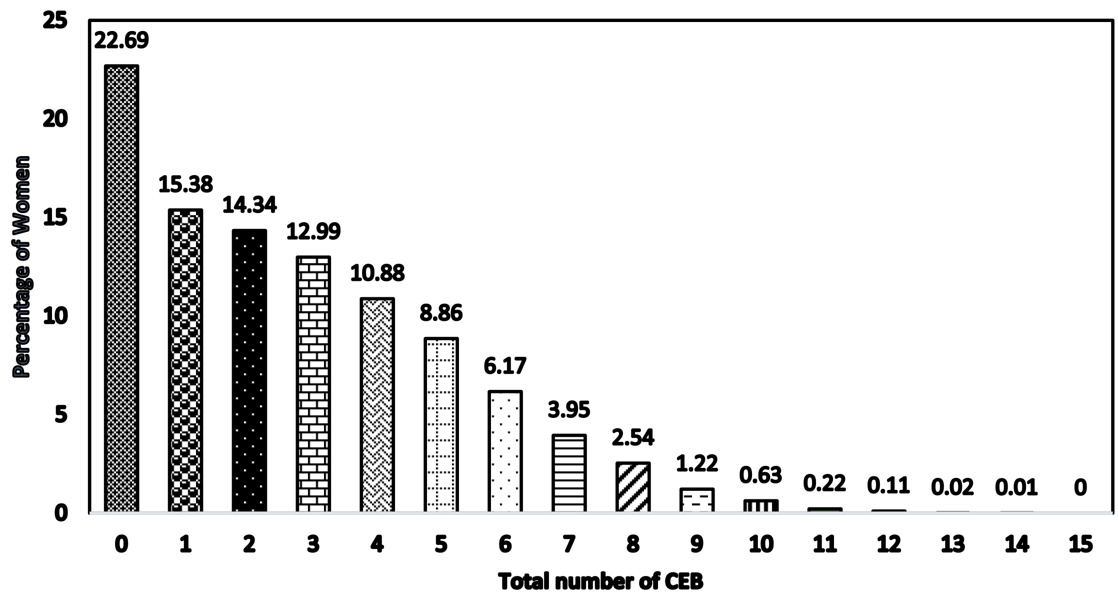


Figure 5: Percentage of women aged 15-49 and the total number of CEB

Source: Author's estimation

Figure 5 reveals that 22.7% of women had zero total number of CEB while only 8.86% of women had five total number of CEB each. Only 0.63% of women had ten total number of CEB while 0.22% of women had eleven total number of CEB. Figure 5: further reviews that few women (6.17% to 0.01%) had a large total number of CEB (i.e. from 6 to 14 CEB).

An overview of the description of women aged 15 to 49 against each occupational category was also presented in Figure 6: below. The results show that 34.3% of women were not working while 37.2% of women were Agricultural self-employed. This means that a large number of women (i.e. 37.2%) were farmers. On the other hand, only 5.5% of women were in the professional/technical/managerial occupational categories while just 12.6% were in the unskilled manual occupational categories.

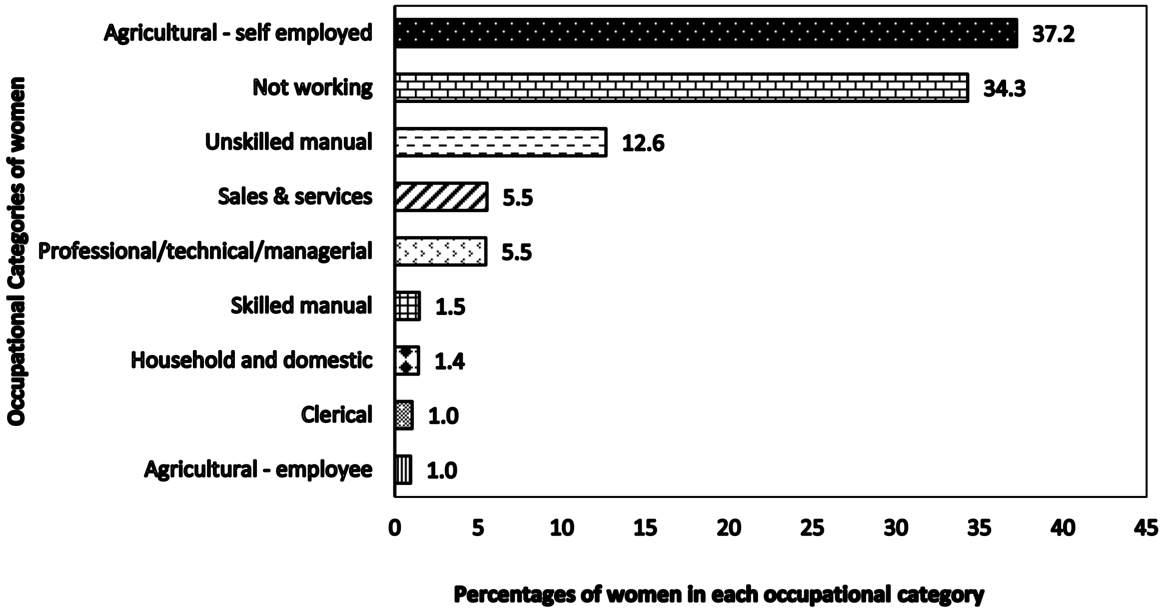


Figure 6: Percentage of women aged 15-49 in various occupational categories

Source: Author's estimation

Table 3 below provides a detailed cross-tabulation of each occupation category against the total number of CEB. Moving along the total number of CEB from zero to fifteen against each occupational category, it is evident that women belonging to agriculture-self-employed, unskilled manual and those not working tend to have, on average, a large number of CEB compared to the rest of the occupational categories. For instance, 54.67% of women belonging to agriculture-self-employed, 14.67% of women belonging to unskilled manual and 22.33% of the women who were not working have nine total number of CEB each. The table also shows that women working in sales and services, clerical, and professional/technical/managerial tend to have, on average, fewer total number of CEB at all ranges (i.e. from zero to 15). For example, with four total number of CEB, women that are in clerical show 1.23%, professional/technical/managerial shows 5.91% while sales and services show 6.21%.

In brief, the descriptive statistics above indeed provided the basis on which one can make a preliminary conclusion on the effects of occupational categories on the total number of children ever born. However, for this study, a Negative Binomial regression together with the Instrumental Variable and Two Stage Least Squares (2SLS) regression models were used to assess and establish the statistical effects and econometric link between the occupational categories and the total number of CEB (i.e. a measure of TFR) in Malawi. This was covered in section 4.4.

Table 2: A cross tabulation of total CEB and occupation categories in percentages

	Occupation categories								
Total CEB	**Not working**	**Professional/technical/managerial**	**Sales & services**	**Clerical**	**Agricultural - self employed**	**Agricultural - employee**	**Household & domestic**	**Skilled manual**	**Unskilled manual**
0	57.57	3.68	3.25	0.70	25.57	0.47	1.06	0.99	6.73
1	37.12	7.07	5.56	1.22	33.23	0.64	1.83	1.19	12.15
2	27.72	7.75	7.33	1.25	36.84	1.02	1.59	1.82	14.68
3	27.48	7.58	7.36	1.54	37.61	1.16	1.47	1.57	14.23
4	24.35	5.91	6.21	1.23	41.68	1.38	1.61	2.10	15.53
5	22.85	4.60	5.89	0.97	46.53	1.15	1.70	1.75	14.57
6	22.36	3.69	5.80	0.92	47.49	1.32	1.32	1.06	16.03
7	22.25	1.54	4.63	0.62	52.01	1.65	1.13	1.54	14.62
8	20.67	2.24	4.65	0.64	52.24	1.28	0.64	2.40	15.22
9	22.33	2.33	2.67	0.00	54.67	1.33	1.00	1.00	14.67
10	20.78	0.00	3.25	0.00	54.55	0.00	0.00	1.30	20.13
11	30.19	1.89	1.89	0.00	49.06	0.00	0.00	3.77	13.21
12	34.62	0.00	3.85	0.00	38.46	0.00	3.85	3.85	15.38
13	25.00	0.00	0.00	0.00	50.00	0.00	0.00	0.00	25.00
14	0.00	0.00	0.00	0.00	50.00	0.00	0.00	0.00	50.00
15	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**34.29**	**5.45**	**5.52**	**1.04**	**37.22**	**0.95**	**1.42**	**1.47**	**12.64**

Source: Author's estimation

4.3 Diagnostic tests

4.3.1 Overdispersion test

An initial diagnostic step was to test for an over-dispersion using a summary statistics table to get an idea of the estimation choice between the Poisson regression and the NBREG models. According to Favero et al (2020), over-dispersion arises due to influences such as the presence of greater variance of the response variable (i.e. CEB) caused by other variables unobserved heterogeneity. The effect of other variables may lead to the dependence of the probability of an event on previous events, the presence of outliers, and the existence of excess zeros on the CEB as a response variable (Fávero et al., 2020).

In simple terms, the variance value must be equal to or close to the mean. If the value of the variance is greater than the mean value, it is called over-dispersion.

Table 3: Overdispersion results using summary statistics

	Mean	Variance
Total number of CEB	2.772	6.038

Source: Author's estimation

The outcome from

Table 3:, indicates a preliminary existence of overdispersion in the data as the variance of the total number of CEB (the dependent variable) is about 2 times greater than its mean. The presence of significant overdispersion in the children ever born conditional on occupational categories and all other covariates in the model is shown in Table 4:.

Table 4: Overdispersion test (H0: Equidispersion) conditional on all covariates

Total number of CEB	Coefficient	Standard Error	t	P>t
Uhat	-.0224621	.0029355	-7.65	0.000

Source: Author's estimation

The outcome in Table 4: above indicates that the Uhat is statistically significant (i.e. P>|t| = 0.000). As such, the null hypothesis is rejected and concludes that there is significant overdispersion in the CEB conditional on the occupational categories and all other covariates included in the model. As such, the negative binomial model was used to assess the effects of occupational categories on children ever born, as a measure of fertility, unlike the Poisson regression model.

4.3.2 Endogeneity test

An endogeneity test was also done to find out if the explanatory variables were correlated with the error term. According to Lin et al (2019), endogeneity would lead to biased and inconsistent parameter estimates (Lin & Wooldridge, 2019). The null hypothesis was that the variables were exogenous. The P-value in Table 5: for both Durbin score chi-squared and Wu-Hausman show that it is statistically significant. As such, the null hypothesis is rejected and concludes that there is strong evidence of endogeneity in the model. This presence of endogeneity was addressed using the instrumental variables (IV) and two-stage least squares (2SLS) to obtain unbiased estimates.

H_0: Variables are exogenous

Table 5: Endogeneity test results

Durbin (score) chi2(2)	= 51.0304	(p = 0.0000)
Wu-Hausman F(2,24544)	= 25.5496	(p = 0.0000)

Source: Author's estimation

4.3.3 Weak Identification Test

According to Andrews et al. (2019), the test uses the Cragg-Donald Wald F-Statistic which is compared with the Stock-Yogo critical values to assess the strength of the instrumental variables (Andrews et al., 2019). In this case, based on the literature, the number of siblings and the husband's education were used as instruments for education in this study. The minimum eigenvalue F-statistics shown in Table 6: is 351.875. This figure was compared with the figures along the critical values at 10%, 15%, 20% and 25%. The results show that the instruments are not weak and have good explanatory power on the endogenous variable (i.e. education).

Table 6: First-stage regression summary statics

Variable	R-sq.	Adjusted R-sq.	Partial R-sq.	F(2,24546)	Prob > F
Educated women	0.0888	0.0882	0.0279	351.875	0.0000

Minimum eigenvalue statistic = 351.875

Critical Values # of endogenous regressors: 1

H_0: Instruments are weak # of excluded instruments: 2

	10%	15%.	20%	25%
2SLS size of nominal 5% Wald test	19.95	11.59	8.75	7.25
LIML size of nominal 5% Wald test	8.86	5.33	4.42	3.92

Source: Author's estimation

4.3.4 Overidentification Restriction Test

Another test was done to determine if the instrumental variables were uncorrelated with the error term in the model. According to Carrasco et al (2022), this is done using the Sargan test (score test) and the Basmann test to assess the validity of the instruments. Specifically, the overidentification restriction states that the number of instruments should not exceed the number of endogenous regressors (Carrasco & Doukali, 2022). The null hypothesis is that the instruments are valid and uncorrelated to the error term. The P-values in Table 7: are statistically not significant. This implies that we fail to reject the null hypothesis and conclude that the instruments (i.e. the number of siblings and the husband's education used as instruments for education) are valid. This suggests that no significant evidence exists that the instruments are correlated with the error term.

Table 7: Results of overidentifying restrictions test:

Sargan (score) chi2(1)	= .671087	(p = 0.4127)
Basmann chi2(1)	= .670641	(p = 0.4128)

Source: Author's estimation

4.3.5 Pairwise Multi-collinearity Test Results

The Pairwise Multi-collinearity test results are shown in Table 8: below. According to Shrestha (2020), the pairs of independent variables with high correlation coefficients (e.g., > 0.7 or < -0.7 or close to 1 or -1) between predictor variables may indicate multicollinearity. Multicollinearity arises when the multiple linear regression analysis comprises some variables that are significantly interrelated with the response variable (i.e. the total number of CEB) as well as among the independent variables. Multicollinearity makes some of the significant variables under study to be statistically insignificant. (Shrestha, 2020).

Table 8: evidently indicates that there is no multicollinearity among the variables used in the model.

Table 8: Pairwise Multi-collinearity test results

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1) Profess/tech/managerial	1.0																
(2) Sales & services	-0.1	1.0															
(3) Clerical	0.0	0.0	1.0														
(4) Agri. Self employed	-0.2	-0.2	-0.1	1.0													
(5) Agri. employee	0.0	0.0	0.0	-0.1	1.0												
(6) Household domestic	0.0	0.0	0.0	-0.1	0.0	1.0											
(7) Skilled manual	0.0	0.0	0.0	-0.1	0.0	0.0	1.0										
(8) Unskilled manual	-0.1	-0.1	0.0	-0.3	0.0	0.0	0.0	1.0									
(9) Women_aged_20_49	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.1	1.0								
(10) Women not poor	0.2	0.1	0.1	-0.3	0.0	0.0	0.0	0.0	0.0	1.0							
(11) Educated	0.1	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	-0.1	0.2	1.0						
(12) Married	0.0	0.1	0.0	0.2	0.0	0.0	0.0	0.1	0.7	-0.1	-0.2	1.0					
(13) Contraceptive use	0.0	0.0	0.0	-	0.0	0.0	0.0	-	-	0.0	0.0	-0.4	1.0				

				0.1				0.1	0.3								
(14) Religion	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	1.0			
(15) Rural	-	-	-	0.3	0.0	-	0.0	0.0	0.0	-0.4	-0.1	0.1	0.0	0.0	1.0		
	0.2	0.2	0.1			0.1											
(16) Wants more children	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	-0.2	0.3	-0.1	0.0	0.0	1.0	
(17) Not working	-	-	-	-	-	-	-	-	-	0.1	0.0	-0.3	0.2	0.0	-0.1	-0.1	1.0
	0.2	0.2	0.1	0.6	0.1	0.1	0.1	0.3	0.3								

Source: Author’s estimation

4.4 Discussion of NBREG, IV and 2SLS Regressions Results

After performing various diagnostic tests in section 4.3, it is now evident that the coefficients of regressions in Table 9: are unbiased, consistent and precise. These coefficients are interpreted in terms of the difference of logs of expected counts for the total number of CEB as a measure of fertility.

According to Maydeu et al (2019), the difference between Instrumental Variable (IV) and the Two Stage Least Square (2SLS) regression is based on the coefficients estimates. The IV regression produce small standard errors compared to the 2SLS. As such, they are most preferred as compared to the coefficients of the 2SLS regression which produces large standard errors in which the prediction of the precision of the coefficients in the model decreases (Maydeu-Olivares et al., 2019).

Table 9: Results of NBREG, IVREG and 2SLS models

Total number of CEB	NBREG	IVREG	2SLS
Professional/tech/manag.	-0.1199***	-0.4190***	-0.1282***
Sales and services	0.0465***	0.0508***	0.0377***
Clerical	-0.0536	-0.2434	-0.0625
Agriculture self-employed	0.0972***	0.3098***	0.0973***
Agriculture employee	0.1194***	0.3862***	0.1088***
Household and domestic	0.0341	0.0255	0.0331
Skilled manual	0.0709**	0.1859**	0.0628**
Unskilled manual	0.0847***	0.0847***	0.0832***
Women_aged_20_49	1.4043***	1.2631***	1.4156***
Women not poor	-0.0179**	-0.0005**	-0.0301**
Educated women	-0.2578***	-1.3193***	
Married women	1.7126***	1.2517***	1.7155***
Contraceptive use	-0.1303***	-0.4279***	-0.1257***
Religion	0.0671	0.2219	0.0408
Rural	0.1971***	0.4602***	0.2034***
Wants more children	0.6754***	1.8995***	0.6875***
EducationHati			-0.1976***
Constant	-2.2809***	0.5510**	-2.3238***
Number of obs		24562	

**** p<.01, ** p<.05, * p<.1*

Source: Author's estimation

Table 9 shows that, the coefficient on professional/technical/managerial (i.e. -0.4190) is statistically significant at a 1% level of significance. In this case, the null hypothesis is rejected and concluded that the difference in the logs of expected counts for the total number of CEB is expected to be 0.4190 unit lower for women who are working in professional/technical/managerial compared to women who are not working while holding the other variables constant.

This coefficient (i.e. -0.4190) is linked to demographic transition theory (DTT) with respect to factors influencing fertility decisions in the context of economic development. The coming of modern economies, the participation of women in the workforce in these occupations has increased. Women in such occupations often prioritize their careers and may delay childbearing or choose to have fewer children with the intention of focusing on their professional aspirations, hence this negative coefficient.

On the other hand, the predisposing and enabling factors in the Andersen Behavioral model of health service use concerning this coefficient (i.e. -0.4190) confirms that women in these occupational categories have lower fertility levels due to reasons including access to family planning services, work-life balance, opportunity cost of parenthood, and income levels. Better access to family planning services allows these women greater control over their fertility of having fewer children, hence lower fertility. On Work-Life Balance, the coefficient also confirms that the nature of these occupations can make it challenging to achieve a balance between work and family life. Women in these occupations face greater challenges in managing work commitments alongside family responsibilities leading to lower fertility levels, hence this inverse relationship to this occupation category. Besides, the roles of these occupations often require significant time and effort leading to opportunity cost of parenthood. This implies that the decision to have children involves a trade-off, and individuals in these occupations might perceive a high opportunity cost associated with parenthood in terms of time and career advancement. It is evident that these occupations are often associated with higher incomes and these women may choose to delay parenthood to focus on career and financial stability before starting a family. This delay contributes to lower fertility rates, hence this negative coefficient.

Furthermore, the -0.4190 coefficient on professional/technical/managerial on fertility is also linked to Goode's (1960) role strain theory. This theory focuses on challenges women face when trying to fulfill multiple roles simultaneously due to reasons such as workplace policies and gender dynamics. Lack of good workplace policies such as career advancement opportunities and maternity leave policies provide inadequate support for work-life balance. Women in these occupational categories are more likely to delay or limit their family size, hence the negative coefficient.

Conversely, the difference in the logs of expected counts for the total number of CEB is expected to be 0.3098, 0.3862, 0.1859 and 0.0847 unit higher for women working in, agricultural – self-employed, agricultural – employee, skilled manual and unskilled manual respectively equally to those women who are not working, while holding the other variables constant. These results guarantee the rejection of the null hypothesis at 1%, 1%, 5%, and 1% for the coefficients on agricultural–self-employed, agricultural-employee, and unskilled manual respectively and conclude that the coefficients are statistically significant to have effects on the total number of children ever born. These results are also supported by the works of Nibaruta et. al. (2021) in Burundi and Pandey et al (2015) in India.

The positive effect values obtained on agricultural–self-employed (0.3098), agricultural–employee (0.3862), skilled manual (0.1859) and unskilled manual (0.0847) on fertility are linked to the Neoclassical Labor Supply Theory of labour-leisure choices with an emphasis on trade-offs between work and leisure. According to this theory, women in these occupations view additional children as a source of labour or potential economic support in the future. Hence the positive relationship between these occupation categories and fertility.

In addition, the neoclassical theory acknowledges the role of children as a form of social security or insurance for parents in their old age. In occupations with higher levels of economic uncertainty, such as agricultural self-employment, women would perceive having more children as a way to secure support in case of economic hardship. This insurance motive contributes to a positive relationship between fertility and these occupation categories leading to high fertility levels and therefore, high population growth.

Likewise, the neoclassical framework assumes that individuals have well-defined preferences and needs. In some cultures or social contexts, these coefficients confirms the positive effect between these occupation categories and a cultural preference for larger families especially in agricultural communities where larger families are culturally valued for contributing to farm labor and continuity of family traditions, leading to a positive effect.

Moreover, the neoclassical model emphasizes the opportunity cost of time (i.e. time allocation). Women in occupations such as unskilled manual labour or self-employed agriculture have more flexibility in their work schedules. This flexibility allows for a better balance between work and family responsibilities, making it more feasible for women in these occupations to have larger families, hence the positive effect as obtained in the regression results.

The study has also reviewed that if the age (20-49 years) of women is to increase by one year, the difference in the logs of expected counts for the total number of CEB is expected to be 1.2631 unit higher while holding the other variables constant. Additionally, the difference in the logs of expected counts of the total number of CEB is expected to be 1.2517 unit higher for women who are married compared to women who are not married, while holding other variables constant. The works of Nyarko (2021) in Gana and Melese et al. (2020) in Ethiopia also found similar results.

Likewise, the results also indicate that the difference in the logs of expected counts for the total number of CEB is expected to be 0.0005 unit lower for rich/middle-income women compared to poor women while holding other variables constant. Besides, the difference in the logs of expected counts for the total number of CEB is expected to be 0.4279 unit lower for women using contraceptives compared to women who do not use the contraceptive, while holding other variables constant.

In addition, the difference in the logs of expected counts for the total number of CEB is expected to be 1.3193 unit lower for women who are educated compared to women who are not educated, while holding other variables constant. The results are also supported by the study done by Forty et al. (2022) in Malawi. On the same, the difference in the logs of expected counts for the total number of CEB is expected to be 0.4602 unit higher for women living in the rural areas compared to women living in the urban area while holding other variables constant. Besides, the difference in the logs of expected counts for the total number of CEB is expected to be 1.8995 unit higher for women who desire for more children compared to women who don't desire for more children while holding other variables constant.

Jointly, the null hypothesis is reject at 1% significant levels for the coefficients on age groups, educated women, married women, women not poor, women using contraceptives, women living in rural areas as well as well women who wants more children and concludes that these coefficients are statistically significant and have effects on the total number of CEB.

Nevertheless, full results of the Negative Binomial regression, Poisson regression, and Ordinary Least Square regression models are also included in the appendices for robustness check. The intention is to maintain accuracy and reliability of the results.

4.5 Chapter Summary

This chapter has discussed the descriptive statistics of variables, empirical findings and various empirical diagnostic tests that have validated the findings of this study. On descriptive statistics, the study found that, on average, women in the sample had at least three total number of children ever born (i.e. the TFR mean is 2.7). On occupation categories, the study has shown that a large number of women (37.2%) were self-employed in Agriculture while other women (34.3%) were not working.

On empirical findings, after applying the Instrumental Variable regression, the study concluded that professional, technical, managerial and some clerical occupations are inversely related to fertility and therefore help in reducing population growth in Malawi. On the contrary, agricultural self-employed, agriculture-employee, skilled manual and unskilled-manual workers are positively related to fertility and therefore facilitate the increase in population growth.

CHAPTER 5

CONCLUSION, POLICY IMPLICATIONS AND FURTHER RESEARCH

5.1 Conclusion

The broader objective of this study was to assess the effects of occupation on fertility in Malawi. The specific objective was to determine the individual (disaggregated) effects of occupational categories on fertility (measured as the total number of CEB). The study used cross-sectional secondary data from the 2015-16 Malawi Demographic Health Survey. The study found that the occupation categories were numerous. As such, the study was done on the grouped occupational categories. These grouped occupational categories were: professional/technical/managerial, sales and services, clerical, agricultural (both employee and self-employed), household and domestic, and skilled and unskilled manual. Guided by literature, other covariates included in the study were women's age (15-49), marital status, wealth index, contraceptive use, religion, type of residence, education, and desire for more children.

Using the Instrumental Variable Regression (IVREG) model, the study found that professional/technical/managerial occupational categories and clerical are negatively related to fertility and have statistical and economic effects on fertility. This implies that professional/technical/managerial occupations are inversely related to fertility and therefore have an effect on reducing population growth in Malawi. The empirical results of this study also found that agricultural self-employed, agricultural–employee, skilled manual and unskilled manual are positively related to fertility and have statistical and economic effects on fertility. This means that these occupational categories have effects on increasing population growth in Malawi.

The study further revealed that sales & services as well as household and domestic occupational categories are not statistically significant to have an effect on fertility. This implies that these occupational categories have no effect to increase or reduce population in Malawi. Overall, these findings underscore the importance of considering occupational diversity when formulating policies and interventions aimed at understanding and addressing population dynamics in Malawi.

Other covariates that were included in the study and were found to be statistically significant at 1% level of significance to influence fertility were: age, marital status, women not poor (wealth index), contraceptive use, residence type, education and desire for children.

5.2 Policy Implications

It is ethically sensitive to note that implementing policies to deliberately reduce population based on specific occupational categories could raise significant concerns since this may interfere with individual reproductive choices and could also violate human rights. However, the Government can consider more indirect policy approaches that could address broader socio-economic factors influencing fertility to deal with population growth in occupation categories with high fertility levels while respecting individuals' freedoms and rights in Malawi.

The study recommends that the Malawi Government, Family Planning Association of Malawi (FPAM) and Family Health Services (FHS) should continuously conduct research and monitoring of fertility patterns, especially in sales and services, unskilled manual, and agricultural (both employed and self-employed) occupation categories since their coefficients are statistically and economically significant to influence population growth. This entails regularly collecting and analyzing demographic data to understand changes in fertility patterns to formulate informed and evidence-based family planning policies and interventions such as promoting the use of contraceptives, antenatal care, maternal health services, and reproductive health care to address emerging population trends in these occupational categories. This is in line with the Malawi 2063 vision under enabler number 5 (i.e. human capital development) with a focus area on managing population growth. The size and quality of a population matter in relation to the speed of socio-economic development. It is also in line with Sustainable Development Goals (SDGs) number 3 (i.e. to ensure healthy lives and promote well-being for all at all ages) under target 3.7 (i.e. to ensure universal access to sexual and reproductive health-care services, including family planning, information and education, and the integration of reproductive health into national strategies and programmes by 2030).

5.3 Study Limitations

There was limited literature from the local perspectives to inform the study. Even at the level of SSA countries, the studies on the effects of occupational categories on fertility at disaggregated level were dearth.

5.4 Areas for further Research

This study was based on cross section design which captured only a specific moment in time (i.e. from 19 October 2015 to 17 February 2016). Further research is required using longitudinal studies to track changes in fertility patterns and occupational choices over time. This could provide insights into how these dynamics evolve and whether certain trends persist. Further research is also required using comparative studies whereby a comparison of findings from Malawi with other countries in the region or with similar socio-economic characteristics would be made. Identifying similarities and differences can contribute to a broader understanding of the relationship between occupation categories and the total fertility rate.

Furthermore, studies can also be done in cultural and Social Dynamics by deepening the exploration of cultural and social influences on fertility choices, including how cultural norms and societal expectations intersect with occupational factors.

5.5 Chapter summary

This chapter has discussed the conclusion of the study, policy implications, study limitations as well as areas for further research. On conclusion, the study has indicated that occupation has effects on fertility. However, on occupational categories, some have effects to reduce population while others have effects to facilitate population increase. On policy implications, the study recommends that the Government of Malawi should promote and enforce the existing work-life balance initiatives for both public and private sectors with an intention to manage population. Besides, the Malawi Government, Family Planning Association of Malawi (FPAM) and Family Health Services (FHS) should continuously conduct research and monitor fertility patterns with an objective to achieve the global replacement fertility rate of 2.1 children per woman. On study limitation, the study found that there was dearth literature from the local perspectives to inform the study. Further research was also recommended to deepening the exploration of cultural and social influences on fertility choices.

REFERENCES

Aaronson, D., Dehejia, R., Jordan, A., Pop-Eleches, C., Samii, C., & Schulze, K. (2021). The effect of fertility on mothers' labor supply over the last two centuries. *The Economic Journal*, *131*(633), 1–32.

Abdoli, S., Masoumi, S. Z., & Kazemi, F. (2022). Environmental and occupational factors and higher risk of couple infertility: a systematic review study. *Middle East Fertility Society Journal*, *27*(1), 33. https://doi.org/10.1186/s43043-022-00124-4

Aldo-Campana-GFMER-O-Frank. (2022). *THE DEMOGRAPHY OF FERTILITY AND INFERTILITY O. Frank Global Health Situation Assessment and Projections Unit Division of Epidemiological Surveillance and Health Situation and Trend Assessment World Health Organization 1211 Geneva 27, Switzerland, Research*.

Andrews, I., Stock, J. H., & Sun, L. (2019). Weak instruments in instrumental variables regression: Theory and practice. *Annual Review of Economics*, *11*, 727–753.

Babitsch, B., Gohl, D., & von Lengerke, T. (2012). Re-revisiting Andersen's Behavioral Model of Health Services Use: a systematic review of studies from 1998-2011. *Psycho-Social Medicine*, *9*, Doc11. https://doi.org/10.3205/psm000089

Bongaarts, J., Blanc, A. K., & McCarthy, K. J. (2019). The links between women's employment and children at home: Variations in low-and middle-income countries by world region. *Population Studies*, *73*(2), 149–163.

Bras, H., & Smits, J. (2022). Contexts of reproduction: Gender dynamics and unintended birth in sub-Saharan Africa. *Journal of Marriage and Family*, *84*(2), 438–456.

Brown, H. V., & Hollis, V. (2013). The Meaning of Occupation, Occupational Need, and Occupational Therapy in a Military Context. *Physical Therapy*, *93*(9), 1244–1253. https://doi.org/10.2522/ptj.20120162

Bwalya, B. B., Kasonde, M. E., Mulenga, J. N., Mapoma, C. C., Wamunyima, N., Siamianze, B., & Onukogu, O. B. (2022). *Contraceptive use and fertility preferences among sexually active males in Zambia.*

Carrasco, M., & Doukali, M. (2022). Testing overidentifying restrictions with many instruments and heteroscedasticity using regularised jackknife IV. *The Econometrics Journal*, *25*(1), 71–97.

Chemhaka, G. B. (2018). *Multilevel determinants of fertility behaviour in Eswatini*.

University of the Witwatersrand, Faculty of Humanities.

Cherie, N., Getacher, L., Belay, A., Gultie, T., Mekuria, A., Sileshi, S., & Degu, G. (2023). Modeling on number of children ever born and its determinants among married women of reproductive age in Ethiopia: A Poisson regression analysis. *Heliyon*, *9*(3).

Fávero, L. P. L., Belfiore, P., dos Santos, M. A., & Souza, R. F. (2020). Overdisp: A stata (and Mata) package for direct detection of overdispersion in poisson and negative binomial regression models. *Statistics, Optimization & Information Computing*, *8*(3), 773–789.

Finlay, J. E., Mejia-Guevara, I., & Akachi, Y. (2018). Inequality in total fertility rates and the proximate determinants of fertility in 21 sub-Saharan African countries. *PloS One*, *13*(9), e0203344.

Forty, J., Navaneetham, K., & Letamo, G. (2022). Determinants of fertility in Malawi: Does women autonomy dimension matter? *BMC Women's Health*, *22*(1), 1–16.

Giuntella, O., Rotunno, L., & Stella, L. (2022). Globalization, Fertility, and Marital Behavior in a Lowest-Low Fertility Setting. *Demography, 59*(6), 2135–2159.

Goode, W. J. (1960). A Theory of Role Strain. American Sociological Review, 25(4), 483–496. *American Sociological Review, Vol. 25, N*, 483-496 (14 pages). https://doi.org/10.2307/2092933

Götmark, F., & Andersson, M. (2020). Human fertility in relation to education, economy, religion, contraception, and family planning programs. *BMC Public Health*, *20*(1), 265. https://doi.org/10.1186/s12889-020-8331-7

Jain, A., Ross, J., MGinn, E., & Gribble, J. (2014). *Inconsistencies in the Total Fertility Rate and Contraceptive Prevalence Rate in Malawi*. *September*, 1–4. www.healthpolicyproject.com

Jammeh, R. (2020). Impact of Women Education on Fertility: A case study of The Gambia. *First Year Master's Thesis*.

Kisato, C. (2021). *Determinants of Fertility in Sub-Saharan Africa: Impacts of Education on Fertility for Ages 15-24*. Flinders University, College of Humanities, Arts and Social Sciences.

Lai, S. L. (2022). Fertility differentials in Bangladesh and Pakistan: evidence from demographic and health surveys. *Asian Population Studies*, *18*(3), 275–293.

Lesthaeghe, R. (2020). The second demographic transition, 1986–2020: sub-replacement fertility and rising cohabitation—a global update. *Genus*, *76*(1), 10. https://doi.org/10.1186/s41118-020-00077-4

Lewis, B. (2019). Fertility and employment: An assessment of role incompatibility among African urban women. In *Women and work in Africa* (pp. 249–276). Routledge.

Lin, W., & Wooldridge, J. M. (2019). Testing and correcting for endogeneity in nonlinear unobserved effects models. In *Panel data econometrics* (pp. 21–43). Elsevier.

Luppi, F., Arpino, B., & Rosina, A. (2022). Fertility plans in the early times of the COVID-19 pandemic: The role of occupational and financial uncertainty in Italy. *PloS One, 17*(12), e0271384. https://doi.org/10.1371/journal.pone.0271384

Malawi National Statistical Office-DHS. (2017). *National Statistical Office (NSO) [Malawi] and ICF. 2017. Malawi Demographic and Health Survey 2015-16. Zomba, Malawi, and Rockville, Maryland, USA. NSO and ICF*.

Masanja, G. F. (2020). Modeling Fertility Determinants among Women of the Reproductive Age in Western Tanzania Using Negative Binomial Regression. *Journal of Economics*, *8*(1), 89–103.

Maydeu-Olivares, A., Shi, D., & Rosseel, Y. (2019). Instrumental variables two-stage least squares (2SLS) vs. maximum likelihood structural equation modeling of causal effects in linear regression models. *Structural Equation Modeling: A Multidisciplinary Journal, 26*(6), 876–892.

Mbalinda, S. N., Kaye, D. K., Nyashanu, M., & Kiwanuka, N. (2020). Using Andersen's behavioral model of health care utilization to assess contraceptive use among sexually active perinatally hiv-infected adolescents in Uganda. *International Journal of Reproductive Medicine, 2020*.

Nibaruta, J. C., Elkhoudri, N., Chahboune, M., Chebabe, M., Elmadani, S., Baali, A., & Amor, H. (2021). Determinants of fertility differentials in Burundi: evidence from the 2016-17 Burundi demographic and health survey. *The Pan African Medical Journal*, *38*, 316. https://doi.org/10.11604/pamj.2021.38.316.27649

Njuguna, J. (2020). *Determinants of fertility preferences among young married men in Gatanga Sub-County, Muranga County*. University of Nairobi.

Nyarko, S. H. (2021). Socioeconomic determinants of cumulative fertility in Ghana. *Plos*

One, *16*(6), e0252519.

Okui, T., & Nakashima, N. (2022). Analysis of Differences in Preterm Birth Rates According to Household Occupation in Japan From 2007 to 2019. *Journal of Preventive Medicine and Public Health = Yebang Uihakhoe Chi*, *55*(4), 371–378. https://doi.org/10.3961/jpmph.22.178

Oppong, C. (2023). *Female and male in West Africa*. Taylor & Francis.

Özgören, A. A., Ergöçmen, B., & Tansel, A. (2018). *Birth and employment transitions of women in Turkey: The emergence of role incompatibility*, *39*, 1241,1290. www.demographic-research.org

Palamuleni, M. E. (2023). Determinants of High Marital Fertility in Malawi: Evidence from 2010 and 2015-16 Malawi Demographic and Health Surveys. *The Open Public Health Journal*, *16*(1).

Pandey, R., & Kaur, C. (2015). Modelling fertility: an application of count regression models. *Chinese Journal of Population Resources and Environment*, *13*(4), 349–357.

Rogers, E., & Stephenson, R. (2018). Examining temporal shifts in the proximate determinants of fertility in low-and middle-income countries. *Journal of Biosocial Science*, *50*(4), 551–568.

Sheiner, E. K., Sheiner, E., Hammel, R. D., Potashnik, G., & Carel, R. (2003). Effect of occupational exposures on male fertility: literature review. *Industrial Health*, *41*(2), 55–62.

Shrestha, N. (2020). Detecting multicollinearity in regression analysis. *American Journal of Applied Mathematics and Statistics*, *8*(2), 39–42.

Taylor, R., Bowyer, P., & Fisher, G. (2023). *Kielhofner's model of human occupation*. Lippincott Williams & Wilkins.

Tesfa, D., Tiruneh, S. A., Gebremariam, A. D., Azanaw, M. M., Engidaw, M. T., Kefale, B., Abebe, B., Dessalegn, T., & Tiruneh, M. (2022). The pooled estimate of the total fertility rate in sub-Saharan Africa using recent (2010-2018) Demographic and Health Survey data. *Frontiers in Public Health*, *10*, 1053302. https://doi.org/10.3389/fpubh.2022.1053302

Teshale, A. B., Worku, M. G., & Tesema, G. A. (2022). Fertility decision and its associated factors in Sub-Saharan Africa: a multilevel multinomial logistic regression analysis.

BMC Women's Health, *22*(1), 337. https://doi.org/10.1186/s12905-022-01920-w

UN-Report-World-Population-Prospects. (2022). *United Nations Department of Economic and Social Affairs, Population Division (2022). The 2022 Revision of World Population Prospects: Summary of Results. UN DESA/POP/2022/TR/NO. 3.* www.macrotrends.net. Retrieved 2023-05-20.

UN-Report. (2020). *World Fertility and Family Planning 2020 January 2020 . https://www.unpopulation.org . #UNPopulation*. https://www.un.org/en/development/desa/population/publications/pdf/family/Ten_key_ messages for WFFP2020_highlights.pdf

Vercherand, J. (2014). *The Neoclassical Model of the Labour Market BT - Labour: A Heterodox Approach* (J. Vercherand (ed.); pp. 53–74). Palgrave Macmillan UK. https://doi.org/10.1057/9781137373618_3

Wasserman, M. (2019). Hours constraints, occupational choice, and gender: Evidence from medical residents. *Occupational Choice, and Gender: Evidence from Medical Residents (March 19, 2019)*.

WHO-Report. (2023). *World health statistics 2023: monitoring health for the SDGs, Sustainable Development Goals. Geneva: World Health Organization; 2023. Licence: CC BY-NC-SA 3.0 IGO. https://www.who.int/data/gho/indicator-metadata-registry/imr-details/123*. www.who.int/data/gho/indicator-metadata-registry/imr-details/123

World-Bank. (2021). *World Bank- Population Estimates And Projections*. https://datacatalog.worldbank.org/search/dataset/0037655/Population-Estimates-and-Projections

APPENDICES

Appendix A: NBREG results in terms of difference of logs of expected counts

Total number of CEB	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Professional/tech/manag.	-0.1199	0.0178	-6.72	0.0000	-0.1548	-0.0849	***
Sales and services	0.0465	0.0163	2.85	0.0044	0.0145	0.0785	***
Clerical	-0.0536	0.0361	-1.49	0.1370	-0.1243	0.0170	
Agriculture self-employed	0.0972	0.0096	10.13	0.0000	0.0784	0.1160	***
Agriculture employee	0.1194	0.0306	3.90	0.0001	0.0595	0.1793	***
Household and domestic	0.0341	0.0308	1.11	0.2676	-0.0262	0.0944	
Skilled manual	0.0709	0.0300	2.36	0.0182	0.0120	0.1297	**
Unskilled manual	0.0847	0.0123	6.91	0.0000	0.0607	0.1087	***
Women_aged_20_49	1.4043	0.0260	54.00	0.0000	1.3534	1.4553	***
Women not poor	-0.0179	0.0085	-2.09	0.0363	-0.0346	-0.0011	**
Educated women	-0.2578	0.0098	-26.26	0.0000	-0.2770	-0.2386	***
Married women	1.7126	0.0436	39.27	0.0000	1.6272	1.7981	***
Contraceptive use	-0.1303	0.0078	-16.65	0.0000	-0.1456	-0.1149	***
Religion	0.0671	0.0421	1.59	0.1112	-0.0154	0.1496	
Rural	0.1971	0.0112	17.68	0.0000	0.1753	0.2190	***
Wants more children	0.6754	0.0086	78.53	0.0000	0.6585	0.6922	***
Constant	-2.2809	0.0580	-39.31	0.0000	-2.3946	-2.1672	***
lnalpha	-16.244	0.0611	.b	.b	-16.3643	-16.1246	
Number of obs		24562					

**** p<.01, ** p<.05, * p<.1*

Source: Author's estimation

Appendix B: Poisson Regression Results

Total number of CEB	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Professional/tech/manag.	-0.1199	0.0178	-6.72	0.0000	-0.1548	-0.0849	***
Sales and services	0.0465	0.0163	2.85	0.0044	0.0145	0.0785	***
Clerical	-0.0536	0.0361	-1.49	0.1370	-0.1243	0.0170	
Agriculture self employed	0.0972	0.0096	10.13	0.0000	0.0784	0.1160	***
Agriculture employee	0.1194	0.0306	3.90	0.0001	0.0595	0.1793	***
Household and domestic	0.0341	0.0308	1.11	0.2676	-0.0262	0.0944	
Skilled manual	0.0709	0.0300	2.36	0.0182	0.0120	0.1297	**
Unskilled manual	0.0847	0.0123	6.91	0.0000	0.0607	0.1087	***
Women_aged_20_49	1.4043	0.0260	54.00	0.0000	1.3534	1.4553	***
Women not poor	-0.0179	0.0085	-2.09	0.0363	-0.0346	-0.0011	**
Educated women	-0.2578	0.0098	-26.26	0.0000	-0.2770	-0.2386	***
Married women	1.7126	0.0436	39.27	0.0000	1.6272	1.7981	***
Contraceptive use	-0.1303	0.0078	-16.65	0.0000	-0.1456	-0.1149	***
Religion	0.0671	0.0421	1.59	0.1112	-0.0154	0.1496	
Rural	0.1971	0.0112	17.68	0.0000	0.1753	0.2190	***
Wants more children	0.6754	0.0086	78.53	0.0000	0.6585	0.6922	***
Constant	-2.2809	0.0580	-39.31	0.0000	-2.3946	-2.1672	***
Number of obs	24562						

**** p<.01, ** p<.05, * p<.1*

Source: Author's estimation

Appendix C: Ordinary Least Square (OLS) Regression Results

Total number of CEB	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Professional/tech/manag.	-0.4278	0.0445	-9.61	0.0000	-0.5151	-0.3405	***
Sales and services	0.0440	0.0468	0.94	0.3469	-0.0477	0.1356	
Clerical	-0.2517	0.0958	-2.63	0.0086	-0.4396	-0.0639	***
Agriculture self employed	0.3114	0.0266	11.72	0.0000	0.2593	0.3634	***
Agriculture employee	0.3798	0.1062	3.58	0.0003	0.1717	0.5879	***
Household and domestic	0.0285	0.0837	0.34	0.7335	-0.1356	0.1926	
Skilled manual	0.1811	0.0951	1.90	0.0569	-0.0053	0.3675	*
Unskilled manual	0.2229	0.0367	6.07	0.0000	0.1509	0.2949	***
Women_aged_20_49	1.2724	0.0247	51.54	0.0000	1.2240	1.3208	***
Women not poor	-0.0097	0.0249	-0.39	0.6969	-0.0585	0.0391	
Educated women	-1.1857	0.0448	-26.49	0.0000	-1.2734	-1.0980	***
Married women	1.2574	0.0264	47.58	0.0000	1.2056	1.3092	***
Contraceptive use	-0.4230	0.0246	-17.17	0.0000	-0.4713	-0.3747	***
Religion	0.1939	0.1460	1.33	0.1842	-0.0923	0.4800	
Rural	0.4638	0.0270	17.18	0.0000	0.4109	0.5167	***
Wants more children	1.9112	0.0228	83.75	0.0000	1.8664	1.9559	***
Constant	0.4426	0.1559	2.84	0.0045	0.1369	0.7482	***
Number of obs	24562						

**** p<.01, ** p<.05, * p<.1*

Source: Author's estimation

Appendix D: Instrumental Variable Regression results

Total number of CEB	**Coefficient**	**St. Err.**	**p-value**	**[95% Conf.**	**Interval]**
Educated women	-1.3193***	0.2612	0.0000	-1.8313	-0.8074
Professional/tech/managerial	-0.4190***	0.0477	0.0000	-0.5125	-0.3256
Sales and Services	0.0508	0.0485	0.2954	-0.0444	0.1460
Clerical	-0.2434**	0.0969	0.0120	-0.4334	-0.0535
Agriculture self-employed	0.3098***	0.0268	0.0000	0.2573	0.3624
Agriculture employee	0.3862***	0.1070	0.0003	0.1765	0.5960
Household domestic	0.0255	0.0838	0.7606	-0.1388	0.1898
Skilled manual	0.1859*	0.0955	0.0516	-0.0013	0.3732
Unskilled manual	0.2235***	0.0368	0.0000	0.1514	0.2955
Women aged 20-49	1.2631***	0.0307	0.0000	1.2030	1.3231
Women not poor	-0.0179 **	0.0085	0.036	-0.0346	-0.0011
Married women	1.2517***	0.0283	0.0000	1.1962	1.3072
Contraceptive use	-0.4279***	0.0264	0.0000	-0.4796	-0.3761
Religion	0.2219***	0.1552	0.0000	-0.0824	0.5262
Rural	0.4602***	0.0279	0.0000	0.4056	0.5148
Wants more children	1.8995***	0.0324	0.0000	1.8360	1.9630
Constant	0.5510**	0.2615	0.0351	0.0384	1.0637

*** p<.01, ** p<.05, * p<.1

Source: Author's estimation