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CHILDLESSNESS AMONG MARRIED WOMEN IN MYANMAR

WIN NAING OO

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Supervised by

Dr. Aye Thida
Professor (Head)
Department of Statistics
Yangon University of Economics

Submitted by

Win Naing Oo
4 Paragu, Ah-2

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Professor
Department of Statistics
Yangon University of Economics

Prof. Dr. Aye Thida
(Promoter)
Head of Department
Department of Statistics
Yangon University of Economics

September, 2022

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Win Naing Oo
4 PhD Ah-2

ABSTRACT

Childlessness has serious social, economic, demographic and health implications. This study aims at investigating social, economic and demographic determinants of voluntary childlessness in Myanmar. Voluntary childlessness is defined as currently married women who have no living children and use any contraceptive method. The data used in this study were secondary data obtained from the 2015-16 Myanmar Demographic and Health Survey (MDHS). The weighted sample of currently married women were 7759 but only 283 voluntary childless women among them were included in this study. Firstly, descriptive statistics was used to point out social, economic and demographic characteristics for currently married women, voluntary childless women and spatial variation of voluntary childless women in Myanmar. Yangon Region and Rakhine State had the highest percentage of voluntary childlessness. Then, the Pearson Chi-square test was applied to examine the association between social, economic and demographic characteristics and voluntary childlessness. Educational attainment of women and their husbands, woman's employment status, occupation of women and their husbands, wealth quintile, woman's age, husband's age, age at first marriage, marital duration and place of residence were independent variables. According to the Pearson Chi-Square test, they were significantly related to voluntary childlessness. In addition, binary response models such as logit, probit and complementary log-log models were applied to investigate social, economic and demographic determinants of voluntary childlessness and the most appropriate model was chosen by using model selection criteria. It was found that the complementary log-log model was most appropriate model. Based on the findings, woman's educational attainment, husband's educational attainment, woman's employment status, woman's occupation such as skilled manual and unskilled manual, fourth and highest wealth quintiles, age at first marriage and place of residence were more likely and significant determinants to be voluntary childlessness. Woman's age, husbands at age groups except (35-39), marital duration for 5-9 years were less likely and significant determinants to be voluntary childlessness.

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LIST OF ABBREVATIONS

AIC	:	Akaike Information Ceiterion
AIDS	:	Acquired Immune Deficiency Syndrome
ANOVA	:	Analysis of Variance
BIC	:	Baysian Information Criterion
CDF	:	Cumulative Distribution Function
CEE	:	Central and Eastern Europe
CI	:	Confidence Intervals
CMW	:	Currently Married Women
EMW	:	Ever Married Women
FRHS	:	Fertility and Reproductive Health Survey
GLMs	:	Generalized Linear Models
HILDA	:	Household Income and Labour Dynamics in Australia
HIV	:	Human Immunodeficiency Virus
LR	:	Likelihood Ratio
MDHS	:	Myanmar Demographic and Health Survey
NFHS-2	:	National Family Health Survey
NKPS	:	Netherlands Kinship Panel Study
NSFG	:	National Survey of Family Growth
OR	:	Odds Ratio
OLR	:	Odds Likelihood Ratio
PSUs	:	Primary Sampling Units
ROC	:	Receiver Operating Characteristic
STIs	:	Sexually Transmitted Infections
TFR	:	Total Fertility Rate
TMFR	:	Total Marital Fertility Rate
UNFPA	:	United Nations Population Fund
USAID	:	United States Agency for International Development
WHO	:	World Health Organization

CHAPTER 1
INTRODUCTION

Most of the children have parents but every parent might not have a child. Because some parents are not found to have children through their long life. Childlessness is one of the main challenges of modern society. For many couples, the inability to bear children is a tragedy. Socially, most societies are organized, especially in developing countries, such that children are necessary for care and support to elderly parents. Even in developed countries with social support systems, children and family are expected to provide much of the care for the elderly (WHO, 2004). Childlessness has caused many psychological, physical, emotional and social problems such as broken family, depression and marital conflicts. Childless women are socially stigmatized and face grave personal and social consequences including economic deprivation, violence and marital disruption (Mulgaonkar, 2002). Childless couples are socially isolated and emotionally very vulnerable in a world society, it is a huge but badly recognized problem (Aiswarya & Moli, 2012). Childlessness and infertility problem cause for decline in fertility rate and that are disregarded issues in reproductive health programs in many countries. It also affects couples living in developed world. Moreover, childlessness is a neglected family planning ingredient in developing countries. It is also a huge but badly recognized problem. However, some women do not desire to have a baby for a specific period because of urbanization, emergence of nuclear family, employment of women and increase in women's educational status. In addition, cultural, environmental and economic factors influence the prevalence of infertility especially in countries where poverty and infections are widespread (Leke et al., 1993).

1.1 Rationale of the Study

According to World Population Report (2003) by the United Nations, fertility rate of the world was declining over three decades from 1970 to 2000, especially in developing countries. In many developing countries, there had been declining

population growth rate which cannot fulfill the replacement level during recent years (Caldwell, 2002). The fertility of women in developing countries is higher on average than in developed countries, yet many women in developing countries remain childless (Baudin et al. 2015). Some developing countries have higher childlessness rates than developed countries (Romaniuk, 1980). The decision to have a child or not is a complex phenomenon involving the individual's various social processes and identities (Blackstone & Stewart, 2012). The population scientists in all over the world have paid more emphasis on trying to understand the important issues of childlessness to a greater extent and it has now become a major concern. Low fertility and childlessness have become an important area of demographic research and has drawn the attention of many demographers and other social scientists (Nasrabad et al. 2013). The level of childlessness (both voluntary and involuntary) in the population influenced on the fertility levels of any population and it plays an important role in determining the levels and differentials of fertility (Jones, G. W, 2007). Childlessness is a factor that results in low birth rates and population decline, which are associated with diminishing labor force and rising proportions in older ages.

Gillespie (2003) identified the attraction of being childfree and the push away from motherhood. The characteristics of attraction are increasing freedom, and better relationships with partners and others. The characteristics of the push from motherhood involve a loss of identity and a rejection of the activities associated with motherhood. One significant pull factor of childlessness is that couples often appear to be happier without offspring (Ramu, 1984). As said by Somers (1993), voluntarily childfree group displayed higher levels of satisfaction between husband and wife. In terms of financial expenditure, married couples without kids have more unrestricted income than households with children (Paul, 2001). According to the numerous studies of childlessness for both the developed and developing world, there are clear negative implications in old age (Rubinstein, 1987).

Childlessness is both due to social and economic constraints and a consequence of endemic health problems. Most childlessness arises not only from an individual's or couple's sterility, but also as a social phenomenon and a means of adaptation to social and economic change (Kreager, 2004). Veevers (1975) found that the childless-by-choice at the turn of the twenty-first century face stigma, but can find friendship in online support groups. Negative types of nonparents are general and functional to promote childbearing (Rogers, 1986). Childlessness of women may be

influenced by factors such as demographic (age, sex, union status) and socio-economic (educational attainment, occupational status) characteristics, values and cultural attitudes (religious practice, attitudes and opinions about gender roles in family life, importance of professional life and family involvement) or early socialization processes in childhood (socio-economic status of parents, geographical origin, size of the siblings) (Australian Demographic Statistics,1999).The choice to remain childless allows each spouse to focus on his/her career without the added responsibility and stress of raising children. One critical aspect of childlessness is to distinguish between involuntary and voluntary childlessness because, as couples increasingly postpone their first births, it becomes more likely that some couples will find that they encounter involuntary fertility limitations due to sterility or medical procedures that limit childbearing (Edmonston et al.2008). The women who consider themselves voluntarily childless, some were always certain of their intention to never become mothers, while others had come to the decision through a series of postponements (Callan, 1983). The reasons for these postponements include social, cultural and financial components (Houseknecht, 1982). On the past decade, voluntary childlessness has emerged as subject of study by demographers, family sociologists, and psychologists. Although the increasing number of studies that have been done, nationally representative studies of voluntary childlessness are rare (Mosher and Bachrach, 1982).

In Myanmar, Population Changes and Fertility Survey Report (1991) presented that it appears to have fallen below four children per women during the years of Second World War and to have risen steadily through the mid-1960s, reaching a level of slightly over five children per woman. Then, fertility decline started again at about that time, proceeding slowly through the mid-1980s and rapidly thereafter. Urban-rural differences have generally increased over time, and urban fertility appears to have fallen below replacement level in the late 1980s. Duration differentials in fertility are very strong in the past as well as in the present. Fertility differences between states and regions are generally modest. Contraception is an integral part of reproductive health and contraceptive use is an important determinant of the level of fertility. According to the results of Myanmar fertility and Reproductive Health Survey (1997), almost half of married women (14817) aged 15-49 used a method of contraception at sometime during their reproductive life. In Fertility and Reproductive Health Survey (2001), it was found that more than half of

the women (56%) of married women (8808) have used a method of contraception at some time during their reproductive life. As regards to the results from Fertility and Reproductive Health Survey (2007) and Myanmar Population and Housing Census (2014), it can be found that the trend of the percentage distribution of married women without children is steadily increasing due to social, economic, demographic and health related factors in Myanmar.

The 2015-16 Myanmar Demographic and Health Survey (MDHS) conducted on demographic and health characteristics of 12,885 ever-married women in Myanmar. The target groups were considered as women aged 15-49 residing in randomly selected households across the country. It provides information on characteristics of women and their husbands, family planning, maternal health care, infant and child mortality, nutrition, marriage and sexual activity, women empowerment, domestic violence and so on. Especially, information on voluntary childlessness such as currently married women, birth order, contraceptive use, marital duration, age at first marriage can be obtained from this survey. There have been studies in detail on childlessness in Myanmar, especially from the cultural, psychological and epidemiological perceptives. However, there is no specific study concerning the voluntary childlessness in Myanmar. Therefore, this study intends to analyze the socio-economic and demographic factors which might affect voluntary childlessness among currently married in Myanmar based on data obtained from the 2015-16 MDHS.

1.2 Objectives of the Study

The main objective is to analyze voluntary childlessness among currently married in Myanmar.

The specific objectives are:

(i) To investigate the social, economic and demographic characteristics of currently married women and spatial variation among voluntary childlessness in Myanmar

(ii) To examine the association between social, economic, demographic characteristics and voluntary childlessness in Myanmar

(iii) To identify the determinants of voluntary childlessness in Myanmar.

1.3 Method of Study

The secondary data obtained from the 2015-16 MDHS were used to study the childless women in Myanmar. Descriptive analysis was carried out to identify the social, economic and demographic characteristics that have an influence on the voluntary childlessness and spatial variation of childlessness in Myanmar. Pearson's Chi-square test was used to describe the association of socio-economic and demographic characteristics with voluntary childlessness. Regression models utilizing binary response variables, such as logit, probit and complementary log-log regression models were used to explore the influencing factors of voluntary childlessness among Currently Married Women (CMW) in this study.

1.4 Scope and Limitations of the Study

This study was based on data from the 2015-16 MDHS. In this survey, data were not based on direct question on childlessness. The voluntary childlessness was applied and it was defined as CMW with no living children and any method used for contraceptive in this study. Although data on 12885 ever-married women (EMW) were available from the 2015-16 MDHS, this study limited to 7870 currently married women of them. To obtain nationally representative estimates, sampling weight was applied and the final weighted samples include 7759 CMW aged (15-49). Social, economic and demographic characteristics are involved in this study although psychological, physical, emotional, social, economic and demographic characteristics are influencing on the childlessness. Because of information of rest of the variables which influenced on childlessness were not available in the 2015-16 MDHS.

1.5 Organization of the Study

This study composes of six chapters. Chapter 1 presents the introduction of the research topic. It includes the rationale of the study, objectives of the study, method of study, scope and limitations of the study and organization of the study. Literature review is expressed in Chapter 2. Chapter 3 mentions research methodology. Assessing childless women in Myanmar is described in Chapter 4. The determinants of childlessness among women in Myanmar are presented in Chapter 5. Chapter 6 represents conclusion.

CHAPTER 2
LITERATURE REVIEW

This chapter presents childlessness, categories of childlessness and reviews of childlessness on previous studies. The variables that provide to formulate the analytical framework for childlessness are also explained in this chapter.

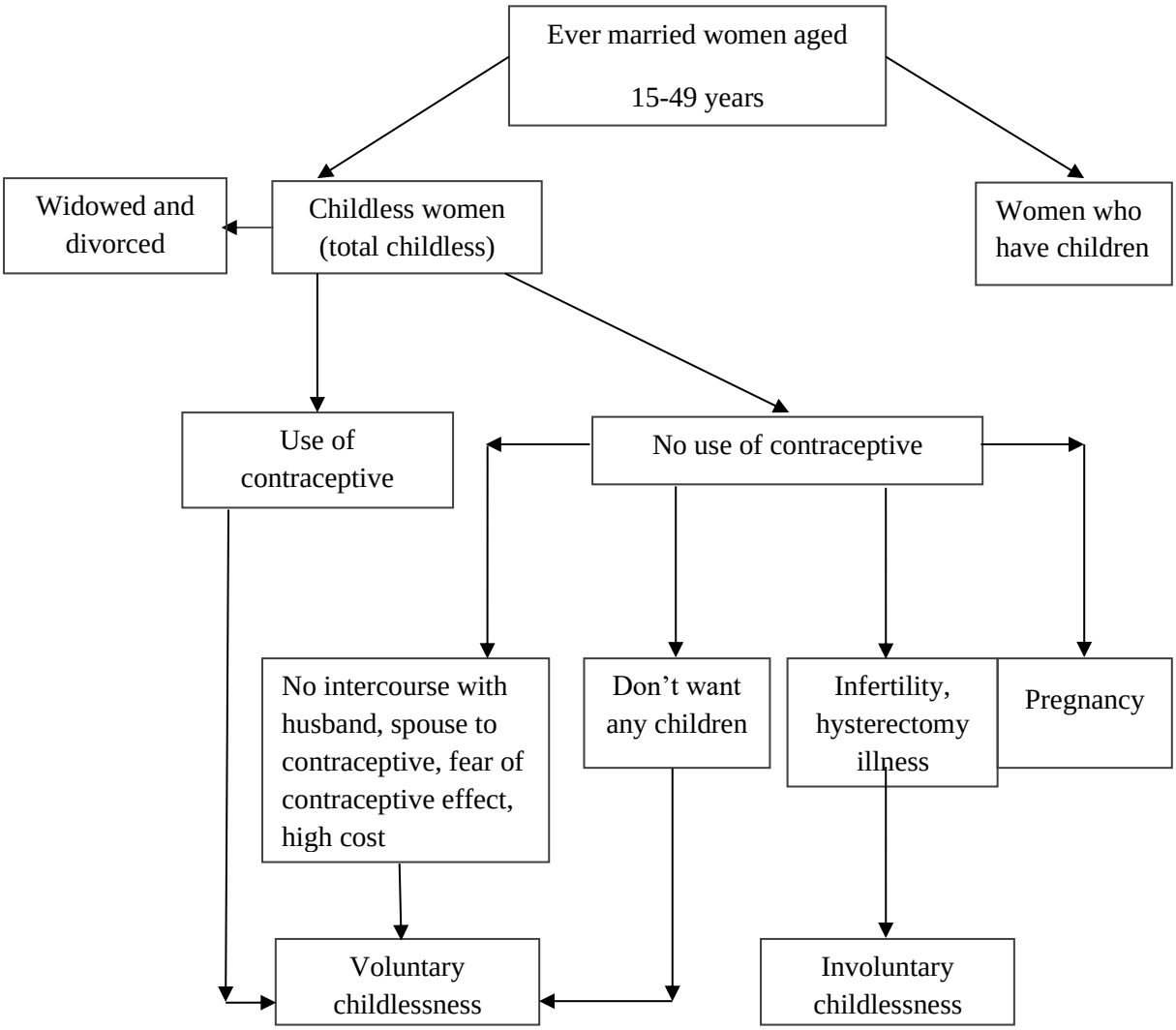
2.1 Defining Childlessness

Childlessness is defined as the inability to achieve pregnancy after one year of unprotected sexual intercourse. Childlessness is defined as woman having no live birth or no living children at the end of her reproductive life span (WHO, 1991). The commonly-used description of childlessness is: after a year unprotected sex, no pregnancy has taken place (Obiyo, 2016). According to Demographic and Health Survey Comparative Reports-9, demographers define childlessness is the inability of non-contraception, sexually active woman to have a live birth. This category, often used by demographers to indicate infertility, includes women who have never been pregnant, those who have suffered pregnancy losses, and those with no live births. Childless means to be deprived of parenthood as these individuals would like to have children but are unable to do so. It is also percentage of women, who are currently married, have been so for at least five years, and who have no living children (WHO, 2004). It is clear that childlessness, infertility, sterility- all these refer to the inability of the couples to conceive or bear children when desired (WHO, 1991).

2.2 Categories of Childlessness

The distinction between the two categories pertains to the choice or the absence of choice in being childless. The phenomenon of permanently not wanting children is labeled as voluntarily childlessness (Veevers, 1980). Involuntary childlessness may be promoted by infection, developmental defects, systemic diet, neoplasm, or other diseases which interfere with the production and passage of sperms and/or ova to the point of fertilization. Tanturri and Mencarini (2006) also

defined these two groups as “childless by chosen” (voluntary childless) and “childless by circumstance” (involuntary childless). The principal distinction of voluntary and involuntary childlessness is shown in Figure (2.1).



Source: Nasrabad et al. (2013)

Figure (2.1) Distribution of Different Categories of Childlessness Among Ever-Married Women Aged 15-49 Years

According to Figure (2.1), there are two types of ever married women aged 15-49 years: who have no children (childless women) and who have children. Childless women who use contraceptive method are voluntary childlessness. Childless women who do not use contraceptive method and no intercourse with husband, spouse to contraceptive, fear of contraceptive effect and high cost are defined as voluntary childlessness. Childless women who do not use contraceptive method and

those don't want any children are called voluntary childlessness. Involuntary childlessness is identified as childless women who do not use contraceptive method and those women were infertile, hysterectomy and unhealthy women.

Other researchers suggest that there are more than two categories of childlessness. There are a range of explanations that women are childless, and situation also plays a large role in it (McQuillan, 2012). Some women do not have children due to timing concerns of finding a partner or not being able to conceive for other circumstances. Therefore, childlessness cannot be classified into only voluntary and involuntary. Moreover, some women may also change their minds about childbearing along their life course due to life situation, as well as due to personal reflection.

2.2.1 Voluntary Childlessness

Voluntary childlessness is the direct result of efforts on the part of a couple not to be issue. It includes motivations of a psychological, social, or economic nature. The voluntarily childless would be more appropriately named "childfree" suggesting a lack of something. The term "voluntarily childless" was used throughout in reference to the subset of women who have never had children and who desire to remain in that category (Veevers, 1973). The voluntary childlessness mentions couples who have decided not to have children but who are physically able to have children (Roger, 1986). Since the past thirty years, the effective contraception (e.g., the pill, intra-uterine devices, transabdominal sterilization) has been available and innovations in contraceptive technology (e.g., injectables, implants, hysteroscopic sterilization) have more success in childless. In addition to the issue of choice, there are several other points to consider when defining voluntary childlessness. The voluntarily childless women at any given time may change their minds later and have children. First, future intent must be ascertained. Even though an individual may identify himself or herself as childless at a given time, this may be a temporary state. Some people simply delay childbearing until some future time and so should not be confused with those who are permanently childless. In fact, the available evidence suggests that there are significant differences between them (Sussman, 1987). However, researchers have observed that some individuals make this decision at an early age ("early articulators"), whereas others make this decision at a later stage in their life ("postponers") (Houseknecht, 1977; Veevers, 1980).

Poston and Trent (1982) said that the oldest childless women are supposed to be primarily childless for voluntary reasons, if data on intentions are not present. This assumption makes sense childlessness was categorized into voluntary, and involuntary, and temporary. The temporarily childless category disappears as women age. Therefore, many researchers assumed childless women in their forties are mostly voluntarily childless. The restrictions of voluntary childlessness imposed based on the researcher and data source. Mosher and Bachrach (1982) and Poston and Trent (1982) used marital status and ever-married women. Krishnan (1993), Ritchey and Stokes (1974) and Rovi (1994) used currently married women. Krishnan (1993), Poston and Trent (1982) used cohabiting women. The voluntary childless women who are sexually active must first of all have the means to avoid conception, so that changes in contraceptive technology and knowledge of them are relevant. Those who do not have children may have more or less strong plans, desires or intentions to have children in the future. So that although those women are currently 'voluntarily childless' nor intend to ultimately be so. This is leading to distinguish between the 'temporary' and 'permanent' voluntarily childless.

Tanturri and Mencarini (2008), in a qualitative interview study of childless women in five Italian cities, found that a third of their respondents had never tried to have children. As Rowland (1998) commented: 'childlessness is commonly a situation consolidated only gradually as youth gives way to middle age'. Poston and Trent (1982), Cambell (1985), Morgan (1991) and Clarke and McAllister (1998) have emphasized the importance of delayed childbearing gradually turning into childlessness.

2.2.2 Reasons for Voluntary Childlessness

The choice to be childless is a process that is situated in the context of work, life experiences, personal health, and relationships. According to the literature, the psychological motivations and sociological circumstances that have inclined an increasing number of individuals to be childless by choice. Houseknecht (1977) reviewed 29 studies which focused on examining the rationale of individuals who do not want to have children. The researcher found that each woman rationalized their decision not to have children as freedom from childcare responsibility; greater opportunity for self-fulfilment, more satisfactory marital relationship, women's career considerations and monetary advantages, doubts about parenting abilities; and

concern about physical aspects of childbirth and recovery. In addition, Houseknecht (1982) argues that the main determinants of voluntary childlessness are educational level, greater labour force opportunities, and occupational prestige.

A study by Park (2005) found that women saw parenting as conflicting with their career and leisure activities. On the other hand, men were rejecting reproduction because of their perceived (often financial) sacrifices. Furthermore, cause of increasing voluntary childlessness is due to the welfare state, which has decreased dependence upon familial structures that are necessary for support in old age. Women chose childlessness because of individualism, a desire for leisure, consumer goods, travel, freedom in Western society. Graham (2013) found that women chose childlessness because they never wanted to become parents, or are not in the 'right' relationship, or are in a relationship where their partner does not want to have children. The voluntary childlessness has also been explored by motivations of gender difference.

According to Silverman and Silverman (1971), amongst reasons for voluntary childlessness were views that a child would interfere with a couple's relationship, would restrict the mother's career or be difficult to afford. The requirement for full-time employment for married women and the evidence that employed married women receive little or no help with household or childrearing tasks from their husbands are important considerations for contemporary women and may influence their decisions about childbearing (Meter & Agronow, 1982). Other priorities for having a child may include establishment of an appropriate labour market career or completion of training, both for the person or their partner or both, the presence of other family members or networks of friends to support parenting. Especially for women, the desire for children is assumed to be instinctive. Therefore, voluntary childlessness means going against nature and social norms at the same time (Veevers, 1973a, 1975). Szymańska (2013) found that factors related to voluntary childlessness are grouped into social context and personal decision-making factors. Social factors include poor financial situation, difficulties in the labor market, lack of adequate housing, family politics of the country, family values, and family structure. Personality factors can also be considered, namely, an effect of partner attitudes, lack of close support, and experiences in the family. Houseknecht (1977) found that increased employment of married women, the higher number of women continuing college and postponing marriage and childbearing have led to a voluntary childlessness.

2.2.3 Consequences of Voluntary Childlessness

Callan (1987) and Somers (1993) examined whether the consequences of voluntary childlessness are beneficial or detrimental to one's physical and emotional health. It was found that no differences in life satisfaction. Weiss (1993) found that there was higher satisfaction among voluntarily childless couples. The voluntarily childless individuals have higher marital satisfaction, as said by researchers investigating the consequences of voluntary childlessness. A study found that childless elderly adults experience less stress in their lives compared to elderly adults with children (McMullin & Marshall, 1996).

The advantages and disadvantages of childlessness in old age suggest that well-being is not necessarily dependent on children, because the childless can meet their expressive (emotional) needs through greater contact with other relatives, friends, and neighbours, as well as with organizations such as clubs and churches. However, the childless in poor health appear to have a higher risk of social isolation or of admission to aged care institutions (Bachrach, 1980; Rowland, 1998). This implies that the support networks of the childless elderly are less effective in providing instrumental (practical) support, at least when the need is continuing. Although the majority of the elderly do not necessarily see family care as the best alternative (Rempel, 1985), without the prospect of periodic help from children, or their assistance as a last resort, the childless must be more reliant on formal services or institutional care.

Childless individuals lack social support and emotional ties later in life and will thereby experience social isolation (Park, 2005). However, other studies have found that the childless elderly do not report less life-satisfaction, or significantly less life-satisfaction, compared to parents (McMullin & Marshall, 1996; Park, 2005). It can be found that the consequences of childlessness to women's health negatively, as childless women often end up unhappy, committing suicide, or being sent to an asylum. Women are discouraged from choosing to be childless because of the negative health consequences of their choice (Gandolfo, 2005).

Childlessness has varied consequences through its effects on societies and on the lifestyles and life chances of individuals. The childless lifestyle enhances life satisfaction for some individuals, while diminishing it for others, for whom parenthood was a personal goal. For societies, childlessness is a factor in low birth rates and population decline, with which are associated diminishing labour force

entries and rising proportions in older ages. Childlessness is therefore a consideration for policy makers, both because of its demographic impact and because of its effects on the lives of individuals. The latter become most apparent in the older ages, where childlessness means that family resources for support of the disabled or frail are less assured. (Rowland, 1998)

2.2.4 Involuntary Childlessness

Involuntary childlessness is a fertility state eventuating from physiological or pathological origin with no conscious attempts by couples to control their fertility (Panko & Thomas, 1972). Involuntary childlessness of women is those with a fecundity impairment who reported to be sterile for non-contraceptive reasons; sub-fecund, that is women reported difficulty conceiving or delivering a baby or difficulty for partner to father a baby; or a doctor advised the woman never to become pregnant because of a medical danger to her, her fetus or both; married or cohabiting women that have had a three-year period of unprotected sexual intercourse with no pregnancy.

Involuntary childlessness is mainly due to subfecundity, i.e. the diminished capacity to reproduce. There are various causes of subfecundity, including genetic factors, psychopathology, disease, nutritional deficiencies and environmental factors. The genetic causes of subfecundity include factors such as chromosome abnormalities, certain types of anaemia, red blood cell incompatibilities between spouses, and metabolic abnormalities. Psychopathological causes responsible for subfecundity are psychoses, alcoholism, illicit drug abuse, cigarette smoking, and psychic stress. Disease is also considered a principal cause of subfecundity. It has noted that tuberculosis, malaria, African sleeping sickness, leprosy, venereal disease, chagas disease, smallpox and filariasis, among others, are especially influential. Also, female circumcision in many African countries has an impact on subfecundity levels because of its health hazards. Nutritional deficiencies involve the effects of famine and malnutrition. Finally, environmental factors affecting subfecundity include such agents as radiation exposure, toxic chemical exposure, and occupational hazards (McFalls, 1979).

2.3 Childlessness in Europe

Increasing childlessness is only one of the many shifts in demographic behavior that have been occurring in Europe in recent decades. Europe's fertility decline has been associated with a decrease in the number of large families, so a sharp rise in childlessness (Billari & Kohler, 2004; Rowland, 1998). Recent estimates of permanent childlessness for the female cohorts born around 1965 were 25% in Italy, 20% in Germany and Finland, but 15% in Austria, Belgium, England and Wales, Greece, Ireland, the Netherlands, Poland and Sweden. Until a few years ago, the proportion of childless women was low and seemed to be mainly due to permanent celibacy and sterility, the traditional determinants of childlessness. According to Hakim (2005), voluntary childlessness remains at below 10 % in most European countries. Women who choose childlessness tend to be career-oriented women, most childless women are lower or middle class.

European societies have experienced a rise in voluntary or involuntary childlessness (Mills et al. 2011; Rotkirch, 2007; Sobotka, 2009; Tanturri & Mencarini, 2008). The trends of childlessness are at a peak in childlessness rates for the 1880-1910 birth cohorts, a more or less continuous drop across the 1910-1945 birth cohorts, and a steady rise across the cohorts born after the Second World War across European countries. (Rowland, 1998). The increase in childlessness has 15% in the younger cohorts (Persson, 2010). In Central and Eastern Europe as well as Southern Europe, both overall fertility and growing proportions of childless people were low (Tanturri & Mencarini, 2008, 2006).

In the early twentieth century, the levels of the long-term childlessness in Italy and Spain were around 25 %. The levels of childlessness declined around 11% to 12 % among the cohorts born in the early 1950s, and then increased to 20% in the 1960s and early 1970s. This pattern shows that the decline in fertility in Southern Europe occurred later than the decreases observed in Western and Northern Europe. But the decline in fertility in the south has severe among women born in 1972. The level of childlessness in Portugal is around 12 % among women born in 1968. The country has the lowest period total fertility rate in Europe, of 1.21 in 2013, but there is no examination on childlessness.

The trends of childlessness in central, eastern, and south-eastern Europe, differed from those in other parts of Europe among women born in the 1940s to mid-1960s. The childlessness levels were only very low (estimated in most countries at 5% to 10 %); and they were more stable than in the rest of Europe. The levels of

childlessness in some Central and Eastern European (CEE) countries (among women in Belarus, Bulgaria, Czech Republic, and Russia who were born in the 1950s) were low (5%) (Larido, 2008). In Estonia, Romania, and Slovakia, the childlessness levels were around 9% to 10 %. These levels were below those in most other parts of Europe. While childlessness has been rising in all of the CEE countries, Childlessness has been increasing in Romania: around 15 % of Romanian women born in the early 1970s.

Among European women born in the 20th century, childlessness varied greatly across time and regions. It universally declined until the 1940s birth cohorts and it tended to stabilize in the state-socialist countries and to rise again in the West (Frejka & Sardon, 2004).

2.4 Childlessness in Some ASIAN Countries

Over the last 3 decades, most economically developed East Asian countries have experienced extremely low fertility levels as well as high and rising childlessness (Sobotka, 2021). The total fertility rate (TFR) in East Asia dropped below 1.5 children per woman between 1985 (Hong Kong) and 2000 (South Korea). Recently, the TFR in South Korea, Hong Kong, and Taiwan dropped below 1.0, reporting the world's lowest fertility in 2020. Only in Japan TFR has been higher, at 1.36 in 2020. The low fertility in East Asia is a consequence of the rapid postponement of marriage and the rising share of women who do not marry during their reproductive lives.

In Singapore, 28% of women born in 1975–1980 were childless at the time of the 2020 Census. Japan has experienced a continuous increase in childlessness among women born between the early 1950s and 1974–1976, when its level peaked at 28%. Permanent childlessness has increased rapidly across East Asia, from low levels at 4% to 12% among women born in the 1950s to very high levels among those born in the 1970s.The childlessness in Hong Kong is 35% among women in 1971 and fell 30% among those born in 1979.In later, childlessness increased in South Korea and Taiwan among women born since the mid-1960s. It shows a similar pattern of childless levels in Japan, Singapore, and Hong Kong. Among the youngest cohorts, lifetime childlessness was found 19% among Korean women and 23% among Taiwanese women born in the late 1970s.

These levels are set to rise further, because of rising proportion of women in their 30s who have never had children. The level of childlessness converges at 37% to 39% at women born in 1983 in Japan, South Korea, and Taiwan. Among women born in 1960, the highest rank of childlessness is found in Hong Kong (21%). Among women born in 1972, Hong Kong, Singapore, and Japan had the highest level of childlessness worldwide. These countries well beyond Western and Southern European countries with high childlessness, such as Germany, Spain, and Italy.

The childlessness in East Asia increases among women born in 1960 to 1972 in the highly developed countries. It is found that 7% to 11% in Japan, Taiwan, Singapore, and South Korea and 14 % in Hong Kong. In Japan, childlessness among married women born in the late 1920s to the 1950s hovered around 3% to 4%. However, childlessness among married Japanese women born since the 1960s has increased continuously, with 1 in 10 married women born in 1965 to 1970 remaining permanently childless. This trend is even more striking in Singapore, where the share of ever-married childless women jumped from a low of 3% among those born in the early 1940s to 14% among those born in the late 1970s. Couples are also taking longer to conceive a child after their wedding. In Japan, the mean interval between marriage and first birth went up from 1.6 years in 1985 to 2.5 years in 2019. The rate of childlessness for women nearing the end of their reproductive period is very high in Singapore and Thailand, 23 % and around 15 % respectively (UN Fund Popul. Act. 2013). In concerning Demographic and Health Survey report (2004), the levels of childlessness in Cambodia are 2.1% and 2.0 % in among women age 40 to 44 and 25 to 49 who have been married for at least five years in 2000. In Indonesia, the levels of childlessness among women age 40 to 44 and 25 to 49 who have been married for at least five years in Bangladesh are 3.7% and 3.2% in 1997. The levels of childlessness for Philippines are 1.6% in age 40 to 44 and 2.3 % in age 25 to 49 in 1998. According to Demographic and Health Survey Report (2021), the rate of childlessness for women age 20-49 of Philippines 3.5 % in 2017. In Vietnam, the lowest levels of childlessness among women age 40 to 44 who have been married for at least five years occurs (0.9 %), and that for age 25-49 (1.3%) in 2000.

2.5 Previous Studies

Panko and Thomas (1972) examined whether there were significant differences between childless women and various women with respect to marriage,

residence, and socioeconomic status variables. The data were derived from the 1960 Census of the United State Population. A two-way factorial analysis of variance was used to allow an assessment of the influence of the various independent variables on race and fertility. Planned comparisons and t tests were applied to show the significant differences uncovered by analysis of variance. As the result, age at marriage was the only discriminating variable, there was an inverse relationship between occupation, and fertility for both Negroes and whites and lower parities did tend to have larger incomes for both races. And also, education was inversely related to children ever born and there was an inverse relationship was noted between size of place and children ever born for both whites and Negroes.

Polonko et al. (1982) inspected the effect of childlessness on marital satisfaction among married couples and found out whether or not age will influence marital satisfaction in Ado-Ekiti L.G.A of Ekiti State. A total number of two hundred participants were used and also selected through random selection method. One-way ANOVA was used to find the significant effects of age and childlessness on marital satisfaction. The results showed that there is no significant influence of age on marital satisfaction and that there is a significant influence of childlessness on marital satisfaction.

Rogers (1986) studied to review the empirical research literature on voluntary childlessness and to develop a model of the childless decision. The review of the literature revealed many factors related to the decision to remain childless. These include lifestyle and demographic characteristics such as place of residence, education level, occupation, income, age at marriage and length of marriage. Personal characteristics include birth order, family background, values and attitudes, and marital satisfaction. Social factors include social norms, sanctions, and the Women's Movement. The decision-making factors influencing voluntary childlessness are awareness of choice, timing of the decision, the cost of raising children, coping with the decision, social support for childlessness and birth control. In diagraming the decision-making model, it was emphasized that most of the factors are interrelated and the strength of any one factor depends upon the couple making the decision not to have children. In this research, the following conclusions were made: (1) more longitudinal research on voluntary childlessness is needed, (2) the motivations and characteristics of husbands need further consideration, (3) studies of childlessness

have the potential to further the understanding of the motivations for parenthoods, and (4) the model needs to be tested using path analysis.

Krishnan (1993) determined the influence of religious affiliation, religious homogamy, religiosity, and religious marriage on voluntary and temporary childlessness and to compare childlessness patterns among Canadian-born and foreign-born women. The 5,315 women in the reproductive ages of 18 to 49 years who were interviewed constitutes a nationally representative sample. Data were obtained from the 1984 Canadian Fertility Survey of 2863 women aged 18-49 years who were married to their first husband or living in consensual unions. The sample included 216 childless women, of whom 98 were voluntarily childless and 91 were temporarily childless. Analysis performed with probit maximum likelihood techniques and bivariate forms revealed that homogamous Catholics were less likely to remain temporarily childless but more likely to be voluntarily childless than non-Catholics. Multivariate analysis found that age, age at marriage, education, and husband's income were statistically as well as significantly related to voluntary childlessness. Estimates of the effects of different independent variables indicate that voluntary childlessness is less prevalent among women who are less educated.

Rovi (1994) pointed out an approach to the study of the childless/childfree based on negative reproductive intentions. Using 11 years of the General Social Survey and a Multinomial Logistic Regression Analysis, the resulting model simultaneously assesses the effects of the independent variables on the probabilities that the married women in this sample are childless/childfree. Sample consists of all currently married women (2914), aged 18 to 44 years, selected from 11 years of the General Social Survey (1971 to 1988). Decade of survey, age groups, working status, education (degree), religious preference, race, rural/urban, siblings were used as independent variables. The analysis showed the effects of the presence of a sibling, the survey year, race, age, years of education, the various working statuses, population size and religious affiliations on the logged odds of the woman being a mother already or postponing children rather than being childless/childfree. The model suggests that the chances of intending to parent increase relative to intending not to parent as education increases.

Hoem, et.al (2006) investigated the relationship between educational field, educational level, and childlessness among Swedish women born in 1955-59. In this study, the concept of educational attainment to cover the field of education taken in

addition to the conventional level of education attained was extended. Register records containing childbearing and educational histories of an entire cohort of women born in Sweden (about a quarter-million individuals) were used to operate with a high number of educational field-and-level. It was found that in each field permanent childlessness increases some with the educational level, but that the field itself is the more important. In general, these women educated for jobs in teaching and health care are in a class of their own, with much lower permanent childlessness at each educational level than in any other major grouping. Women educated in arts and humanities or for religious occupations have unusually high fractions permanently childless.

Chancey (2006) studied on voluntary childlessness since the waning of the baby boom provide cross-sectional estimates for a single time period. In this study, author used data from the 1973-2002 cycles of the National Survey of Family Growth (NSFG) to estimate change in voluntary childlessness using a consistent definition by period and birth cohort. Data for this study come from the National Survey of Family Growth (NSFG), funded by the United States Department of Health and Human Services, conducted by the National Center for Health Statistics at six semi-regular intervals from 1973 to 2002. All survey data were collected through personal interviews. The universe of all six cycles included the noninstitutionalized population of women aged 15-44 living in the continental United States. In Cycles I (1973) and II (1976), only the ever-married or custodial parents were included. The sample of Cycle V (1995) was taken from households which were included in the National Health Interview Survey of 1993. Cycle VI (2002) included men as well as women. I restrict my analyses to women only. The number of women interviewed in each cycle was: Cycle I (1973), 9797; Cycle II (1976), 8611; Cycle III (1982), 7969; Cycle IV (1988), 8450; Cycle V (1995), 10847; Cycle VI (2002), 7643. It was found that voluntary childlessness stayed relatively constant through the seventies and eighties, but showed a large increase from the mid-nineties to 2002. This study showed that voluntary childlessness increased in recent years because baby-boomers postponed childbearing until they no longer desired it, and younger women born in the seventies are now deciding to remain childless earlier. The author discussed the role of these younger women in establishing a ceiling for voluntary childlessness. It also provided initial results supporting the theory that voluntary childlessness is diffusing among women of lower education and higher religiosity.

Tanturri (2006) pointed out determinants on childlessness in Italy by using logistic regression model. The data based on the prospective and retrospective survey conducted by the Italian National Statistical Office was used in this study. A weighted multinomial logit model is used to contrast "voluntary childless men (or women)" with other categories: the "un-voluntary childless" and fathers (or mothers). Covariates include background and early life course characteristics; family formation variables; work related features, attitudes and values. Results were found that voluntary childlessness is a common behavior among men and women, but its determinants partly differ, with particular regard to socio-economic status. The result indicated that voluntary childlessness among men associated with poor education, poor health and the unemployed. Conversely, women would have more chance to be voluntary childless when women possess a university degree and a managerial position.

Soe (2008) investigated in a suburban Buddhist community in Yangon, Myanmar to find out cultural beliefs and gender norms which affects the life of childless women in contemporary Myanmar society. The study was con ducted by using in depth interviews in which nine childless women were interviewed and clues were looked from their husband and family members. It was found that childless women in Myanmar society suffer from gender norms, cultural beliefs, economic problems and social problems throughout the life. It was also found that some women did not know modern fertility technologies and cannot access to these. All women were expecting support from their society and families.

Edmonston et al. (2008) studied trends for adults who intend to remain childless Canadian and explored the socio-economic characteristics associated with childless intentions. The data based on Statistics Canada's General Social Surveys for 1990, 1995, 2001 and 2006. The result had been found that there was no apparent change in childless intentions from 1990 to 2006. There was a strong age pattern associated with childless intentions according to the estimating an age-period-cohort-model. The results were also found that there were associations for childless intentions with higher levels of education, higher family income, age, religion and home language and province of residence.

Keizer et al. (2008) focused on pathways into childlessness and evidence of gendered life course dynamics. This study utilized binary logistics regression model by using the data from the Netherlands Kinship Panel Study (NKPS) that is a

nationally representative survey conducted in 2002–2004 from which 5062 persons (2867 women and 2195 men) between the ages of 40 and 79 were selected. According to the results of logistic regression, women with higher levels of educational attainment are more likely to remain childless, whereas men's educational attainment does not shape their likelihood of remaining childless. Apparently, men do not experience the childbearing-work nexus in the way women do. Women who have no breaks over the course of their 48-employment career are less likely, whereas their male counterparts are more likely to enter parenthood. A stable career seems very important for men's transition to parenthood. And the impact of the marital history on childlessness varies by gender. The finding that men who have had multiple relationships are more likely to remain childless compared to their female counterparts reflects this notion. Women are somewhat more likely than men to seize a second chance to have a child.

Sultan (2009) examined on the differences in the levels of depression inflicted by a sample of 400 couples; 200 childless and 200 childbearing couples who were aged 20-69 years was taken from different cities of Pakistan. The results indicated that childless couples tend to demonstrate higher levels of depression as compared to that of childbearing couples. Findings of the gender differences suggested that infertile females tend to have higher levels of depression as compared to infertile males. The data provided evidence that education, age, income, family system and rural/urban area do not play any important role in deterioration of sadness of infertile couples. The findings further showed the positive role played by language for depression that implies the sample of Urdu language is more likely to be depressed as compared to Punjabi speaking sample in One-way ANOVA Analysis.

Parr (2010) studied childlessness in later adult life among males in Australia. The data were collected from 1,610 males aged 45–59 interviewed in 2001 for Wave 1 of the Household Income and Labour Dynamics in Australia (HILDA) survey, a large-scale, nationwide, longitudinal survey of the household population. Logistic regression model was used to identify the early life course antecedents of a man being childless in later life, in this study. It had been found that father's and mother's occupations, the level and type of education, and birthplace were significant factors of childless in later life of men. It was also found that there was significant relationship with childlessness and the lengths of time a man has been in married. The result also

showed that there was significant relationship between childlessness and cohabitation and his current occupation.

Poston and Cruz (2016) analyzed childlessness among White, Black and Hispanic women in the U.S. Then childlessness trends from 1910 to 2010 for the three groups were examined. The data from the 2006-08 National Survey of Family Growth to examine the degree of voluntary, involuntary, and temporary childlessness among the women were used. Having categorized the women according to their type of childlessness, estimate multinomial regression equations predicting the likelihood of a woman being in each of the childlessness groups versus being in the group of women having children. The dependent variable is the four category variable of temporarily childless, voluntarily childless, involuntarily childless, and childed. The childed category is the reference category and some social and demographic characteristics such as age, education, never married, separated/divorce. It was found that an important predictor of whether a woman was childless (in any of the three categories) versus having children was her level of education. The higher her level of education, the more likely she was to be in one of the childless categories, as opposed to being childed. Also, never married women are much more likely than currently married women to be childless (in any of the three categories) than to have children. They found that an important predictor of whether a woman was childless versus having children was her level of education. The higher level of education for a woman, the more likely she was to be in one of the childless categories, as opposed to being childed.

Fieder et al. (2011) determined the effects of income and education related with age on marital status and childlessness in men and women by using binary logistic regression. The data based on nearly 10 million individual records on individuals aged 16 to 50 of censuses from Brazil, Mexico, Panama, South Africa, USA and Venezuela dating from 2000 or later. Regarding income, the findings for both outcome variables are strongly consistent across all six countries. Highest-income males and lower-income females have the highest proportion of ever-married and the lowest proportion of childlessness. There is no corresponding consistency of findings as regards education either between the sexes or among the countries. The result showed that the highest-income males have the highest proportion of ever-married and the lowest proportion of childlessness. Similar result was found in lower-income females. The highly educated women have a more chance of childlessness at

all ages than less well educated women. It had been found that a greater proportion of low-income men remain unmarried and childless.

Praween et al. (2012) found spatial, socio-economic and demographic variation of childlessness in India. This paper used the data obtained from 1998 to 1999 National Family Health Survey (NFHS-2). In this study, childlessness was defined as childless women as those who are currently married for more than 3 years, age more than 3 years, age more than 20 years, currently not pregnant, never used family planning methods, staying with their husband and have no living children. Multiple logistic regression analysis was used to estimate the prevalence odds ratios for childlessness, adjusting for various covariates. It has been found that women with high school complete and above education, Women belonging to other religion, women belonging to other (general) caste, women belonging to higher standard of living households, currently not working women, spousal age gap of 15 years and above were significant to be childless whereas women in rural area. And Muslims women were significant determinants on childlessness.

Nasrabad et al. (2013) estimated the level and trend of childlessness across time in Iran by using data from the 2000 Iran Demographic and Health Survey (IDHS) and the 1991-2003 survey of Socio-Economic Characteristics of Household in Iran (SECHI). The Iran Demographic and Health Survey provide valuable information that are relevant to the analysis of childlessness. The IDHS covered around 4000 households in each province (2000 households in rural and 2000 households in urban areas). Five principal measures for childlessness were used in the analysis: childlessness, voluntary - and involuntary childlessness, completed (life time) childlessness and primary infertility. Childlessness includes all 'Zero Parity' ever- married women ages 15-49. Voluntary childlessness includes both childless women who are using contraception and women whose ideal is to not have children. Involuntary childlessness consists of childless women who have not used contraception and main reasons for not using contraception are infertility, hysterectomy and childlessness. The results can be found that childlessness in five-year age-groups between ages 15 and 39 increased during 1991-2003. This pattern resembles that of infertility within 5 years of marriage. Increased proportion of women with zero parity in Iran seems to be due to tempo effects resulted from short postponement of first birth. Most of childless women do not remain childless and most of them progress to motherhood ultimately. According to the IDHS data,

Provincial estimates show that most provinces with a low level of socio- economic development experienced the highest involuntary childlessness as compared with other provinces. The results were found that increase in voluntary childlessness in Iran which can be attributed to postponement of first birth within marriage. Continuing higher education seems to be an important factor of postponement childbearing and voluntary childlessness. Since the longer postponements may cause higher involuntary sterility, it is important that young couple become aware of the relationship between age and fecundity and biological risks of postponing motherhood.

Waren and Pals (2013) claimed that childlessness among women has been well researched, but much of that data does not apply to men. To compare and contrast distinguishing factors, data from the National Survey of Family Growth in order between the two groups were used. It was found that traditional sex role belief decreases the probability of being voluntarily childless in both men and women. Waren and Pals (2013) used data from the National Survey Family Growth (2002) to compare voluntarily childless men to other men and to voluntarily childless women in an effort to determine the distinctions between groups. Because they will estimate the effects of education and labour force experience on the likelihood of voluntary childlessness. Voluntarily childless women have higher education, a smaller percentage of them have no have no work experience or have ever been out of work.

Miettinen and Szalma (2014) studied an overview of trends in female and male childlessness in Europe over the last decades and whether the national demographic and social indicators effects on childlessness by using logistic regression. The data from Eurobarometer Surveys 2001–2011 was used in this study. This study distinguished childlessness as a personal preference (personal ideal number of children is zero) from intended childlessness (intention to have no children) as these reflect somewhat different dimensions of childlessness as a conscious decision. It can be found that, on average, childlessness as a personal preference is relatively rare in Europe, although in some western European countries a sizeable proportion of young adults express a desire to have no children. Intentional childlessness is slightly more common than ideal childlessness is, since about 11% of currently childless young adults aged 18 to 40 years in Europe intend to have no children. It analyzed the factors related to childlessness intentions and ideals on the individual and country

levels. A weaker individual socioeconomic position influenced the intention to remain childless through various channels, such as unemployment or low socioeconomic status. Associations between individual's social position and ideal childlessness were less clear. Results also indicated that macro-economic conditions did not have a direct impact on intentional childlessness, whereas a higher prevalence of traditional family values in a country was related to a lower likelihood of individuals considering childlessness to be their ideal family form.

Avison and Furnham (2015) found the association between personality and childbearing motivation, with a focus on voluntary childlessness. An online survey of 780 adults was conducted to assess the big five personality traits, the trait of Independence, desire for parenthood, motivations for choosing childlessness and various other socio-demographic characteristics. Compared to parents or those desiring children, childfree respondents scored significantly higher in Independence and significantly lower in Agreeableness and Extraversion. For non-parents, level of desire for parenthood was negatively correlated with Independence and positively correlated with Agreeableness and religiosity. The ideal number of children desired was positively correlated with Agreeableness and religiosity. Childfree respondents who decided early in life not to have children ('early articulators') were significantly higher in Independence and Openness to Experience than those who decided later in life. Motivations for childlessness loaded onto five factors, four of which correlated significantly with personality traits. The results suggest that personality plays a considerable role in influencing individuals towards, or away from, parenthood.

Abma and Martinez (2006) used the data from Population Survey of the U.S. Census Bureau that is conducted by the National Center for Health Statistics. The data were collected from a nationally representative sample of noninstitutionalized women between the ages of 15 and 44. The sample sizes for women aged 15 - 44 in the all cycles are 10,847 women. Thus, perhaps the voluntarily childless are becoming increasingly composed of women who are satisfied with their situation rather than those feeling they have sacrificed for the sake of a career.

Tanturri et al. (2016) examined micro level determinants of childlessness in a plurality of countries (Eastern, Northern, Central and Southern Europe), characterized by diverse socioeconomic background. The logistic regression model was used in order to estimate the probability of being childlessness women (or men) -versus being mothers (or fathers) at 30-39 and at 40-49 years old. The result showed that the

education level, occupational class, health status and attitudes are related to childlessness.

Reher and Requena (2018) studied on childlessness in the twentieth century Spanish women born in 1920 and 1969 and investigated the factors characterizing traditional/ old childlessness. The microdata from Spanish Census of 2011 were used and the logistic regression was applied in this study. Change over time, as measured by inter-cohort variations, reveals strikingly different patterns of behavior characterized by a reversal of the traditional association of childlessness with marital status and educational attainment that takes place in a period of intense and pervasive social change. The results showed that marital status, education level and place of residence are significant determinants on childlessness.

Rybinska and Morgan (2019) constructed life-lines characterizing women's childless expectations and fertility behavior using nineteen panels of the 1979 National Longitudinal Survey of Youth (NLSY-79), One-quarter of women in the NLSY-79 cohort ever reported an expectation for childlessness but only 14.8 percent of women remain childless. Childless women follow two predominant life course paths: (1) repeated postponement of childbearing and the subsequent adoption of a childless expectation at older ages or (2) indecision about parenthood signaled through vacillating reports of childless expectations across various ages. It was found that more than one in ten women became a mother after considering childlessness: an understudied group in research on childlessness and childbearing preferences. These findings reaffirm that it is problematic to assign expected and unexpected childlessness labels to the reproductive experience of childless women. In addition, despite their variability over time, childless expectations strongly predict permanent childlessness, regardless of the age when respondents offer them. Longitudinal logistic regression analysis of these childless expectations indicates a strong effect of childbearing postponement among the increasingly selective group of childless women. However, net of this postponement, few variables commonly associated with childlessness are associated with reports of a childless expectation. In conclusion, it was found that the effects of socio-demographic and situational factors on childless expectations are channeled predominantly through repeated childbearing postponement.

Verkroost and Moden (2022) pointed out relationship between childlessness and development overall for sub-Saharan Africa. Then contributed by differentiating

between female and male childlessness; and between involuntary, voluntary and circumstantial childlessness. Moreover, constructed new indicators of subnational historical development to assess both inter- and intra-country variation, and distinguish between three components (health, education and income) to investigate the drivers behind relationship. Using 291 Demographic and Health Surveys between 1986 and 2018 from 38 countries and 384 regions, it was found that a U-shaped relationship between female childlessness and development, and a linear relationship for men. There were negative associations of female involuntary childlessness with health and educational advancements, combined with positive correlations of voluntary and circumstantial childlessness with education and income improvements. While these positive associations are stronger among men than women, the negative relationships of involuntary childlessness with health and education observed for women are absent for men, resulting in an overall positive and linear relationship between development and childlessness among men. The findings have implications for how we might expect childlessness rates to evolve with future levels of development.

2.6 Social, Economic and Demographic Characteristics Related to Voluntary Childlessness

A number of socio-demographic characteristics are consistently associated with voluntary childlessness, especially for women. Socio-demographic characteristics that normally affect fertility rates also serve to distinguish the voluntarily childless from the rest of the population. The voluntarily childless tend to be older than the childless in general, for a variety of reasons. Most women do not have a child as soon as they become fecund, so many of their initial prime reproductive years are spent at zero parity (Chancy, 2006).

All studies found that education to be high among the voluntarily childless, although Ritchey and Stokes (1974) find that education has no effect when accounting for postponed childbearing. Krishnan (1993), Poston & Cruz (1990), and Rovi (1994) found that education to have significant positive effects on voluntary childlessness. Childfree women tend to be more highly educated than average (Abma & Martinez 2006; Bram 1984), although Hoem et al. (2006) suggest the field of education is more important than the level: women educated for entry into teaching or healthcare have higher fertility rates and significantly lower rates of childlessness than those educated

in arts or humanities. Two studies from Hoem et al. (2006), cast doubt on the assumption that higher education per se must result in higher childlessness: several factors – such as the field of education and the institutional context-may influence the relationship between education and childlessness. However, Waren and Pals (2013) observed that whilst economic variables, in particular education, were significant predictors of voluntary childlessness for women, they did not have this relation for men. Voluntary childlessness appears to be related to the wife's education level. In general, the more highly educated a woman is, the more likely she is to be voluntarily childless (Barnett & MacDonald, 1976; Bram, 1984; Feldman, 1981; Gustavus & Henley, 1971; Macklin, 1980; Rao, 1974; Veevers, 1973b; Tanturri et al., 2016; and Reher & Requena, 2018). Many women who pursue an advanced education delay or postpone marriage and childbearing until their education is complete. The postponement of childbearing may continue after college if the occupation of the husband and/or wife becomes more important and satisfying than the prospects of having children (Gustavus & Henley, 1971; Hoffman & Manis, 1979; Houseknecht, 1982; Rao, 1974; Veevers, 1973b, 1979). A woman who is college educated is not only more likely to be working but also probably has a higher paying job than a less educated woman. Wives who are employed have substantially higher rates of childlessness than housewives (Barnett & MacDonald, 1976; Bram, 1984; Macklin, 1980; Pohlman, 1970; Veevers, 1979, Tanturri et al., 2016).

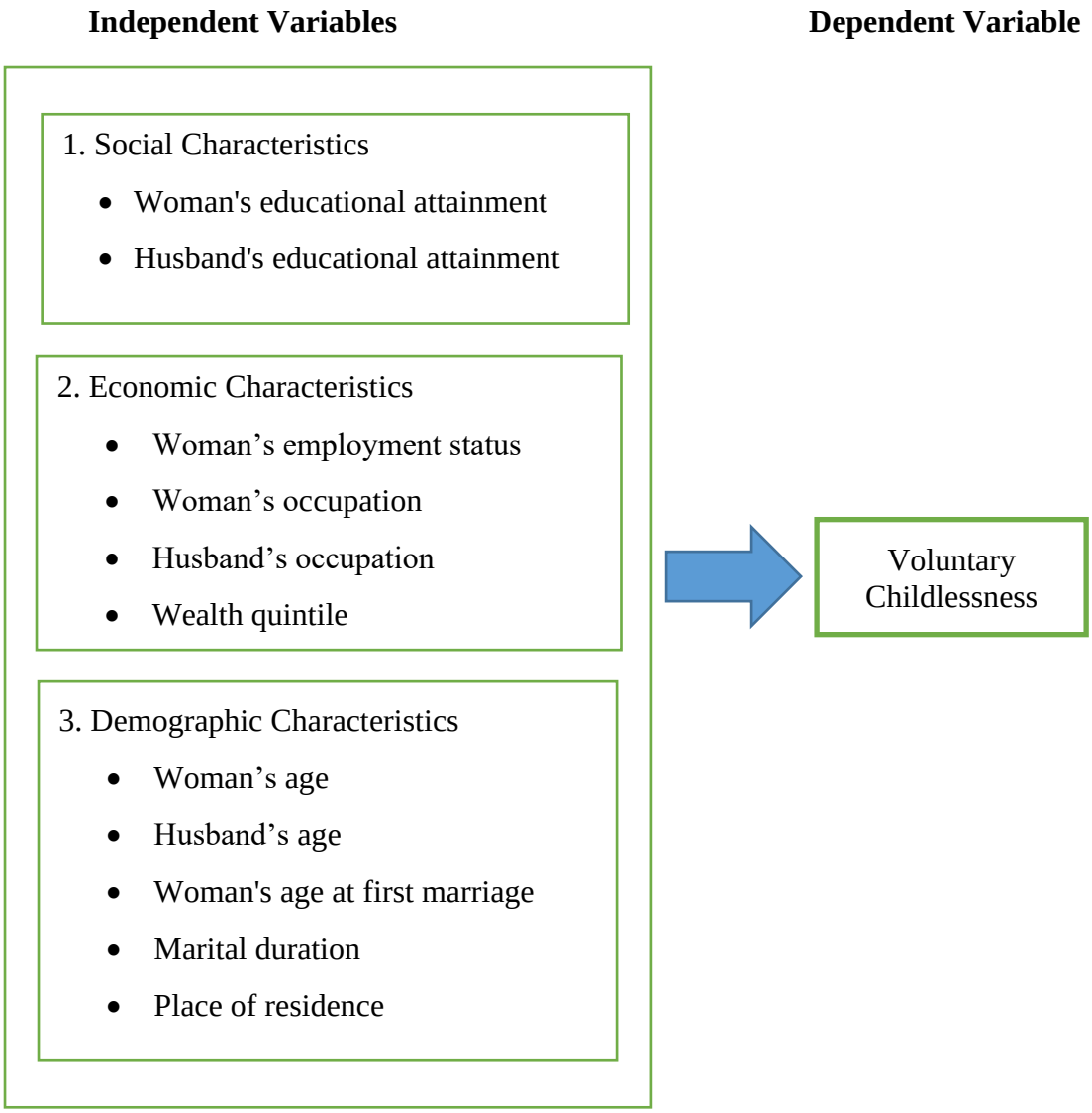
Wives with professional careers have the highest rates of voluntary childlessness (Bram, 1984; Gustavus & Henley, 1971; Poston, 1976; Rao, 1974; Veevers, 1979). Compared with women who have or desire children, voluntarily childless women are more likely to have relatively higher incomes, to be employed in professional or managerial occupations, and to live in urban areas (Abma & Martinez, 2006; Bachu, 1999; Veevers, 1979; Waren and Pals, 2013:). According to the research, many voluntarily childless women are also highly represented in professional or management occupations (Bachu, 1999; Crispell, 1993; Cwikel et al. 2006) and have higher incomes (Bachu, 1999). McAllister & Clarke (1998) concluded that individuals who are voluntarily childless value a general quality of life over a career; this quality of life is said to include a basic level of economic security, good housing, and an egalitarian relationship.

A factor related to higher education, career attainment and childlessness is age at first marriage. The older a person is at first marriage, the more likely he/she is to be

highly educated, career-oriented, and voluntarily childless (Macklin, 1980; Veevers, 1979). Age at marriage influences the childlessness decision in that the older a woman is when she marries, the more likely it is that she has established a childless lifestyle and the fewer the number of fertile years she has left before menopause. Length of marriage is also associated with childlessness (Rao, 1974). Several studies show that the incidence of voluntary childlessness is higher in urban areas than in rural areas (Gustavus & Henley, 1971; Poston, 1976; Veevers, 1973b, 1979; Reher & Requena, 2018).

2.7 Analytical Framework

In this study, the analytical framework for voluntary childlessness was formulated based on the framework conducted by Nasrabad et al. (2013). The previous studies pointed out there were relationship between some social, economic and demographic independent variables such as educational level, employment status, age at marriage, place of residence, religious preference, race, rural/urban, siblings and voluntary childlessness. Based on findings of previous studies, and the data available from the 2015-16 MDHS were used to construct the analytical framework of voluntary childlessness. Some independent variables which were related to voluntary childlessness were not included in this study. The analytical framework of childlessness among women is shown in Figure (2.2).



Source: Own Compilations (2022)

Figure (2.2) Analytical Framework for Childlessness

In Figure (2.2), the dependent variable is considered as being voluntary childless woman as those who are currently married with no living children and currently using any family planning methods. The independent variables consist of social, economic, and demographic characteristics. Social characteristics includes woman's educational attainment and husband's educational attainment. Economic characteristics comprises woman's employment status, woman's occupation, husband's occupation and wealth quintile. Demographic characteristics contains woman's age, husband's age, age at first marriage, marital duration and place of residence.

CHAPTER 3
RESEARCH METHODOLOGY

The purpose of this chapter is to introduce source of data, test of independence and the binary response regression models employed in the analysis of the data, especially binary logistic regression, probit regression and complementary log-log regression. Besides, variable descriptions are also presented in this chapter.

3.1 Source of Data

In this study, the secondary data obtained from CMW aged 15-49 of the 2015-16 MDHS were used. The 2015-16 MDHS was implemented by the Ministry of Health and Sports of the Republic of the Union of Myanmar. The funding for the 2015-16 MDHS was provided by the United States Agency for International Development (USAID) and the three Millennium Development Goal Fund. There were 12885 ever married women in the 2015-16 MDHS, out of whose were 7870 CMW. To get statistics that are representative of Myanmar, the distribution of the women in the sample needs to be weighted. After weighting, the distribution of the women in the states/regions has been changed to represent total sample size, but the total sample size 12885 women have not changed. There were (7759) weighted CMW and among them, only (283) were voluntary childless women and (7476) were not voluntary childless women.

Survey methodology of the 2015-16 MDHS are mentioned in Appendix-A. It contains survey objectives, sampling design and Questionnaire design of the 2015-16 MDHS.

3.2 Description of Variables

To account for the influence of voluntary childless of women, the description of eleven independent variables is used in this analysis. The description and classification of a dependent variable, social, economic and demographic variables are presented in Tables (3.1), (3.2), (3.3) and (3.4).

Table (3.1) Description of Dependent Variable

Dependent Variable	Definition	Coding
Childlessness	Childlessness is defined as currently married woman with no living children and use any contraceptive method.	0 = Not childless woman (Reference) 1 = Childless woman

Table (3.2) Description of Social Variables

Social Variables	Definition	Coding
Woman's educational attainment	Highest level of education for woman	1 = No education (Reference) 2 = Primary 3 = Secondary 4 = Higher
Husband's educational attainment	Highest level of education for husband	1 = No education (Reference) 2 = Primary 3 = Secondary 4 = Higher

Table (3.3) Description of Economic Variables

Economic Variables	Definition	Coding
Woman's employment status	Woman who was employed in the 7 days before the survey	1 = Unemployed (Reference) 2 = Employed
Woman's occupation	Occupation refers to types of job.	1 = Not working (Reference) 2 = Professional/technical/managerial 3 = Clerical/Sales/Services/Domestic service 4 = Agriculture 5 = Skilled manual 6 = Unskilled manual
Husband's occupation	Occupation refers to types of job.	1 = Professional/technical/managerial (Reference) 2 = Clerical/Sales/Services/Domestic service 3 = Agriculture 4 = Skilled manual 5 = Unskilled manual
Wealth quintile	Households are given scores based on the number and kinds of consumer goods they own, ranging from a television to a bicycle or car, plus housing characteristics such as source of drinking water, toilet facilities, and flooring materials. These scores are derived using principal component analysis. National wealth quintiles are compiled by assigning the household score to each usual household member, ranking each person in the household population by their score, and then dividing the distribution into five equal categories, each with 20% of the population.	1 = Lowest (Reference) 2 = Second 3 = Middle 4 = Fourth 5 = Highest

Table (3.4) Description of Demographic Variables

Demographic Variables	Definition	Coding
Woman's age (Years)	Completed years of woman's age	1 = 15-19(Reference) 2 = 20-24 3 = 25-29 4 = 30-34 5 = 35-39 6 = 40-49
Husband's age (Years)	Completed years of husband's age	1 = Under 25(Reference) 2 = 25-29 3 = 30-34 4 = 35-39 5 = 40-44 6 = 45 and above
Age at first marriage (Years)	Age of woman who has firstly got married	1 = 15-19 (Reference) 2 = 20-24 3 = 25-29 4 = 30 and above
Marital duration (Years)	Duration of Marriage (years)	1 = Under 5(Reference) 2 = 5-9 3 = 10-14 4 = 15-19 5 = 20 and above
Place of Residence	Permanent Place of Residence	1 = Rural (Reference) 2 = Urban

3.3 Tests of Independence

The mean or any similar statistic cannot be used to look at the relationship between two categorical variables because these variables have not been measured continuously. When only categorical variables are measured, the frequencies of those categories that fall into each combination can be analyzed. The data can be displayed in a contingency table where each row represents a category for one variable and each

column represents a category for the other variable. Pearson's Chi-square statistic is used to test if there is a significant relationship between two nominal (categorical) variables. This statistic is very helpful for identifying the extent to which two categorical variables are associated (Beh & Lombardo, 2014).This test requires large sample sizes to be accurate. An often-quoted rule of thumb regarding sample size is that none of the expected cell values should be less than five. The null hypothesis for this test is that there is no relationship between two variables. The alternative hypothesis is that there is a relationship between two variables. Pearson's Chi-square test statistic follows an asymptotic Chi-square distribution with (r–1) (c–1) degrees of freedom when row and column variables are independent. It is calculated as

$$\chi^2 = \sum_{i=1}^{r} \sum_{j=1}^{c} \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

where

O_{ij} = observed frequencies

E_{ij} = expected frequencies = $\frac{O_{i.}\, O_{.j}}{N} = \frac{Row\ Total * Column\ Total}{\text{total number of observations}}$

$O_{i.} = \sum_{j=1}^{c} O_{ij}$ = Sum of the observed frequencies for i^{th} row

$O_{.j} = \sum_{i=1}^{r} O_{ij}$ = Sum of the observed frequencies for j^{th} column

N = total number of observations

r = number of rows

c = number of columns

The critical value for the chi-square statistic is determined by the level of significance (typically 0.05) and the degrees of freedom. If the observed chi-square test statistic is greater than the critical value, the null hypothesis can be rejected.

3.4 Regression Analysis for Binary Response Variables

A binary response model is a regression model in which the dependent variable Y is a binary random variable that takes on only the values zero and one. Regression methods have become an integral component of any data analysis

concerned with describing the relationship between a response variable and one or more explanatory variables. Many response variables of interest in economics and other social sciences can only take two values. The two possible outcomes are usually denoted by 0 and 1. Such variables are called dummy variables or dichotomous variables. Many distribution functions have been proposed for use in the analysis of dichotomous outcome variable. Cox and Snell (1989) discussed some of these.

When the response variable is a dummy variable or a dichotomous variable, and could be explained as a function of the predictors, then the acceptable model of fitting such data is binomial regression. Some of the link functions for Binomial regression are logit, probit and complementary-log-log transformations (Alison, 1999). They all follow the same form $\pi(x) = \Phi(\alpha + \beta x)$ for a continuous cumulative distribution function (cdf) Φ. The choice of link function can be crucial to the accuracy of the result of binary modeling of a data set.

3.4.1 Generalized Linear Model

Generalized Linear Models (GLMs) are frequently used in analyzing binary response data in which the dependence of a response variable Y on a set of possible explanatory variables $X_1, X_2, ..., X_p$. One aspect of building a satisfactory model is by choosing a proper link function (Nelder & Wedderburn, 1972).

The generalized linear model is specified by:

(i) independent observations $Y_1, Y_2, ..., Y_n$ distributed according to an exponential family distribution,

(ii) a set of explanatory variables X, available for each observation, describing the systematic linear component through $g[E(Y|X)] = g(\mu) = (X^T\beta) = \eta$, and

(iii) the link function $g(\mu) = \eta$ relating the conditional mean response μ of an observation to the systematic linear component η. To find an appropriate generalized linear model for regression data involves choosing the independent variables, the link function and the variance function.

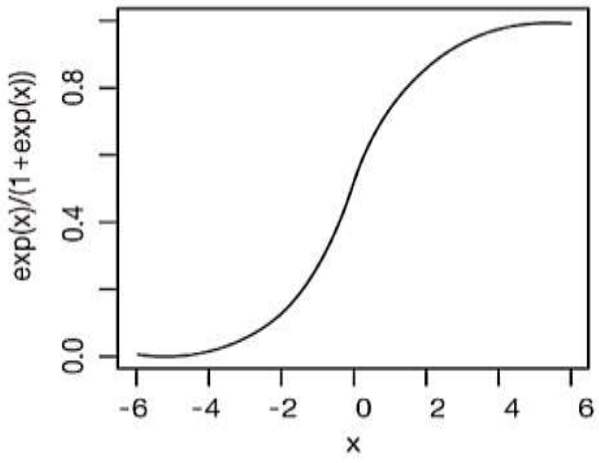
3.4.2 Logistic Regression Model

Logistic Regression is a classification algorithm used to find the probability of an event either success or failure. It is used when the dependent variable is binary in nature. Logistic regression sometimes called the logistic model or logit model. It supports categorizing data into discrete classes by studying the relationship from a given set of labelled data. The logistic model is popular because the logistic function, on which the logistic regression model is based, provides estimates in the range 0 to 1 and an appealing S-shaped description of the combined effect of several risk factors on the risk for an event (Kleinbaum & Klein, 2010).

There is a sample of "*n*" independent observations of the pair (x_i, y_i), i=1,2,3,…,n, where y_i denotes the value of a dichotomous outcome variable and x_i is the value of the independent variable for the i^{th} subject. Furthermore, assume that the outcome variable has been coded as 0 or 1, representing the absence or the presence of the characteristic, respectively. The logistic regression model is given in following equation

$$\pi(x) = \frac{e^{\beta_o + \beta_1 x}}{1 + e^{\beta_o + \beta_1 x}} \tag{3.1}$$

Where β_o and β_1 are the unknown parameters.



Source: Kleinbaum & Klein, (2010)

Figure (3.1) Graph of Logistic Curve

Figure (3.1) displays logistic function when β_o and β_1 are 0 and 1. The logistic or logit function is used to transform an S-shaped curve into an approximately straight line. It is based on sigmoid function where output is probability and input can be from

$-\infty$ *to* $+\infty$.It is a mathematical function having a characteristic "S"-shaped curve or sigmoid curve. Logistic regression is also known as the binomial logistic regression.

In linear regression, the method used most often for estimating unknown parameters is least squares. In that method, the values of β_0 and β_1 which minimize the sum of squared deviations of the observed values of *Y* from the predicted values based upon the model. Under the usual assumption for linear regression the method of least squares yields estimators with a number of desirable statistical properties. Unfortunately, when the method of least squares is applied to a model with a dichotomous outcome the estimators no longer have these same properties.

The general method of estimation that leads to the least squares function under the linear regression model is called maximum likelihood. This method will provide the foundation for approach to estimation with the logistic regression model. In a very general sense the method of maximum likelihood yields values for the unknown parameters which maximize the probability of obtaining the observed set of data. In order to apply this method that must first construct a function, called the likelihood function. This function expresses the probability of the observed data as a function of the unknown parameters. The maximum likelihood estimators of these parameters are chosen to be those values that maximize this function. Thus, the resulting estimators are those which agree most closely with the observed data.

If Y is coded as 0 or 1 then the expression for $\pi(x)$given in Equation (3.1) provides (for an arbitrary value of $\beta = (\beta_0, \beta_1)$, the vector of parameters) the conditional probability that Y is equal to 1 given x. This will be denoted as $P(Y = 1 | X = x)$. It follows that the quantity $1 - \pi(x)$gives the conditional probability that *Y* is equal to zero given *x*, *P(Y=0|***X=**x). Thus, for those pairs *(*x_i*, yi*), where $Y_i = 1$, the contribution to the likelihood function is $\pi(x_i)$, and for those pairs where $Y_i = 0$, the contribution to the likelihood function is 1- $\pi(x_i)$, where the quantity $\pi(x_i)$ denotes the value $\pi(x_i)$ computed at x_i. A convenient way to express the contribution to the likelihood function for the pair *(*x_i*, yi*) is through the expression

$$f(y:\pi) = \pi(x_i)^{y_i}[1-\pi(x_i)]^{1-y_i} \tag{3.2}$$

Since the observations are assumed to be independent, the likelihood function is obtained as the product of the terms given in Equation (3.2) as follows:

$$l(\beta) = \prod_{i=1}^{n} \pi(x_i)^{y_i} [1 - \pi(x_i)]^{1-y_i} \quad (3.3)$$

The principle of maximum likelihood States that the estimate of β the value which maximizes the expression in Equation (3.3). This expression, the log likelihood, is defined as

$$l(\beta) = \ln[\, l(\beta)] = \sum_{i=1}^{n} \{ y_i \ln[\, \pi(x_i)] + (1 - y_i) \ln[1 - \pi(x_i)] \} \quad (3.4)$$

To find the value of β that maximizes $l(\beta)$ that differentiate $l(\beta)$ with respect to β_0 and β_1 and set the resulting expressions equal to zero. These equations, known as the likelihood equations, are

$$\sum_{i=1}^{n} [y_i - \pi(x_i)] \quad = 0 \quad (3.5)$$

and

$$\sum_{i=1}^{n} x_i [y_i - \pi(x_i)] \quad = 0 \quad (3.6)$$

In Equations (3.5) and (3.6), it is understood that the summation is over i varying from 1 to n. In linear regression, the likelihood equations, obtained by differentiating the sum of squared deviations function with respect to β are linear in the unknown parameters and thus are easily solved. For logistic regression the expression in Equations (3.5) and (3.6) are nonlinear in β_0 and β_1 and thus require special methods for their solution.

The value of β given by the solution to Equations (3.5) and (3.6) is called maximum likelihood estimate and will be denoted as $\hat{\beta}$.

3.4.3 Logit Transformation

A logit model of a binary response variable is specified as follows:

$$\ln(\text{odds}) = \text{Logit}\,(p) = \ln\left(\frac{p_i}{1 - p_i}\right) = \sum_{k=0}^{n} \beta_k \, x_{ik} \quad (3.7)$$

The ratio $\left(\frac{p_i}{1 - p_i}\right)$ is the odds that Y_i=1. The inverse transformation is $\Lambda^{-1}(p) = \ln\left(\frac{p_i}{1 - p_i}\right)$ and it is called the logit of p .It is the log of odds that Y_i is 1 rather than 0.

Any value of p in the range (0, 1) is transformed into a value of the logit (p) in $(-\infty,+\infty)$, so that as $p\to 0$, logit $(p)\to-\infty$, (Lawal, 2003). In logit regression, the errors are assumed to have a standard logistic distribution. The mean of a standard logistic distribution is 0, and its variance is $\frac{\pi^2}{3}$.

Logit model can be generalized to *k* explanatory variables which require a linear predictor, which is a function of several predictors.

$$p_i=\Lambda(\eta_i)=\Lambda(\beta_0+\beta_1 X_{i1}+\beta_2 X_{i2}+...+\beta_k X_{ik})$$

$$= \Lambda(X_i^{'}\beta)$$

$$= \frac{1}{1+\exp[-(X_i^{'}\beta)]}$$

$$\text{Also Logit}(p)=\ln\left(\frac{p_i}{1-p_i}\right)=\beta_0+\beta_1 X_{i1}+\beta_2 X_{i2}+...+\beta_k X_{ik}=(X_i^{'}\beta) \quad (3.8)$$

The odds can vary on a scale of $(0,\infty)$, so that the log-odds can vary on the scale of $(-\infty,+\infty)$.

Exponentiating (3.9), then

$$Exp[\ln(\frac{P_i}{1-P_i})]=\exp(\beta_0+\beta_1 X_{i1}+\beta_2 X_{i2}+...+\beta_k X_{ik})$$

$$\left(\frac{p_i}{1-p_i}\right)=\exp(\beta_0+\beta_1 X_{i1}+\beta_2 X_{i2}+...+\beta_k X_{ik})$$

$$= \left(e^{\beta_0}\right)\left(e^{\beta_1}\right)^{X_{i1}}\left(e^{\beta_2}\right)^{X_{i2}}...\left(e^{\beta_k}\right)^{X_{ik}} \quad (3.9)$$

The $\left(e^{\beta_j}\right)$, j = 0,1,…,k is the multiplicative effect on the odds of increasing by 1, while holding other constant, (Cakmakyapan & Goktas, 2013). The coefficients of a logit regression model are the log-odds ratio. The coefficients give information on how the log-odds changes with a unit change in the predictor. The sign of the log-odds indicates the direction of the relationship of a predictor with the logit. The

exponential of the coefficient then gives the expected odds-ratio, which gives intuitive sense of how the logit is changing. (Long, 1997).

3.4.4 Assumptions of Logistic Regression Model

Logistic regression is foremost used to model a binary (0, 1) variable based on one or more other variables, called predictors. The binary variable being modeled is generally referred to as the response variable, or the dependent variable. For a model to fit the data well, it is assumed that

(i) The response variable is binary.
(ii) The observations are independent.
(iii) There is no multicollinearity among predictors.
(iv) There are no extreme outliers.
(v) There is a linear relationship between predictors and the logit of the response variable.
(vi) The sample size is sufficiently large.

The response is also assumed to fit closely to an underlying probability distribution from which the response is a theoretical sample. The goal of a model is to estimate the true parameter(s) of the underlying PDF of the model based on the response as adjusted by its predictors. In the case of logistic regression, the response is binary (0, 1) and follows a Bernoulli probability distribution. Since the Bernoulli distribution is a subset of the more general binomial distribution, logistic regression is recognized as a member of the binomial family of regression models. (Hilbe, 2009).

3.4.5 Merits of Logistic Regression Model (LRM)

(i) Logit model produces statistically sound results. By allowing for the transformation of a dichotomous dependent variable to a continuous variable ranging from $-\infty$ to $+\infty$, the problem of out of range estimate is avoided.
(ii) The logit model provides results which can be easily interpreted and the method is simple to analyse.
(iii) It gives parameter estimates which are asymptotically consistent, efficient and normal, so that the analogue of the regression t test can be applied.

3.4.6 Demerits of Logistic Regression Model

(i) The disturbance terms are heteroscedastic and weighted least squares should be used.

(ii) The estimated results should be interpreted carefully in a small sample.

(iii) The conventionally measured R^2 is of limited value to judge the goodness of fit.

3.4.7 Probit Model

The origin of probit analysis was in Biology. The probit analysis can be seen in the study of the effect of some drug on the survival of a number of insects. The probit probability model is associated with the cumulative normal probability function.

In order to explain the behavior of a dichotomous dependent variable, it has to use a suitably chosen Cumulative Distribution Function (CDF). The logit model uses the cumulative logistic function. But this is not the only CDF that one can use. In some applications, the normal CDF has been found useful. The estimating model that emerges from the normal CDF has been found useful. The estimating model that emerges from the normal CDF is known as the probit model or normit model.

The index I_i can be expressed as $I_i = \beta_1 + \beta_2 X_i$ (3.10)

In probit analysis, the unobservable utility index (I_i) is known as normal equivalent deviate (n.e.d) or simply normit. Since normal equivalent deviate. or I_i will be negative whenever P_i < 0.5, in practice the number 5 is added to the normal equivalent deviate and the result so obtained is called the probit i.e;

Probit = normal equivalent deviate + 5 = I_i + 5

In order to estimate $\beta_1 \; and \; \beta_2$, equation (3.11) can be written as

$$I_i = \beta_1 + \beta_2 X_i + U_i \quad (3.11)$$

3.4.8 Probit Transformation

Another suitable transformation function for a binary response is the probit link function. Probit is also referred to as inverse Normal function, (McCullagh & Nelder, 1989). In order to ensure that *p* is between 0 and 1, a positive monotone function that maps the linear predictor, $(\eta = \alpha + \beta X_i)$into the unit interval.

$$p_i = P(\eta_i) = P(\alpha + \beta X_i) \quad (3.12)$$

Where, $P(.)$: cumulative distribution function.α and β : are parameters to be estimated. A reasonable a priori $P(.)$ should be both smooth and symmetric, and should approach p = 0 and p = 1 as asymptotes. Given the cumulative distribution function of the unit-normal distribution,

$$\Phi(z) = \frac{1}{\sqrt{2\pi}} \int_{-\alpha}^{z} e^{\frac{1}{2}z^2} dz \tag{3.13}$$

The normal distribution $\Phi(.)$ yields linear probit model, such that:

$$p_i = \Phi(\alpha + \beta X_i) = \frac{1}{\sqrt{2\pi}} \int_{-\alpha}^{\alpha+\beta X_i} e^{\frac{1}{2}z^2} dz \tag{3.14}$$

$$\text{Then } \Phi^{-1}(p_i) = \sum_{k=0}^{n} \beta_k X_{ik} \tag{3.15}$$

Where Φ: Standard normal cumulative distribution.

The probit model can also be generalized to *k* explanatory variables, such that

$$\begin{aligned} p_i &= \Phi(\eta_i) \\ &= \Phi(\beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \ldots + \beta_k X_{ik}) \\ &= \Phi(X_i' \beta) \end{aligned} \tag{3.16}$$

In probit regression, the errors are assumed to have a standard normal distribution. It is defined in terms of the inverse normal probability integral as $\Lambda = \Phi^{-1}(p)$, then Λ is referred to as the probit of p.

3.4.9 Logit versus Probit

(i) The chief difference between logit and probit is that logistic has slightly flatter tails i.e; the normal or probit curve approaches the axes more quickly than the logistic curve.

(ii) Qualitatively, logit and probit models give similar results; the estimates of parameters of the two models are not directly comparable.

3.4.10 Complementary Log-log Model and Transformation

Complementary log-log model says $\log\{-\log[1-\pi(x)]\} = \mathbf{X'_{p\times n}\beta_{p\times 1}}$. The expression on the left-hand side is called the complementary log-log transformation.

Like the logit and the probit transformation, the complementary log-log transformation takes a response restricted to the (0, 1) interval and converts it into existent in (−∞,+∞) interval. The log of 1-π (x) is always a negative number. This is changed to a positive number before taking the log for a second time. The model can be written down like,

$$\pi(x) = 1 - \exp[-\exp(X'_{p\times n}\beta_{p\times 1})]$$

$$\log\{-\log\{1-\pi(x)\} = (\beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_k X_k)$$

$$-\log\{1-\pi(x)\} = \exp(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_k X_k) \quad (3.17)$$

3.5 Comparison of Link Functions for Logit, Probit and Complementary Log-Log Models

A link function is the function that links the linear model to the conditional mean response. The critical role that link function plays in GLM is linking the actual Y to the E(Y|X) = μ using a transformation, or linking function, that will allow the parameter range to be unbounded (from negative infinity to positive infinity) while ensuring that the model predictions will be in the plausible range. A proper link function will guarantee that regardless of the input, the model will produce predictions in the proper range. Also, without a properly specified link, the constant variance assumption of residuals will be violated. Because the observed Y has only two possible values 0 and 1, the residuals have only two possible values for each observation. With only two possible values, the residuals cannot be normally distributed. Moreover, the best line to describe the relationship between X and E(Y |X) is not likely to be linear, but rather an S-shape. In GLM, there are link functions called canonical links for different distributions, such as logit link for binomial regression, log link for Poisson regression and inverse squared link for inverse Gaussian distribution (McCullagh & Nelder, 1989). However, there are still many functions other than these canonical links that also can map the systematic linear component onto the interval [0, 1]. Also, even though GLM's with canonical links, such as the logit link in binomial regression, guarantee maximum information and a simple interpretation of the regression parameters, those links do not always provide the best fit available to a given data set. Usually, the choice of link function is arbitrary, but link misspecification can lead to substantial bias in the regression

parameters and the mean response estimates (Czado & Santner, 1992). Thus, how to choose a proper link is still important. Logit link is the canonical link function for binary response data, but the probit is also popular, or there are other options that are sometimes used, such as the complementary log-log.

Table (3.1) Binomial Link Functions and Corresponding Distributions

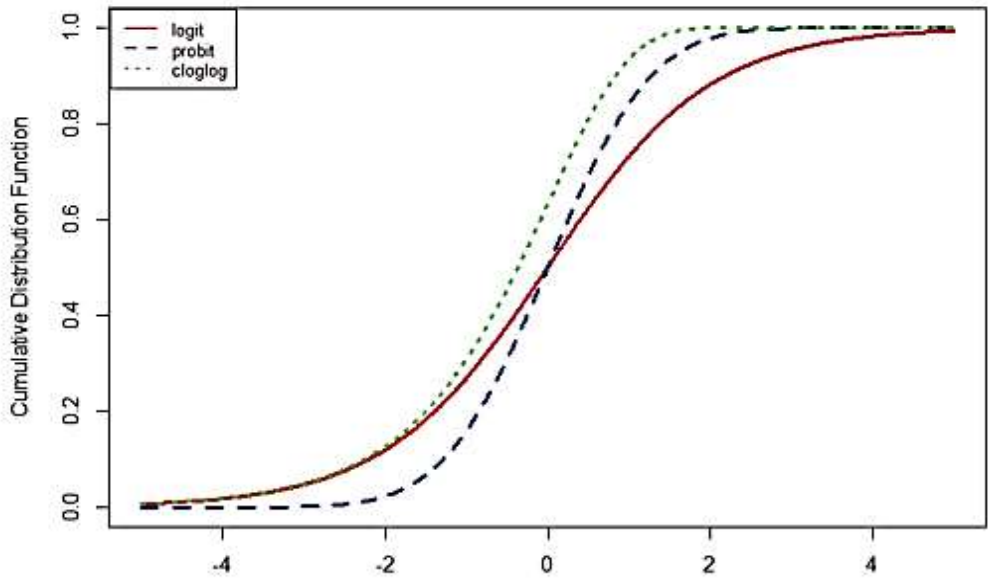
Link	g(μ)	Distribution	Mean	Variance
Logit	$\log[\mu/(1-\mu)]$	Logistic	0	$\pi^2/3$
Probit	$\Phi^{-1}(\mu)$	Normal	0	1
Complementary log-log	Log [-log (1- μ)	Extreme-value	-γ	$\pi^2/6$

Φ is cumulative standard normal distribution function.

Source: Agresti (2002)

According to Table (3.1), the distributions of the three link functions are logistic, normal and extreme value, respectively. The mean and variances of these three distributions are not the same.

Both logit and probit links have the same property, which is link [π(x)] = -link [1-π(x)]. This means that the response curve for π(x) has a symmetric appearance about the point π(x) = 0.5 and so π(x) has the same rate for approaching 0 as well as for approaching 1. When the data given are not symmetric in the [0,1] interval and increase slowly at small to moderate value but increases sharply near 1. The logit and probit models are inappropriate. However, in this situation, the complementary log-log model might give a satisfied answer. Figure (3.1) shows graphically cumulative distribution function corresponding to the three link functions.

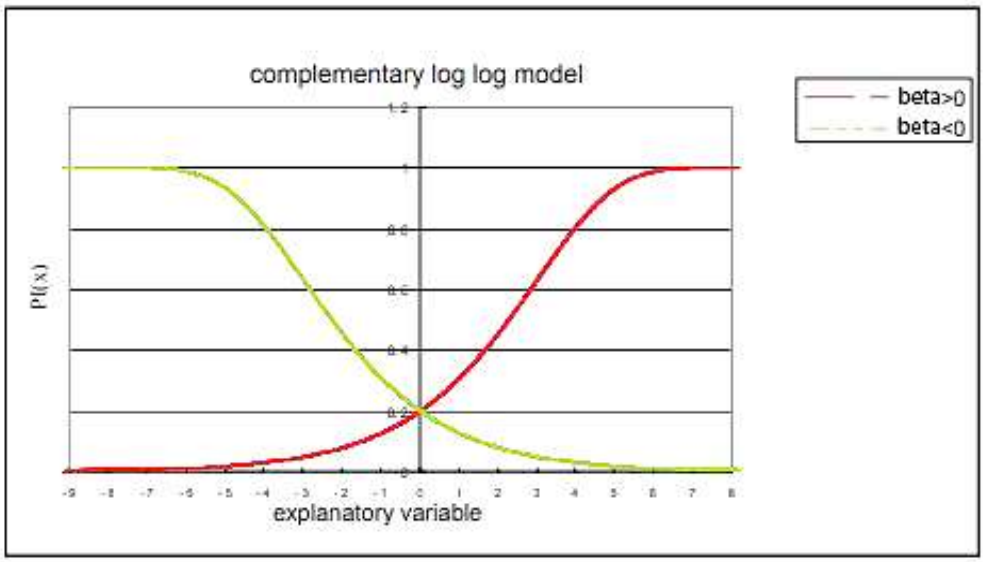


Source: Agresti (2002)

Figure (3.2) Cumulative Distribution Function Corresponding to the Logit, Probit and Complementary Log-Log Link Functions

According to Figure (3.2), the red solid line shows the Cumulative Distribution Function (CDF) of logistic distribution that corresponds to logit link, the blue dashed line shows the CDF of standard normal distribution (probit link) and the green dotted one shows CDF of gumbel distribution (clog-log link). The logit and probit are symmetric link functions, since they approach 0 at the same rate as they approach 1, as indicated by the curves that go through the point (0,0.5) symmetric with the reverse. Whereas the clog-log has an asymmetric curve, it approaches to 1 faster than to 0.

Unlike logit and probit, the complementary log-log model is asymmetrical, it is frequently used when the probability of an event is very small or very large. The distribution of response variable has an S-shaped curve, it approaches 0 fairly slowly but approaching 1 quite sharply, when $\beta > 0$. Figure (3.3) presents complementary log-log model.



Source: Agresti (2002)

Figure (3.3) Complementary Log-Log Model

Since the log-log applies to the complement of π (x), the link for this GLM is called the complementary log-log link.

3.6 Fitting the Regression Model for Binary Response Models

There are four parts involved in the evaluation of the regression model. First, the overall model (relationship between all of the independent variables and dependent variable) needs to be assessed. Second, the importance of each of the independent variables needs to be assessed. Third, predictive accuracy or discriminating ability of the model needs to be evaluated. Finally, the model needs to be validated.

3.6.1 Overall Model Evaluation

(1) Omnibus Tests

Omnibus tests are a kind of statistical test. It is needed to test whether the explained variance in a set of data is significantly greater than the unexplained variance, overall. In addition, Omnibus test as a general name refers to an overall or a global test. Other names include F-test or Chi-Square test. Omnibus test as a statistical test is implemented on an overall hypothesis that regarding coefficients $\beta_1 = \beta_2 = \ldots = \beta_k = 0$ vs. at least one is not equal to zero in multiple linear regression or in logistic

regression. Usually, it tests more than two parameters of the same type and its role is to find general significance of at least one of the parameters involved.

Omnibus test commonly refers to either one of those statistical tests:

(a) ANOVA F-test to test significance between all factor means and between their variances equality in analysis of variance procedure;

(b) The omnibus multivariate F Test in ANOVA with repeated measures;

(c) F test for equality/inequality of the regression coefficients in the multiple regression;

(d) Chi-Square test for exploring significance differences between blocks of independent explanatory variables or their coefficients in a logistic regression.

Those omnibus tests are usually conducted whenever one tends to test an overall hypothesis on a quadratic statistic (like sum of squares or variance or covariance) or rational quadratic statistic (like the ANOVA overall F test in Analysis of Variance or F-test in analysis of covariance or the F-test in linear regression, or chi-square in logistic regression). While significance is founded on the omnibus test, it doesn't specify exactly where the difference is occurred, meaning, it does not bring specification on which parameter is significantly different from the other, but it statistically determine that there is a difference, so at least two of the tested parameters are statistically different. If significance was met, none of those tests will tell specifically which mean differs from the others (in ANOVA), which coefficient differs from the others. The model tested can be defined by y_i, whereas y_i is the category of the dependent variable for the i^{th} observation and x_{ij} is the j independent variable (j = 1, 2, ... k) for that observation, β_j is the j^{th} coefficient of x_{ij} and indicates its influence on and expected from the fitted model. The omnibus test is used to test the null hypothesis that all coefficients are equal to zero against the alternative hypothesis that at least one coefficient is not equal to zero.

(2) Cox and Snell R-Square

Cox and Snell's R-Square as a transformation of the statistic of $-2\ln\left[L(M_{Intercept})/L(M_{Full})\right]$ is used to determine the convergence of a logistic regression. The ratio of the likelihoods reflects the improvement of the full over the

intercept model (the smaller the ratio, the greater the improvement). The Cox and Snell R-Square is

$$R^2 = 1 - \left[\frac{L(M_{Intercept})}{L(M_{Full})} \right]^{2/M} \tag{3.18}$$

L(M) is the conditional probability of the dependent variable given the independent variables. If there are N observations in the dataset, then L(M) is the product of N such probabilities. Thus, taking the n^{th} root of the product L(M) provides an estimate of the likelihood of each Y value. Cox and Snell's pseudo R-squared has a maximum value that is not 1. If the full model predicts the outcome perfectly and has a likelihood of 1, Cox and Snell's R-Square will be $(1\text{-}L\ (M_{Intercept})^{2/N})$, which is less than one.

(3) Likelihood Ratio (LR)

The basic measure of how well the maximum likelihood estimation procedure fits is the likelihood value, similar to the sums of squares values used in multiple regression.

Likelihood ratio measures model estimation fit with the value of -2 times the log of the likelihood value, referred to as -2 log likelihood. The minimum value for -2 log likelihood is 0, which corresponds to a perfect fit (likelihood = 1 and -2 log likelihood is then 0). Thus, the lower the - 2 log likelihood value, the better fitted the model. The -2 log likelihood value can be used to compare between equations for the change in fit or used to calculate measures comparable to the R^2 measures in multiple regression.

The Likelihood Ratio Test

Likelihood Ratio (LR) uses maximum likelihood estimation to compute the coefficients for the LR equation. The method of maximum likelihood estimation chooses values for parameter estimators (regression coefficients) which make the observed data — maximally likely. Standard errors are obtained as a by-product of the maximization process. The goal of logistic regression is to estimate the unknown parameters in the following equation.

$$P(Y)=\frac{\exp(\beta_0+\beta_1X_{i1}+\beta_2X_{i2}+...+\beta_kX_{ik})}{1+\exp(\beta_0+\beta_1X_{i1}+\beta_2X_{i2}+...+\beta_kX_{ik})}. \quad (3.19)$$

This is done with maximum likelihood estimation which entails finding the set of parameters for which the probability of the observed data is greatest. The maximum likelihood equation is derived from the probability distribution of the dependent variable. Since each y_i represents a binomial count in the population, the joint probability density function of Y is:

$$f(y/\beta)=\prod_{i=1}^{N}\frac{n_i!}{y_i!(n_i-y_i)!}P^{y_i}(1-P)^{n_i-y_i} \quad (3.20)$$

For each population, there are $\binom{n_i}{y_i}$ different ways to arrange Y failures from among n_i trials. Since the probability of a failure for any one of the n_i trials P_i, the probability of Y_i failures is $P_i^{y_i}$. Likewise, the probability of n_i - y_i successes is $(1-P)^{n_i-y_i}$. The likelihood function has the same form as the probability density function, except the parameters of the function are reversed, that is, the likelihood function expresses the values of in terms of known, fixed values for Y. Thus

$$L(\beta\backslash Y)=\prod_{i=1}^{N}\frac{n_i!}{y_i!(n_i-y_i)!}P^{y_i}(1-P)^{n_i-y_i} \quad (3.21)$$

The maximum likelihood estimates are the values for that maximize the likelihood function in equation (3.21). Finding the maximum likelihood estimates requires computing the first and second derivatives of the likelihood function. The likelihood function can be considerably simplified to reduce the task of taking the derivative of the likelihood function with respect to β.

3.6.2 Model Selection Criterion

There are several criteria for selecting the best parsimonious model in generalized linear modeling, as advocated by several authors, (Lawal, 2003).

(1) Akaike Information Criterion (AIC)

AIC is one of the model selection criteria (Clayton et al., 1986). AIC is defined as:

$$AIC = - 2 \ln (L) +2p \quad (3.22)$$

where L: maximized value of the likelihood function for the estimated model.

p: number of parameters in the model.

When comparing competing models fitted by maximum likelihood to the same data, the smaller the AIC, the better the fit, (Lawal, 2003).

(2) Bayesian Information Criterion (BIC)

The Bayesian information criterion (BIC), proposed by Schwarz and hence also referred to as the Schwarz information criterion and Schwarz Bayesian information criterion, is another model selection criterion based on information theory but set within a Bayesian context (Clayton et al., 1986). The BIC is computed as follows:

$$\text{BIC} = -2\log L(\hat{\theta}) + k\log n \tag{3.23}$$

Where n = the number of observations

The best model is the one that provides the minimum BIC.

3.7 Receiver Operating Characteristic (ROC) Curve

ROC is the plot of sensitivity versus 1-specificity (precise) over all possible outpoints. The area under the curve provides a measure of discrimination. It is a visual index to compare competing models. It plots the probability of detecting true signal (sensitivity) and false signal (1- specificity) over all possible outpoints. It is helpful in comparing two or more diagnostic tests.

3.8 Statistical Significance of Individual Regression Coefficients

If the overall model works well, the next step is importance of each independent variable. The logistic regression coefficient for the i^{th} independent variable shows the change in the predicted log odds of having an outcome for one unit change in the i^{th} independent variable, all other things being equal. That is, if the i^{th} independent variable was changed 1 unit while all of the other predictors are held constant, log odds of outcome is expected to change b_i units. There are a couple of different tests designed to assess the significance of an independent variable in logistic regression, the likelihood ratio test and the Wald statistic (Menard, 2001).

3.8.1 Wald Test

The Wald statistic can be used to assess the contribution of individual predictors or the significance of individual coefficients in a given model. The formula for computing the Wald statistic is

$$W = \frac{\hat{\beta}_i}{SE(\hat{\beta}_i)} \tag{3.24}$$

Where $\hat{\beta}_i$ is the estimate of the coefficient of the independent variable X_i and SE ($\hat{\beta}_i$) is the standard error of $\hat{\beta}_i$. The Wald statistic is chi-square distributed with 1 degree of freedom. The null hypothesis is rejected if the p-value of the test is less than α (Type I error) significant level and it implies that the variable is important in the model.

Hypothesis tests for logit and probit models are based on Wald statistic, (Alison, P.D.1999). For an individual coefficient, to test the hypothesis: $H_o : \beta_j = \beta_j^{(0)}$, the Wald statistic should be calculated as

$$Z_0 = \frac{\beta_j - \beta_j^{(0)}}{SE(\beta_j)} \tag{3.25}$$

where $SE(\beta_j)$: the asymptotic standard error of β_j.

Z_0 follows an asymptotic unit-normal distribution under the null hypothesis.

3.8.2 Odds and Odds Ratio

Odds are determined from probabilities and range between 0 and infinity. Odds are defined as the ratio of the probability of success and the probability of failure. The odds of success are the probability of success (p) divided by the probability of failure (1-p). In proportional odds model, the outcome variable is ordered with multiple levels, and the odds of being at or below a particular category($Y \leq m$). Odds ratio is the ratio between odds. The importance of this is that a large odds ratio (OR) can represent a small probability and vice-versa. The odds of being at or below a category in Ordinary Likelihood Ratio (OLR) equals the probability of being at or below a category divided by the probability of being above that category:

$$Odds(Y \leq m) = \frac{\Pr(Y \leq m)}{\Pr(Y \rangle m)}. \tag{3.26}$$

Since the probability of being at or below a category and the probability of being above that category is complementary, $\Pr(Y \leq m) + \Pr(Y > m) = 1$. This equation (3.28) can be rewritten as:

$$Odds = (Y \leq M) = \frac{\Pr(Y \leq m)}{1 - \Pr(Y \rangle m)} . \quad (3.27)$$

It can be remarked that the odds of being at or below a category *m* in OLR equals the probability of being at or below a category divided by its complementary probability, 1 minus the probability of being at or below that category. The probability of being at or below a category $\Pr(Y \leq m)$ is the cumulative probability since it equals the sum of the probabilities of all categories at or below that category:

$$\Pr(Y \leq m) = \Pr(Y = 1) + \Pr(Y = 2) + \cdots + \Pr(Y = m) \quad (3.28)$$

when *m* = 1,2, …, M.

The odds of being at or below a category in OLR are also called the cumulative odds. The cumulative odds in OLR are basically comparisons between two complementary probabilities (Xu and Long, 2005). The odds ratio in OLR is the change in the odds (i.e., the odds of being above a particular category versus being at or below that category) for a one-unit increase from any value of *X* to the value of (*X* +1), and it is an exponentiated logit coefficient, exp (β). In contrast, the odds of being at or below a particular category is the inverse of the odds of being above that category. It is the exponentiated logit coefficient with a negative sign before that (i.e., exp(-β)).

3.8.3 Odds Ratios with 95% Confidence Intervals

Odds ratio with 95% confidence intervals (CI) can be used to assess the contribution of individual predictors (Katz, 1999). It is important to note however, that unlike the p value, the 95% CI does not report a measure's statistical significance. It is used as a proxy for the presence of statistical significance if it does not overlap the null value (OR=1). The 95% CI is used to estimate the precision of the OR. A large CI indicates a low level of precision of the OR, whereas a small CI indicates a higher precision of the OR. An approximate confidence interval for the population log odds ratio is 95% CI for the

$$\ln (OR) = \ln (OR) \pm 1.96 \times \{SE \ln (OR)\} \quad (3.29)$$

where ln (OR) is the sample log odds ratio, and SE ln (OR) is the standard error of the log odds ratio (Morris & Gardner, 1988).

Taking the antilog, 95% confidence interval for the odds ratio:5% CI for OR is

$$e^{\ln (OR) \pm 1.96 \times \{SE \ln (OR)\}} \quad (3.30)$$

CHAPTER 4
ASSESSING CHILDLESS WOMEN IN MYANMAR

The purpose of this chapter is to describe voluntary childlessness in Myanmar and to present the descriptive statistics of socio-economic and demographic characteristics of childless women and association between socio-economic and demographic characteristics and voluntary childlessness in Myanmar based on the 2015-16 MDHS.

4.1 Childlessness in Myanmar

According to the 2014 Myanmar Population and Housing Census, population of Myanmar was 51.48 million and population growth rate shows that the population of Myanmar increased at the rate of 0.89% per annum from 2003 to 2014. Women of reproductive age represented nearly 28% of population. According to the Myanmar Fertility and Reproductive Health Survey (FRHS, 2001), there were 8.1% of the EMW and 8.3 % of CMW have no children. In 2007 Myanmar FRHS, it was found that 8.9% of the EMW and 9.1% of the CMW have no children. It can be also found that 40.9% of the all sample women (12885) and 11.3% of the CMW have no children in the 2015-16 MDHS.

In the 2015-16 MDHS the following results were found that the current total fertility rate was 2.3 children per woman: 1.9 children in urban areas and 2.4 children in rural areas. The fertility levels were lower among highly educated women and women living in wealthy households compared with other women. The mean number of children ever born is 1.6% for all women and 2.5% for CMW. The mean number of children born to women age 45- 49 was 3.2 children and the mean number born to CMW in this age group was 3.9 children. It was found that 17% of women age 45-49 have given birth to six or more children, despite the relatively low number of children ever born to older women. Among women age 40-49, 17% to 18% have not had any

births and many women complete their reproductive years without having children in Myanmar. Moreover, Total Marital Fertility Rate (TMFR) was also declined; it was 5.8% in 1983 census, 4.99% in 2014 census and 4.03% in the 2015-16 MDHS. But, infertility had been a common gynecological problem in Myanmar, but there was no datum available on sub- fertility problem in Myanmar, and many limitations to the available services in Myanmar (Department of Health, 2004). According to the data from Fertility and Demographic Health Survey (2001), 97% of CMW know a method of contraception but only 37% of them were using it (UNFPA, 2002). In the 2015-16 MDHS, nearly 99% of CMW know a method of contraception and it has been found that 52% of CMW women use a method of contraception.

In Myanmar, there were many reasons for childlessness of women. There is no gender discrimination in Myanmar education system toward women. As the result of Myanmar 1983 Population Census, female literacy rate and labour force participation rate at reproductive age 15-49 are 76.19% and 90.31% respectively. In 2014 Myanmar Population and Housing Census, it was found that those rates are 76.24% and 94.85%. Therefore, it can be seen that these rates of women at age 15-49 are high. Higher literacy rate in women is becoming one of the factors affecting on decreasing marital fertility rate. Most of the Myanmar women were dependents and they usually worked as unpaid housewives in the past in Myanmar. Recently, Myanmar women were more accessible to work due to recent changes in the economic system and there had been increasing trend of women working outside their homes and working in public and private sectors. During 2001, labor force participation rate (age 15 and over) of the whole country was 83.3% for male and 50.6% for women, 41.8% of them were working in service works (Union of Myanmar, 2003). High literacy rate of Myanmar women is another factor for reduction in TMFR. Women delay their age at marriage to fulfill their career goals at present. Women reduce the chance of getting pregnant in advancing age.

4.2 Descriptive Statistics of Voluntary Childlessness among Currently Married Women

The distribution of childlessness among currently married women is described in Table (4.1).

Table (4.1) Distribution of Voluntary Childlessness among Currently Married Women

Voluntary Childlessness	Currently Married Women	
	Number	Percent
Yes	283	3.7
No	7476	96.3
Total	**7759**	**100.00**

Source: MDHS (2015-16)

According to Table (4.1), there are a total of 7759 currently married women. Among them, there are 283 (3.6%) voluntary childless women but 7476 (96.4%) are not childless women.

4.2.1 Social Characteristics of Currently Married Women

In this section, social characteristics such as educational attainment of currently married women and their husbands are shown in Table (4.2).

Table (4.2) Distribution of Social Characteristics

Social Characteristics	Currently Married Women	
	Number	Percent (%)
Woman's educational attainment		
No education	1193	15.4
Primary	3656	47.1
Secondary	2286	29.5
Higher	624	8.0
Total	**7759**	**100.0**
Husband's educational attainment		
No education	1149	14.8
Primary	3205	41.3
Secondary	2915	37.6
Higher	490	6.3
Total	**7759**	**100.0**

Source: MDHS (2015-16)

As shown in Table (4.2), the percentage of the currently married women who have completed primary educational level is 47.1%, followed by 29.5% for secondary educational level, 15.4% without any educational attainment and 8.0% in higher educational level**.** Similarly, the percentage of husbands who have attained primary educational level 41.3%, followed by 37.6% in secondary educational level, 14.8% without any educational attainment and 6.3% in higher educational level.

4.2.2 Economic Characteristics of Currently Married Women

The distribution of economic characteristics such as employment status of women, types of occupation of women and their husbands and wealth quintile is presented in Table (4.3).

Table (4.3) Distribution of Economic Characteristics

Economic Characteristics	Currently Married Women	
	Number	**Percent (%)**
Employment Status		
Unemployed	2821	36.4
Employed	4938	63.6
Total	**7759**	**100.0**
Woman's Occupation		
Not working	2270	29.3
Professional/technical/managerial	351	4.5
Clerical	81	1.1
Sales	1356	17.5
Agricultural - self employed	748	9.6
Agricultural - employee	447	5.7
Domestic service	14	0.2
Services	46	0.6
Skilled manual	460	5.9
Unskilled manual	1986	25.6
Total	**7759**	**100.0**

Table (4.3) Distribution of Economic Characteristics (Continued)

Economic Characteristics	Currently Married Women	
	Number	Percent (%)
Husband's Occupation		
Professional/technical/managerial	573	7.4
Clerical	88	1.1
Sales	546	7.0
Agricultural - self employed	1403	18.1
Agricultural - employee	577	7.4
Domestic service	22	0.3
Services	89	1.2
Skilled manual	1509	19.5
Unskilled manual	2952	38.0
Total	**7759**	**100.0**
Wealth Quintile		
Lowest	1486	19.2
Second	1622	20.9
Middle	1586	20.4
Fourth	1556	20.0
Highest	1509	19.5
Total	**7759**	**100.0**

Source: MDHS (2015-16)

According to Table (4.3), 36.4% are unemployed women and 63.6% of CMW are employed women. Regarding women's occupation, the percentage of CMW who are not working is 29.3%, followed by 25.6% unskilled manual, 17.5% sales, 9.6% agricultural-self-employed, 5.9% skilled manual, 5.7% agricultural employee. The percentages of currently married women for the rest types of occupation are less than 5%. According to husband's occupation, it shows that minority of husbands (38%) are unskilled manual, followed by 19.5% skilled manual and 18.1% agricultural-self-employed. The percentages of husbands for the rest types of occupation are less than 10%. In relation to wealth quintile, 19.2%, 20.9%, 20.4%, 20.0% and 19.5% are the lowest, second, middle, fourth, and highest wealth quintiles, respectively.

4.2.3 Demographic Characteristics of Currently Married Women

The distribution of demographic characteristics such as woman's age, husband's age, age at first marriage, marital duration and place of residence for currently married women is shown in Table (4.4).

Table (4.4) Distribution of Demographic Characteristics

Demographic Variables	Currently Married Women	
	Number	Percent (%)
Woman's age		
15-19	228	2.9
20-24	834	10.7
25-29	1258	16.2
30-34	1505	19.4
35-39	1482	19.1
40-49	2452	31.7
Total	**7759**	**100.0**
Husband's age		
Under 25	673	8.7
25-29	1089	14.0
30-34	1375	17.7
35-39	1437	18.5
40-44	1313	16.9
45 and above	1872	24.2
Total	**7759**	**100.0**
Woman's age at first marriage		
15-19	3636	46.9
20 -24	2699	34.8
25-29	943	12.2
30 and above	481	6.1
Total	**7759**	**100.0**

Table (4.4) Distribution of Demographic Characteristics (Continued)

Demographic Characteristics	Currently Married Women	
	Number	**Percent (%)**
Marital duration (Years)		
Under 5	1491	19.2
5-9	1436	18.5
10-14	1390	17.9
15-19	1340	17.3
20 and above	2102	27.1
Total	**7759**	**100.0**
Place of residence		
Rural	5737	73.9
Urban	2022	26.1
Total	**7759**	**100.0**

Source: MDHS (2015-16)

As shown in Table (4.4), the percentages of currently married women within age groups 15-19, 20-24, 25-29, 30-34, 35-39 and 40 and above are 2.9%, 10.7%, 16.2%, 19.4%, 19.1% and 31.7%, respectively. Then, the percentage of husbands with age groups under 25, 25-29, 30-34, 35-39, 40-44 and 45 and above are 8.7%, 14.0%,17.7%, 18.5%, 16.9% and 24.2% respectively. The percentages of women aged at first marriage are 46.9% at 15-19 years, 34.8% at 20-24 years, 12.2% at 25-29 years and 6.1% at 30 years and above. The percentage of women who got married under 5 years is 19.2% and it is the largest percentage. The percentage of those women by marital duration 5-9 years, 10-14 years, 15-19 years, 20 years and above are 18.5%, 17.9%, 17.3% and 27.1%. Regarding the place of residence, the percentage of currently married women who lived in rural area is 73.9% and that of women who live in urban is 26.1%.

4.3 Spatial Variation of Childless Women in Myanmar

The distribution of childless women and women having children by states and regions in Myanmar is illustrated in Table (4.5) and Figure (4.1).

Table (4.5) State and Region Wise Prevalence of Childlessness in Myanmar

State / Region	Total Number of Currently Married Women	Number of Childless Women (%)	Number of Women Having Children (%)
States	**2178**	**36(1.7)**	**2142(98.3)**
Kachin	238	3(1.3)	235(98.7)
Kayah	40	0(0.0)	40(100.0)
Kayin	201	2(0.9)	199(99.1)
Chin	66	0(0.0)	66(100.0)
Mon	278	8(2.9)	270(97.1)
Rakhine	454	16(3.5)	438(96.5)
Shan	901	7(0.8)	894(99.2)
Regions	**5581**	**247(4.4)**	**5334(95.6)**
Sagaing	828	14(1.7)	814(98.3)
Taninthayi	174	0(0.0)	174(100.0)
Bago	780	60(7.7)	720(92.3)
Magway	642	18(2.8)	624(97.2)
Mandalay	838	37(4.4)	801(95.6)
Yangon	1042	66(6.3)	976(93.7)
Ayeyawaddy	1083	41(3.8)	1042(96.2)
Naypyitaw	194	11(5.7)	183(94.3)
Country	**7759**	**283(3.6)**	**7476(96.4)**

Source: MDHS (2015-16)

As shown in Table (4.5), overall, 3.6% of currently married women are childless in Myanmar. The percentage of childlessness among women in regions (4.4%) is higher than that of childless women in states (1.7%).

There are 1.3% childless women and 98.7% women who have children among currently married women who live in Kachin State. It has been found that the

percentages of women who are childless and have children are 0.9% and 99.1% in Kayin State. In Mon State, 2.89% are childless women and 97.1% are women who have children. In Rakhine State, the percentage of childless women is 3.5% and the percentage of women who have children is 96.5%. Among all states, Rakhine State shows highest percentage of childlessness.

This phenomenon requires further exploration to explain the possible factors for this induction. The proportion of the population in Rakhine State substantially declines from age 20 and above. This may reflect a huge out migration or other factors. Migration of women in Rakhine State has cause of low birth rate in this area. In general, younger migrant women are no consider to have a child in their mobile life.

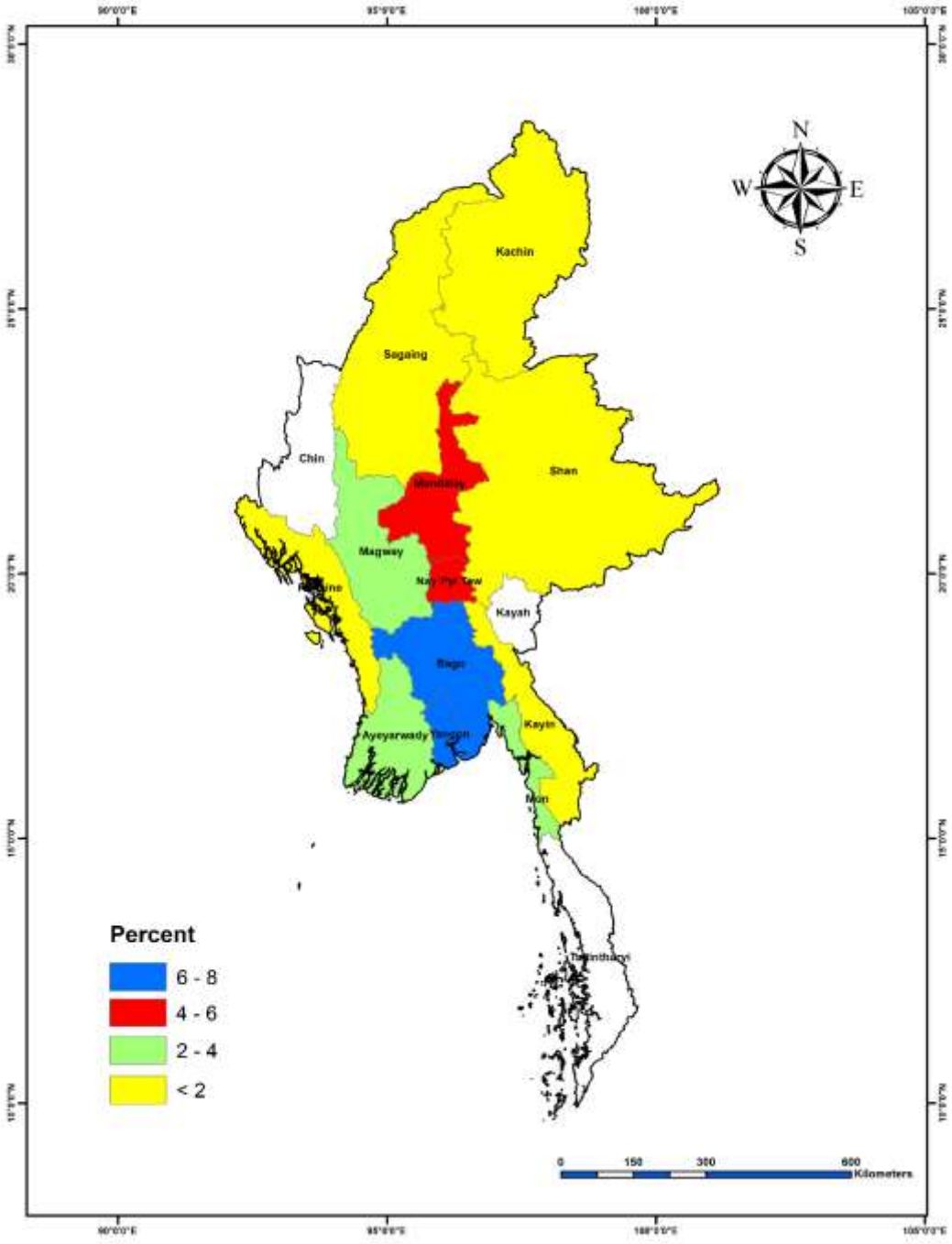
Women who are childless and have children in seven regions in Myanmar such as 1.7% and 98.3% in Saging Region, 7.7% and 92.3% in Bago Region, 2.8% and 97.2% in Magway Region, 4.4% and 95.5% in Mandalay Region, 6.3% and 93.7% in Yangon Region, 3.8% and 96.2% in Ayeyawaddy Region and 5.7% and 94.3% in Naypyitaw Region. Bago Region exhibits the largest percentage of childlessness in Myanmar. The second and third largest percentages of childlessness found in Yangon and Naypyitaw Regions.

The proportion of the population in Bago Region also substantially declines from age 15 and above. This may reflect a huge out aboard and local migration or other factors. Aboard and local migration of women in Bago Region has cause of mass contraceptive use and low birth rate in this area. The total fertility rate for all women aged 15 – 49 in Bago Region is 2.19 children per woman, which is lower than the Union TFR of 2.3. So, younger migrant to aboard and local women are no consider to have a child in their life.

The proportion of the urban population in Yangon Region is much higher than the Union level where 30 percent of the total population live in urban areas. The large population size, the high population density and the high proportion of urban population in Yangon Region may be attributed to migration of people from other States/Regions to Yangon City, in search of employment, schooling and other economic and social opportunities. These of above factors of women in Yangon Region has cause of low birth rate and high childless rate in this area.

The Nay Pyi Taw pyramid shows a large proportion of population in the economically active age groups (15 – 64), with most of it concentrated between the ages of 15 – 39. This could be attributed to the movement of people to the new capital city to work for government and other emerging enterprises.

In Chin State, Kayah State and Taninthayi Region, there are no childless women and all sample women have children.



Source: Table (4.5)

Figure (4.1) Percentage of Childlessness by States and Regions

4.4 Bivariate Analysis

The relationship between social, economic and demographic characteristics and voluntary childlessness is analyzed using the Chi-square test and the results are shown in the following Tables (4.6), (4.7) and (4.8).

Table (4.6) Association between Social Characteristics and Childlessness

Variables	Childlessness (%)	Not Childlessness (%)	Chi-Square	P-value
Woman's Education				
No education	10(3.5)	1183(15.8)	109.916***	0.000
primary	85(30.1)	3571(47.8)		
secondary	151(53.3)	2135(28.5)		
higher	37(13.1)	587(7.9)		
Total	**100.0**	**100.0**		
Husband's Education				
No education	9(3.1)	1140(15.2)	87.163***	0.000
primary	76(26.9)	3129(41.9)		
secondary	170(60.1)	2745(36.7)		
higher	28(9.9)	462(6.2)		
Total	**100.0**	**100.0**		

Source: MDHS (2015-16)

***denotes significant at 1% level, **denotes significant at 5% level and * denotes significant at 10% level

As shown in Table (4.6), 3.5% of childless women have no education. The percentage of childless women with primary educational level is 30.1%, 53.3% in secondary educational level and 13.1% in higher level, respectively. It can found that the percentage of childless women who have attained secondary educational level is the highest compared to other educational levels. The second highest percentage of those women is completed the primary level but those women who have not attended any educational level is the lowest percentage. Unlike the childless women, the percentage of women having child is 47.8% in primary level as the highest but the lowest (7.9%) is in higher level. There is statistically significant association between woman's educational attainment and childlessness at the 1 % level.

In addition, the percentage of husbands with no education is 3.1% as the lowest. The percentages of those who are in primary, secondary and higher educational levels are 26.9%, 60.1% and 9.9%, respectively. Among these percentages, that of their husbands in secondary level is the highest. Therefore, it can be seen that there is much

more differ between the percentage of those who are in secondary level and the rest levels. The percentage of husbands who have married women not having any children in primary level is 41.9%, followed by 36.7% in secondary level, 15.2% with no education. But, those women who have completed higher educational level are 6.2% as the lowest compared to other levels. There has been statistically significant association between husband's educational attainment and childlessness at the 1 % level. There is statistically significant association between all social characteristics and childlessness at the 1 % level.

Table (4.7) Association between Economic Characteristics and Childlessness

Variables	Childless Women (%)	Not Childless Women (%)	Chi-Square	P-value
Employment Status				
Unemployed	82(29.0)	2739(36.6)	6.903***	0.000
Employed	201(71.0)	4737(63.4)		
Woman's Occupation				
Not working	55(19.4)	2215(29.6)	39.186***	0.000
Professional/technical/managerial	18(6.4)	334(4.5)		
Clerical, sales, domestic service and services	61(21.5)	1436(19.2)		
Agriculture	37(13.1)	1158(15.5)		
Skilled Manual	37(13.1)	422(5.6)		
Unskilled Manual	75(26.5)	1911(25.6)		
Husband's Occupation				
Professional/technical/managerial	28(9.9)	545(7.3)	19.281***	0.001
Clerical, sales, domestic service and services	29(10.3)	716(9.6)		
Agriculture	64(22.3)	1916(25.6)		
Skilled Manual	78(27.7)	1431(19.1)		
Unskilled Manual	84(29.8)	2868(38.4)		
Wealth Quintile				
Lowest	61(21.8)	1425(19.1)	24.565***	0.000
Second	37(13.0)	1585(21.2)		
Middle	41(14.4)	1545(20.7)		
Fourth	71(25.0)	1484(19.9)		
Highest	73(25.8)	1437(19.1)		

Source: MDHS (2015-16)

***denotes significant at 1% level, **denotes significant at 5% level and * denotes significant at 10% level

According to Table (4.7), childless women who are unemployed were 29% and 71% of childless women are employed. The percentages of women having child for unemployed and employed are 36.65% and 63.4%, respectively. The percentages of the employed women both having child and not having child are higher than that of the unemployed women. There is statistically significant association between woman's employment status and childlessness at the 1 % level.

Concerning woman's occupation, the percentages of childless women are 19.4% women who are not working, 6.4% in professional/technical/managerial, 21.5% in clerical, sales, domestic service and services, 13.1% in agriculture, 13.1% in skilled manual and 26.5% in unskilled manual, respectively. The percentage of childless women who are in unskilled manual was the highest compared to other job categories. The second highest percentage of those women are clerical, sales, domestic service and services and the smallest percentage of those women are women in agricultural employed. Differing on the childless women, the percentage of women who are not childlessness is 29.6% as the highest in not working but that of professional/ technical/managerial women is 4.5% as the lowest. There is statistically significant association between woman's occupation and childlessness at the 1 % level.

As regards to the husband's occupation, the percentages of husbands are 9.9% in professional/technical/managerial, 10.3% in clerical, sales, domestic service and services, 22.3% in agriculture, 27.7% in skilled manual and 29.8% in unskilled manual, respectively. It can found that the percentage of husbands who are in unskilled manual is the largest compared to other job categories. The second largest percentage of those is skilled manual and the smallest percentage of those is professional/ technical/ managerial. The percentage of husbands who are not childlessness is 38.4% as the largest in unskilled manual but 7.3% of husbands as the smallest is in Professional/technical/managerial. There is statistically significant association between husband's occupation and childlessness at the 1 % level.

Dealing with wealth quintile, 21.8%, 13%, 14.4%, 25%, and 25.8% of childless women are the lowest, second, middle, fourth, highest wealth quintiles respectively. Among these percentages mentioned above, it can be found that the highest quintile is minority as the highest percentage and then, the percentages are not much more difference between fourth and highest quintiles. The percentages of not childless women are 19.1% in lowest wealth quintile, 21.2% in second wealth quintile, 20.7% in middle wealth quintile, 19.9% in fourth quintile and 19.1% in highest wealth quintile. Twenty-

one percentage of not childless women in second wealth quintile is little higher than other wealth quintiles. There is statistically significant association between wealth quintiles and childlessness at the 1 % level. It can be found that all economic characteristics are significantly related to childlessness at 1 % level.

Table (4.8) Association between Demographic Characteristics and Childlessness

Variables	Childless Women (%)	Not Childless Women (%)	Chi-Square	P-value
Woman's age (Years)				
15-19	70(24.7)	158(2.1)	959.938***	0.000
20-24	129(45.6)	705(9.4)		
25-29	53(18.7)	1205(16.1)		
30-34	15(5.3)	1490(19.9)		
35-39	13(4.6)	1469(19.7)		
40-49	3(1.1)	2449(32.8)		
Husband's age (Years)				
Under 25	148(52.1)	525(7.0)	822.204***	0.000
25-29	80(28.2)	1009(13.5)		
30-34	34(12.0)	1340(17.9)		
35-39	9(3.2)	1429(19.1)		
40-44	8(2.8)	1305(17.5)		
45 and above	4(1.7)	1868(25.0)		
Woman's age at first marriage (Years)				
15-19	101(35.7)	3535(47.3)	17.368***	0.001
20-24	123(43.5)	2576(34.4)		
25-29	44(15.5)	899(12.1)		
30 and above	15(5.3)	466(6.2)		
Marital duration (Years)				
Under 5	256(90.5)	1235(16.5)	963.008***	0.000
5-9	14(4.9)	1422(19.0)		
10-14	10(3.5)	1380(18.5)		
15-19	1(0.4)	1339(17.9)		
20 and above	2(0.7)	2100(28.1)		
Place of residence				
Rural	179(63.3)	5558(74.3)	17.416***	0.000
Urban	104(33.7)	1918(25.7)		

Source: MDHS (2015-16)

***denotes significant at 1% level, **denotes significant at 5% level and * denotes significant at 10% level

According to Table (4.8), the percentages of childless women are 24.7% at 15-19 years, 45.6% at 20-24 years, 18.7% at 25-29 years, 5.3% at 30-34 years, 4.6%at 35-39 years and 1.1% at 40 and above years. The largest age group of childless women is 45.6% at 20-24 years and smallest percentage of childless women is 1.1% at 40 and above years. Unlike the childless women, the percentage of women who are not childlessness is 32.8% as the largest at 40 and above years but 2.1% of not childless women at 15-19 years is 2.1% as the lowest. There is statistically significant association between woman's age and childlessness at the 1 % level.

Dealing with the age of the husbands, the majority of childless husbands aged under 25 years is 52.1%. The percentage of childless men aged 25-29 years is 28.2% as the second largest group, followed by 12.0% at 30-34 age group, 3.2% at 35-39 age group, 2.8% at 40-44 age group and 1.7% at 45 and above age group. The percentage of husbands who have child at age group (45 and above) is 25.0% as the largest percentage but 7% of those husbands are the smallest percentage at age under 25 years old. There is statistically significant association between husband's age and childlessness at 1 % level.

According to the age at first marriage of women, the percentage of childless women who aged between 20-24 years is 43.5% as the largest among all age groups. The percentages of age at first marriage at 15-19, 25-29, 30 and above are 35.7%, 15.5% and 5.3%, respectively. In not childless women, the percentage of not childless women aged between 15-19 years is 47.3% as the largest among all age groups. the percentage of not childless women aged at 30 and above is 6.2% as the smallest. There is statistically significant association between age at first marriage of women and childlessness at 1 % level.

Regarding to the marital duration, the percentage of childless women who had married under 5 years is (90.5%) as the highest among all age groups. The percentages of marital duration between 5-9 years, 10-14 years and 15-19 years are 4.9%, 3.5%, 0.4% and 0.7% is the percentage of marital duration for 20 and above years. In not childless women, the percentage of women who are 20 and above years' age at first marriage is 28.1% as the largest and under 5 years age at first marriage is 6.5% as the smallest. There is statistically significant association between marital duration and childlessness at 1 % level.

According to place of residence, the percentage of childless women who live in rural area is 63.3% and those women in urban area are 33.7%. The percentages of

childless women in rural area more reside than that of in urban area. Opposite the childless women, the percentage of not childless women whom live in rural area is 74.3% and those women in urban are 25.7%. There is statistically significant association between place of residence and childlessness at 1% level. According to all results, it can be seen that there is association between demographic characteristics and childlessness at 1 % level.

CHAPTER 5
DETERMINANTS OF CHILDLESSNESS AMONG WOMEN IN MYANMAR

This chapter describes the social, economic and demographic determinants of voluntary childlessness by using binary response models such as logit, probit and complementary log-log models. Then, comparison of these models by using model evaluation criteria was made and the appropriate model for voluntary childlessness was selected.

5.1 Results of Binary Response Models

Since childlessness or not is binary response variable, it is analyzed by using generalize linear models. In this study, under the assumption of binary response- logit, probit and complementary log-log models are used to cover both symmetric and asymmetric of the data (Cox & Snell, 1989). Therefore, model evaluation and parameter estimate of these models are presented in this section. The dependent variable is childlessness and independent variables are also considered woman's educational attainment, husband's educational attainment, woman's employment status, woman's occupation, husbands' occupation, wealth quintile, woman's age, husbands' age, age at first marriage, marital duration and place of residence.

The curves of response for logit, probit and complementary log-log models are shown in Appendix Figures (C-1), (C-2) and (C-3). According to the figures, the distribution of response has an S-shaped curve in three models.

The sketch of Receiver Operating Characteristic (ROC) for three models are shown in Appendix Figures (C-4), (C-5) and (C-6). The area under the ROC curves for the logit, probit and complementary log-log models are 0.9404, 0.9411, and 0.9404. The performances of three models are above diagonal line, indicating that three models are better than random guess.

5.1.1 Model Evaluation of Logit Model

The overall model fitting information for the logit regression model is given in Table (5.1).

Table (5.1) Overall Model Evaluation for Logit Regression Model

Specification	Value	df	P-Value
Likelihood Ratio χ^2 (Omnibus Test)	1007.79	38	0.000
Cox & Snell R- Square (Pseudo R-Square)	0.4145		
-2Log Likehood	711.7685		
Akaaike I.C(AIC)	1501.537		
BIC	1773.399		

Source: Own Calculation

According to the results of Table (5.1), Omnibus test of model coefficient shows that the inclusion of eleven independent variables yields a Chi-square value of 1007.79, with 38 degree of freedom, P-value = 0.000. Therefore, the overall model is statistically significant, which means that adding the eleven explanatory variables to the model have significantly increased ability to predict whether the factors influenced on childlessness. The result of Cox and Snell R-square, 0.4145 indicates a reasonable fit of the model to the data. This shows that 41.45% of the variation in childless women or not can be explained by social, economic and demographic characteristics. Since -2 log likelihood statistic is 711.7685, it can be said that the existence of a relationship between the independent variables and the dependent variable is supported. The results of the AIC and BIC are 1501.537 and 1773.399, respectively.

5.1.2 Parameter Estimates of Logit Regression Model

The parameter estimates for social, economic and demographic determinants of childlessness in the logit regression model are shown in Table (5.2).

Table (5.2) Parameter Estimates of Logit Regression Model

Independent Variables	Coefficient	Std. Err.	Wald Statistic	P-Value	95% Confidence Interval		Odds
					Lower	Upper	
Constant	-2.97***	0.58	-5.15	0.000	0.02	0.16	0.05
Woman's educational attainment							
No education (Ref :)							
Primary	0.68*	0.38	1.80	0.072	0.94	4.12	1.97
Secondary	0.86**	0.38	2.24	0.025	1.11	5.02	2.37
Higher	0.92*	0.46	2.00	0.046	1.02	6.16	2.50
Husband's educational attainment							
No education (Ref :)							
Primary	0.68*	0.40	1.73	0.083	0.91	4.30	1.98
Secondary	0.97**	0.40	2.45	0.014	1.22	5.73	2.64
Higher	1.14**	0.48	2.36	0.018	1.21	8.03	3.12
Woman's employment status							
Unemployed (Ref :)							
Employed	0.44*	0.24	1.81	0.070	0.96	2.51	1.56
Woman's occupation							
Not working (Ref :)							
Professional/technical/managerial	0.19	0.42	0.45	0.656	0.53	2.76	1.21
Clerical, sales, domestic service and services	0.38	0.30	1.25	0.212	0.81	2.63	1.46
Agriculture	0.25	0.35	0.71	0.475	0.64	2.58	1.29
Skilled Manual	0.58*	0.33	1.72	0.085	0.92	3.42	1.78
Unskilled Manual	0.65**	0.30	2.14	0.032	1.06	3.49	1.92
Husband's Occupation							
Professional/technical/managerial (Ref :)							
Clerical, sales, domestic service and services	-0.11	0.33	-0.35	0.728	0.47	1.70	0.89
Agriculture	0.02	0.32	0.06	0.954	0.54	1.92	1.02
Skilled Manual	-0.26	0.29	-0.89	0.374	0.43	0.43	0.77
Unskilled Manual	-0.36	0.31	-1.17	0.242	0.38	0.38	0.70

Table (5.2) Parameter Estimates of Logit Regression Model (Continued)

Independent Variables	Coefficient	Std. Err.	Wald Statistic	P-Value	95% Confidence Interval		Odds
					Lower	Upper	
Wealth quintile							
Lowest (Ref :)							
Second	0.18	0.31	0.58	0.560	0.66	2.17	1.20
Middle	0.35	0.29	1.21	0.225	0.81	2.48	1.41
Fourth	0.46*	0.25	1.87	0.062	0.98	2.59	1.59
Highest	0.40*	0.23	1.76	0.078	0.96	2.35	1.50
Woman's age							
15-19 (Ref :)							
20-24	-1.61***	0.26	-6.26	0.000	0.12	0.33	0.20
25-29	-3.62***	0.39	-9.18	0.000	0.01	0.06	0.03
30-34	-5.56***	0.61	-9.05	0.000	0.001	0.01	0.004
35-39	-5.69***	0.76	-7.51	0.000	0.001	0.01	0.003
40-49	-7.81***	1.20	-6.54	0.000	0.0009	0.004	0.0004
Husband's age							
Under 25 (Ref :)							
25-29	-0.46**	0.18	-2.56	.011	0.45	0.90	0.63
30-34	-0.52**	0.25	-2.09	0.036	0.37	0.97	0.60
35-39	-1.27***	0.41	-3.07	0.002	0.13	0.63	0.28
40-44	-0.48	0.47	-1.04	0.300	0.25	1.54	0.62
45 and above	-0.74	0.62	-1.18	0.236	0.14	1.62	0.48
Woman's age at first marriage							
15-19 (Ref :)							
20-24	1.56***	0.24	6.55	0.000	2.98	7.56	4.74
25-29	3.10***	0.40	7.86	0.000	10.25	48.16	22.22
30 and above	4.11***	0.66	6.22	0.000	16.70	222.27	60.92
Marital duration							
Under 5 (Ref :)							
5-9	-1.16***	0.33	-3.52	0.000	0.16	0.60	0.31
10-14	0.14	0.53	0.27	0.785	0.41	3.24	1.15
15-19	-0.86	1.10	-0.78	0.436	0.05	3.68	0.42
20 and above	0.70	1.18	0.59	0.552	0.20	20.40	2.02
Place of residence							
Rural (Ref :)							
Urban	0.47***	0.19	2.47	0.014	1.10	2.33	1.60

Source: Own Calculation

Note: ***, **, * represent 1%, 5% and 10% level of significance, respectively.

According to Table (5.2), the independent variables woman's educational attainment, husbands' educational attainment, woman's employment status, woman' occupation (skilled manual and unskilled manual), wealth quintile (fourth and highest), woman's age, husbands' age (25-29, 30-34, 35-39), age at first marriage, marital duration (5-9 years) and urban place of residence are statistically significant. Husband's occupation is not statistically significant for the childlessness of woman.

Social Determinants of Voluntary Childlessness in Logit Model

Regarding social characteristics, the coefficient of woman's primary educational attainment has positively influenced on childlessness. This effect is statistically significant at 10% level. The odds ratio suggests that women who have primary educational attainment are 1.97 times more likely to be childlessness compared to women with no education. A 95% confidence interval suggests that magnitude of the effect can be increased from 0.94 times to 4.12 times. The coefficient of woman's secondary educational attainment has positively influenced on childlessness. This effect is statistically significant at 5% level. The odds ratio suggests that women who had secondary educational attainment are 2.37 times more likely to be childlessness compared to no educated women. A 95% confidence interval suggests that magnitude of the effect can be increased from 1.11 times to 5.02 times. The coefficient of woman's higher educational attainment has positively influenced on childlessness. This effect is statistically significant at 5% level. The odds ratio suggests that women who had higher educational attainment are 2.50 times more likely to be childlessness compared to no educated women. A 95% confidence interval suggests that magnitude of the effect can be increased from 1.02 times to 6.16 times.

The coefficient of husband's primary educational attainment has positively influenced on childlessness. This effect is statistically significant at 10% level. The odds ratio suggests that husbands who have primary educational attainment were 1.98 times more likely to be childlessness compared to husbands with no education. A 95% confidence interval suggests that magnitude of the effect can be increased from 0.91 times to 4.30 times. The coefficient of woman's secondary educational attainment has positively influenced on childlessness. This effect is statistically significant at 5% level. The odds ratio suggests that husbands who have secondary educational attainment are 2.64 times more likely to be childlessness compared to husbands with no education. A 95% confidence interval suggests that magnitude of the effect can be increased from

1.22 times to 5.73 times. The coefficient of woman's higher educational attainment has positively influenced on childlessness. This effect is statistically significant at 5% level. The odds ratio suggests that husbands who have higher educational attainment are 3.12 times more likely to be childlessness compared to no educated husbands. A 95% confidence interval suggests that magnitude of the effect can be increased from 1.21 times to 8.03 times.

Economic Determinants of Voluntary Childlessness in Logit Model

The coefficient of woman' employment status has positively influenced on childlessness and it is statistically significant at 10% level. The odds ratio suggests that employed women are 1.56 times more likely to be childlessness compared to unemployed women. A 95% confidence interval suggests that magnitude of the effect can be increased from 0.96 times to 2.51 times.

The coefficient of woman's occupation (skilled manual) is statistically significant at 10% level and it has positively related to childlessness. The odds ratio suggests that women who worked in skilled manual are 1.78 times more likely to be childlessness compared to not working women. A 95% confidence interval suggests that magnitude of the effect can be fold increase from 0.92 times to 3.42 times. The coefficient of woman's occupation (unskilled manual) is statistically significant at 5% and it has positively related to childlessness. The odds ratio suggests that unskilled manual women are 1.92 times more likely to be childlessness compared to not working women. A 95% confidence interval suggests that the magnitude of the effect can be increased from 1.06 times to 3.49 times.

In the case of wealth quintile, the coefficients of fourth and highest women have positively related to childlessness and are statistically significant at 10% level. The odds ratio of richer women suggests that is 59% more likely to be childlessness compared to lowest women. A 95% confidence interval suggests that magnitude of the effect can be increased from 0.98 times to 2.59 times. The odds ratio of richest women suggests that is 50% more likely to be childlessness compared to poorest women. A 95% confidence interval suggests that magnitude of the effect can be increased from 0.96 times to 2.35 times.

Demographic Determinants of Voluntary Childlessness in Logit Model

Woman's age is statistically significant at 1% level and it is negatively related to childlessness. The odds ratio suggests that women aged (20-24) are 80.1% less likely to be childlessness compared to women aged (15-19). A 95% confidence interval is recommended to reduce the efficiency level from 66.97% to 88%. The odds ratio suggests that women aged (25-29) is 97.3% less likely to be childlessness compared to women aged (15-19). A 95% confidence interval is recommended to reduce the efficiency level from 94.2% to 98.77%. The odds ratio suggests that women aged (30-34) are 99.6% less likely to be childlessness compared to women aged (15-19). A 95% confidence interval is recommended to reduce the efficiency level from 98.72% to 99.88%. The odds ratio suggests that women aged (35-39) are 99.7% less likely to be childlessness compared to women aged (15-19). A 95% confidence interval is recommended to reduce the efficiency level from 98.51% to 99.92%. The odds ratio suggests that women aged (40 and above) is 99.96% less likely to be childlessness compared to women aged (15-19). A 95% confidence interval is recommended to reduce the efficiency level from 99.58% to 99.99%.

The coefficients of husband's age groups (25-29, 30-34 and 35-39) are statistically significant at 5% level and it was negatively related to childlessness. The odds ratio suggests that husbands aged (25-29) are 37% less likely to be childlessness compared to husbands aged (under 25). A 95% confidence interval is recommended to reduce the efficiency level from 10.1% to 55.4%. The odds ratio suggests that husbands aged (30-34) is 40% less likely to be childlessness compared to husbands aged (under 25). A 95% confidence interval is recommended to reduce the efficiency level from 3.23% to 63.34%. The coefficients of husband's age group (35-39) are statistically significant at 1% level and it is negatively related to childlessness. The odds ratio suggests that husbands aged (35-39) are 72% less likely to be childlessness compared to husbands aged (under 25). A 95% confidence interval is recommended to reduce the efficiency level from 36.71% to 87.45%.

The coefficient of ages at first marriage is statistically significant at 1% level and it is positively related to childlessness. The odds ratio suggests that women who got marriage at age 20-24 are 4.74 times more likely to be childlessness compared to women who got marriage at age 15-19. A 95% confidence interval suggests that magnitude of the effect can be increased from 2.98 times to 7.56 times. The odds ratio

suggests that women who got marriage at age 25-29 are 22.22 more likely to be childlessness compared to women who got marriage at age 15-19. A 95% confidence interval suggests that magnitude of the effect can be increased from 10.25 times to 48.16 times. The odds ratio suggests that women who got marriage at age 30 and above are 60.92 times more likely to be childlessness compared to women who got marriage at age 15-19. A 95% confidence interval suggests that magnitude of the effect can be increased from 16.70 times to 222.27 times.

The coefficient of 5-9 years' marital duration is statistically significant at 1% level and it is negatively related to childlessness. The odds ratio suggests that women who have 5-9 years' marital duration are 68.68% less likely to be childlessness compared to women who have under five years' marital duration. A 95% confidence interval is recommended to reduce the efficiency level from 40.26% to 83.59%.

The coefficient of women who lived in urban area is statistically significant at 5% level and it is positively related to childlessness. The odds ratio suggests that women who live in urban area are 1.60 times more likely to be childlessness compared to women who live in rural areas. A 95% confidence interval suggests that magnitude of the effect can be increased from 1.10 times to 2.33 times.

5.1.3 Model Evaluation of Probit Regression Model

The overall model fitting information for the probit regression model is given in Table (5.3).

Table (5.3) Overall Model Evaluation for Probit Regression Model

Specification	Value	df	P-Value
Likelihood Ratio χ^2 (Omnibus Test)	995.59	38	0.000
Cox & Snell R- Square (Pseudo R-Square)	0.4095		
-2Log Likehood	717.8644		
Akaaike I.C(AIC)	1513.729		
BIC	1785.59		

Source: Own Calculation

According to the results of Table (5.3), Omnibus test of model coefficient shows that the inclusion of eleven independent variables yields a Chi-square value of 995.59, with 38 degree of freedom, P-value = 0.000. Therefore, the overall model is statistically significant, which means that adding the eleven explanatory variables to

the model have significantly increased ability to predict whether the factors influenced on childlessness. The result of Cox and Snell R-square, 0.4095 indicates a reasonable fit of the model to the data. This shows that 40.95% of the variation in childless women or not can be explained by social, economic and demographic characteristics. Since -2 log likelihood statistic is 717.8644, it can be said that the existence of a relationship between the independent variables and the dependent variable is supported. The results of the AIC and BIC are 1513.729 and 1785.59, respectively.

5.1.4 Parameter Estimates of Probit Regression Model

The estimation results for social, economic and demographic determinants of childlessness in the probit regression model are shown in Table (5.4).

Table (5.4) Parameter Estimates of Probit Regression Model

Independent Variables	Coefficient	Std. Err.	Wald Statistic	P-Value	95% Confidence Interval		Odds
					Lower	Upper	
Constant	-1.43***	0.29	-4.98	0.000	0.14	0.42	0.24
Woman's educational attainment							
No education (Ref :)							
Primary	0.33*	0.18	1.79	0.074	0.97	1.98	1.39
Secondary	0.42**	0.19	2.24	0.025	1.05	2.20	1.52
Higher	0.41*	0.22	1.85	0.064	0.98	2.34	1.51
Husband's educational attainment							
No education (Ref :)							
Primary	0.29	0.18	1.59	0.112	0.93	1.91	1.34
Secondary	0.41**	0.18	2.22	0.026	1.05	2.16	1.51
Higher	0.45**	0.23	1.97	0.049	1.00	2.48	1.58
Woman's employment status							
Unemployed (Ref :)							
Employed	0.23*	0.13	1.79	0.074	0.98	1.64	1.26

Table (5.4) Parameter Estimates of Probit Regression Model (Continued)

Independent Variables	Coefficient	Std. Err.	Wald Statistic	P-Value	95% Confidence Interval		Odds
					Lower	Upper	
Woman's occupation							
Not working (Ref :)							
Professional/technical/managerial	0.09	0.22	0.42	0.672	0.71	1.69	1.10
Clerical, sales, domestic service and services	0.17	0.16	1.12	0.262	0.87	1.64	1.20
Agriculture	0.18	0.18	0.98	0.325	0.84	1.72	1.20
Skilled Manual	0.28	0.18	1.53	0.125	0.93	1.88	1.32
Unskilled Manual	0.36**	0.16	2.21	0.027	1.04	1.96	1.43
Husband's Occupation							
Professional/technical/managerial (Ref :)							
Clerical, sales, domestic service and services	-0.06	0.17	-0.34	0.732	0.68	1.31	0.94
Agriculture	-0.01	0.17	-0.05	0.959	0.71	1.38	0.99
Skilled Manual	-0.16	0.15	-1.07	0.285	0.63	1.14	0.85
Unskilled Manual	-0.23	0.16	-1.44	0.151	0.58	1.09	0.79
Wealth quintile							
Lowest (Ref :)							
Second	0.02	0.16	0.14	0.890	0.75	1.39	1.02
Middle	0.06	0.15	0.40	0.688	0.79	1.42	1.06
Fourth	0.16	0.13	1.24	0.216	0.91	1.52	1.17
Highest	0.19*	0.12	1.61	0.108	0.96	1.52	1.21
Woman's age							
15-19 (Ref :)							
20-24	-0.86***	0.14	-6.32	0.000	0.33	0.55	0.42
25-29	-1.82***	0.20	-9.28	0.000	0.11	0.24	0.16
30-34	-2.67***	0.28	-9.40	0.000	0.04	0.12	0.07
35-39	-2.65***	0.34	-7.76	0.000	0.04	0.14	0.07
40-49	-3.52***	0.50	-7.06	0.000	0.01	0.08	0.03

Table (5.4) Parameter Estimates of Probit Regression Model (Continued)

Independent Variables	Coefficient	Std. Err.	Wald Statistic	P-Value	95% Confidence Interval		Odds
					Lower	Upper	
Husband's age							
Under 25 (Ref :)							
25-29	-0.26**	0.10	-2.59	0.010	0.64	0.94	0.77
30-34	-0.26**	0.13	-2.05	0.040	0.60	0.99	0.77
35-39	-0.61***	0.19	-3.26	0.001	0.38	0.79	0.55
40-44	-0.37*	0.21	-1.73	0.083	0.46	1.05	0.69
45 and above	-0.32	0.25	-1.26	0.206	0.44	1.19	0.73
Woman's age at first marriage							
15-19 (Ref :)							
20-24	0.82***	0.12	6.86	0.000	1.79	2.87	2.27
25-29	1.48***	0.20	7.78	0.000	3.02	6.36	4.39
30 and above	1.83***	0.29	6.22	0.000	3.50	11.09	6.23
Marital duration							
Under 5 (Ref :)							
5-9	-0.53***	0.14	-3.79	0.000	0.45	0.77	0.59
10-14	0.03	0.22	0.13	0.895	0.67	1.57	1.03
15-19	-0.21	0.38	-0.55	0.580	0.38	1.72	0.81
20 and above	0.37	0.45	0.84	0.404	0.61	3.47	1.45
Place of residence							
Rural (Ref :)							
Urban	0.24**	0.10	2.36	0.018	1.04	1.54	1.27

Source: Own Calculation

Note: ***, **, * represent 1%, 5% and 10% level of significance, respectively.

According to Table (5.4), the independent variables such as woman's educational attainment, husband's secondary and higher educational attainment, woman's employment status, woman's occupation (skilled manual), woman's age, husband's age groups (25-29, 30-34, 35-39, 40-44), age at first marriage, marital duration (5-9 years), and place of residence are statistically significant.

Social Determinants of Voluntary Childlessness in Probit Model

Woman's educational attainment indicates positively and statistically significant coefficient on childlessness. The coefficient of primary educational attainment and higher educational attainment are statistically significant at 10 % level and that for secondary educational attainment is statistically significant at 5 % level. The odds ratio suggests that women who have primary educational attainment are 38% more likely to be childlessness compared to no educated women. The 95 % confidence interval proposes that magnitude of the effect can be increased from 0.96 times to 1.98 times. The odds ratio suggests that women who have completed secondary educational level are 52% more likely to be childlessness compared to no educated women. The 95 % confidence interval proposes that magnitude of the effect can be increased from 1.05 times to 2.20 times. The odds ratio suggests that women who have completed higher education level are 51% more likely to be childlessness compared to no educated women. The 95 % confidence interval proposes that magnitude of the effect can be increased from 0.97 times to 2.34 times.

The coefficient of husband's secondary educational attainment and higher educational attainment are statistically significant at 5 % level. The odds ratio suggests that husbands who have attained secondary educational level are 51% more likely to be childlessness compared to no educated husbands. The 95 % confidence interval proposes that magnitude of the effect can be increased from 1.05 times to 2.16 times. The odds ratio suggests that husbands who have attained higher educational level are 57% more likely to be childlessness compared to no educated husbands. The 95 % confidence interval proposes that magnitude of the effect can be increased from 1.00 times to 2.47 times.

Economic Determinants of Voluntary Childlessness in Probit Model

The coefficient of woman' employment status has positively influenced on childlessness and it is statistically significant at 10% level. The odds ratio suggests that employed women have 1.26 times more likely to be childlessness compared to unemployed women. A 95% confidence interval suggests that magnitude of the effect can be increased from 0.98 times to 1.64 times.

The coefficients of women from unskilled manual positively effect on childlessness and statistically significant at 5 %. The odds ratio suggests that women

who work in services are 42% more likely to be childlessness compared to not working women. A 95% confidence interval suggests that magnitude of the effect can be increased from 1.04 times to 1.96 times.

Demographic Determinants of Voluntary Childlessness in Probit Model

Woman's age is negatively effects on childlessness and statistically significant at 1 % level. It has been found that women aged 20-24, women aged 25-29, women aged 30-34, women aged 35-39 and women aged 40 and over are 58%, 83%, 93%, 93% and 97% less likely to be childlessness respectively compared to women aged 15-19. A 95% confidence interval suggests that magnitude of the effect can be anywhere from a 44.62% decrease to a 67.44% decrease, from a 87.93% decrease to a 96.04% decrease, from a 86.25% decrease to a 96.41% decrease, from a 86.25% decrease to a 96.41% decrease and from a 92.12% decrease to a 98.89% decrease for each age group.

The coefficients of husband's age groups (25-29, 30-34, 35-39, and 40-44) are statistically significant at 5% level and it is negatively related to childlessness. The odds ratio suggests that husbands aged (25-29) are 23% less likely to be childlessness compared to husbands aged (under 25). A 95% confidence interval suggests that magnitude of the effect can be anywhere from a 6% decrease to a 36% decrease. The odds ratio suggests that husbands aged (30-34) was 23.18% less likely to be childlessness compared to husbands aged (under 25). A 95% confidence interval suggests that magnitude of the effect can be anywhere from a 2% decrease to a 41% decrease. The coefficients of husband's age group (35-39) are statistically significant at 1% level and it is negatively related to childlessness. The odds ratio suggests that husbands aged (35-39) are 46% less likely to be childlessness compared to husbands aged (under 25). A 95% confidence interval suggests that magnitude of the effect can be anywhere from a 22% decrease to a 63% decrease. The odds ratio suggests that husbands aged (40-44) are 31% less likely to be childlessness compared to husbands aged (under 25). The 95% confidence interval suggests that magnitude of the effect can be anywhere from a 5% decrease to a 54% decrease.

Age at first marriage is statistically significant at 1% level and it is positive related to childlessness. Women who got marriage at age 20-24 are 2.27 times more likely to be childlessness compared to women who got marriage at age 15-19. A 95% confidence interval suggests that magnitude of the effect can be anywhere from 1.79

times to 2.86 times. Women who got marriage at age 25-29 are 4.38 times more likely to be childlessness compared to women who got marriage at age 15-19. A 95% confidence interval suggests that magnitude of the effect can be anywhere from a 3.02 -times to a 6.36-times. Women who got marriage at age 30 and above are 6.22 times more likely to be childlessness compared to women who got marriage at age 15-19. A 95% confidence interval suggests that magnitude of the effect can be anywhere from a 3.50-timesto a 11.08-times.

The coefficient of 5-9 years' marital duration is statistically significant at 1% level and it is negatively related to childlessness. The odds ratio suggests that women who have 5-9 years' marital duration are 41% less likely to be childlessness compared to women who have under five years' marital duration. A 95% confidence interval suggests that magnitude of the effect can be anywhere from a 23% decrease to a 55% decrease.

The coefficient of women living in urban area was statistically significant at 5% level and it is positively related to childlessness. The odds ratio suggests that women who live in urban area are 1.26 times more likely to be childlessness compared to women who lived in rural areas. A 95% confidence interval suggests that magnitude of the effect can be anywhere from 1.04 times to 1.54 times.

5.1.5 Model Evaluation of Complementary Log-Log Regression Model

The overall model fitting information for the complementary log-log regression model is given in Table (5.5).

Table (5.5) Overall Model Evaluation for Complementary Log-Log Regression Model

Specification	Value	df	P-Value
Likelihood Ratio χ^2 (Omnibus Test)	1009.10	38	0.000
Cox & Snell R- Square (Pseudo R-Square)	0.4194		
-2Log Likehood	711.1132		
Akaaike I.C(AIC)	1500.226		
BIC	1772.088		

Source: Own Calculation

According to the results of Table (5.5), Omnibus test of model coefficient shows that the inclusion of eleven independent variables yields a Chi-square value of 1009.10, with 38 degree of freedom, P-value = 0.000. Therefore, the overall model is statistically significant, which means that adding the eleven explanatory variables to the model have significantly increased ability to predict whether the factors influenced on childlessness situation. The result of Cox and Snell R-square, 0.4194 indicates a reasonable fit of the model to the data. This shows that 41.94% of the variation in childless women or not can be explained by socio-economic and demographic characteristics. Since -2 log likelihood statistic is 711.1132, it can be said that the existence of a relationship between the independent variables and the dependent variable is supported. The results of the AIC and BIC are 1500.226 and 1772.088, respectively.

5.1.6 Parameter Estimates of Complementary Log-Log Regression Model

The parameter estimates for social, economic and demographic determinants of childlessness among women in the complementary log-log regression model are shown in Table (5.6).

Table (5.6) Parameter Estimates of Complementary Log-Log Regression Model

Independent Variables	Coefficient	Std. Err.	Wald Statistic	P-Value	95% Confidence Interval		Odds
					Lower	Upper	
Constant	-3.05***	0.52	-5.86	0.000	0.02	0.13	0.05
Woman's educational attainment							
No education (Ref :)							
Primary	0.59*	0.35	1.69	0.091	0.91	3.54	1.79
Secondary	0.78**	0.35	2.21	0.027	1.09	4.35	2.18
Higher	0.82*	0.42	1.98	0.048	1.01	5.14	2.28
Husband's educational attainment							
No education (Ref :)							
Primary	0.65*	0.37	1.75	0.079	0.93	3.96	1.92
Secondary	0.90**	0.37	2.42	0.015	1.19	5.06	2.45
Higher	1.08***	0.44	2.46	0.014	1.24	6.98	2.95
Woman's employment status							
Unemployed (Ref :)							
Employed	0.41*	0.21	1.95	0.051	0.99	2.27	1.50
Woman's occupation							
Not working (Ref :)							
Professional/technical/managerial	0.20	0.37	0.55	0.584	0.59	2.52	1.22
Clerical, sales, domestic service and services	0.32	0.26	1.21	0.226	0.82	2.31	1.38
Agriculture	0.17	0.31	0.55	0.582	0.64	2.19	1.19
Skilled Manual	0.50**	0.28	1.76	0.078	0.95	2.88	1.65
Unskilled Manual	0.53*	0.26	2.04	0.041	1.02	2.84	1.70

Table (5.6) Parameter Estimates of Complementary Log-Log Regression Model (Continued)

Independent Variables	Coefficient	Std. Err.	Wald Statistic	P-Value	95% Confidence Interval		Odds
					Lower	Upper	
Husband's Occupation							
Professional/technical/managerial (Ref :)							
Clerical, sales, domestic service and services	-0.04	0.28	-0.15	0.880	0.55	1.66	0.96
Agriculture	0.06	0.28	0.21	0.831	0.62	1.82	1.06
Skilled Manual	-0.19	0.25	-0.78	0.433	0.51	1.34	0.82
Unskilled Manual	-0.24	0.26	-0.93	0.354	0.48	1.30	0.79
Wealth quintile							
Lowest (Ref :)							
Second	0.20	0.27	0.74	0.461	0.72	2.05	1.22
Middle	0.38	0.25	1.54	0.124	0.90	2.38	1.46
Fourth	0.41**	0.21	1.97	0.048	1.00	2.28	1.51
Highest	0.35*	0.19	1.78	0.074	0.97	2.07	1.42
Woman's age							
15-19 (Ref :)							
20-24	-1.44***	0.23	-6.18	0.000	0.15	0.37	0.24
25-29	-3.30***	0.37	-9.02	0.000	0.02	0.08	0.04
30-34	-5.10***	0.58	-8.80	0.000	0.002	0.02	0.01
35-39	-5.24***	0.72	-7.28	0.000	0.001	0.02	0.01
40-49	-7.23***	1.14	-6.32	0.000	0.0001	0.01	0.001
Husband's age							
Under 25 (Ref :)							
25-29	-0.38**	0.15	-2.48	0.013	0.51	0.92	0.68
30-34	-0.48**	0.22	-2.20	0.028	0.40	0.95	0.62
35-39	-1.16***	0.39	-2.95	0.003	0.14	0.68	0.31
40-44	-0.38	0.44	-0.86	0.392	0.29	1.62	0.69
45 and above	-0.73	0.56	-1.29	0.196	0.16	1.46	0.48

Table (5.6) Parameter Estimates of Complementary Log-Log Regression Model (Continued)

Independent Variables	Coefficient	Std. Err.	Wald Statistic	P-Value	95% Confidence Interval		Odds
					Lower	Upper	
Woman's age at first marriage							
15-19 (Ref :)							
20-24	1.40***	0.22	6.35	0.000	2.62	6.20	4.03
25-29	2.85***	0.37	7.72	0.000	8.40	35.82	17.34
30 and above	3.82***	0.63	6.05	0.000	13.22	156.84	45.53
Marital duration							
Under 5 (Ref :)							
5-9	-1.15***	0.32	-3.56	0.000	0.17	0.60	0.32
10-14	0.06	0.51	0.11	0.910	0.39	2.88	1.06
15-19	-0.10	1.09	-0.91	0.362	0.04	3.13	0.37
20 and above	0.49	1.15	0.43	0.671	0.17	15.47	1.63
Place of residence							
Rural (Ref :)							
Urban	0.42***	0.16	2.60	0.009	1.11	2.10	1.53

Source: Own Calculation

Note: ***, **, * represent 1%, 5% and 10% level of significance, respectively.

According to Table (5.6), the independent variables such as educational attainment of women and their husbands, woman's employment status, woman's occupation (skilled manual and unskilled manual), the fourth and the highest wealth quintiles, woman's age, husband's age group (25-29, 30-34, 35-39), age at first marriage, marital duration (5-9) years and place of residence are statistically significant characteristics on childlessness.

Social Determinants of Voluntary Childlessness in Complementary Log Log Model

The coefficient of woman's educational attainment is positively related to childlessness. The odds ratio of primary educational attainment suggests that women who have attained primary educational level are 1.79 times more likely to be

childlessness as compared to no educated women and it is statistically significant at 10% level. A 95% confidence interval suggests that magnitude of the effect can be increased from 0.91 times to 3.54 times. The odds ratios for secondary and higher educational attainments are 2.18 times and 2.28 times more likely to be childlessness compared to no educated women. The coefficients for secondary and higher educational attainment are statistically significant at 5 % level. The 95 % confidence intervals suggest that magnitude of the effect can be increased from 1.09 times to 4.35 times in secondary educational level and from 1.00 times to 5.14 times in higher educational level.

The coefficient of husband's educational attainment is positively related to childlessness. The odds ratio of primary educational attainment suggests that husbands who have attained primary educational level are 1.92 times more likely to be childlessness as compared to no educated husbands and it is statistically significant at 10% level. A 95 % confidence intervals suggest that magnitude of the effect can be increased from 0.93 times to 3.96 times. The odds ratios of secondary and higher educational attainments are 2.45 times and 2.95 times more likely to be childlessness compared to no educated husbands. The coefficients for secondary and higher educational attainment are statistically significant at 5% level. The 95 % confidence intervals suggest that magnitude of the effect can be increased from 1.19 times to 5.06 times in secondary educational level and from 1.24 times to 6.98 times in higher educational level.

Economic Determinants of Voluntary Childlessness in Complementary Log Log Model

The coefficient of woman's employment status has positive relation with childlessness and statistically significant at 5% level. The odds ratio of employed women is 1.50 times more likely to be childlessness as compared to unemployed women. A 95% confidence interval suggests that magnitude of the effect can be increased from 0.99 times to 2.27 times.

Regarding woman's occupation, the odds of suggest that women who work in skilled manual are 1.65 times more likely to be chance for childlessness as compared to not working women and it is statistically significant at 10% level. A 95 % confidence interval for skilled manual suggests that magnitude of the effect can be increased from 0.95 times to 2.88 times. Women who are unskilled manual are 1.70

times more likely to be chance for childlessness as compared to not working women and it is statistically significant at 5% level. A 95 % confidence interval for unskilled manual suggest that magnitude of the effect can be increased from 1.02 times to 2.84 times.

In wealth quintile, the coefficients of the fourth and highest quintiles are positively related to childlessness and statistically significant at 5% level and 10 % level. The odds ratio suggests that the fourth quintile women are 51% and the highest quintile women are 42% more likely to be chance for childlessness as compared to the lowest women. The 95 % confidence intervals for fourth and highest quintiles suggest that magnitude of the effect can be increased from 1.00 times to 2.28 times and from 0.97 times to 2.07 times.

Demographic Determinants of Voluntary Childlessness in Complementary Log Log Model

Woman's age is statistically significant at 1% level and it is negatively related to childlessness. The odds ratio suggests that women age (20-24) is 76% less likely to be childlessness as compared to women age (15-19). A 95% confidence interval is recommended to reduce the efficiency level from 63% to 85%. The odds ratio suggests that women age (25-29) is 96% less likely to be childlessness compared with women age (15-19). A 95% confidence interval is recommended to reduce the efficiency level from 92% to 98%. The odds ratio suggests that women age (30-34) are 99.4% less likely to be childlessness compared with women age (15-19). A 95% confidence interval is recommended to reduce the efficiency level from 98.11% to 99.81%. The odds ratio suggests that women age (35-39) is 99.47% less likely to be childlessness compared with women age (15-19). A 95% confidence interval is recommended to reduce the efficiency level from 97.82% to 99.87%. The odds ratio suggests that women's age 40 and above is 99.93% less likely to be childlessness compared with women age (15-19). A 95% confidence interval is recommended to reduce the efficiency level from 99.33% to 99.99%.

In husband's age, an odd ratio suggests that husbands aged (25-29) is 32% less likely to be childlessness as compared to husbands aged (under 25). It is negatively related to childlessness and statistically significant at 5% level. A 95% confidence interval is recommended to reduce the efficiency level from 7.8% to 49.55%. The odds ratio suggests that husbands aged (30-34) is 38% less likely to be childlessness compared with

husbands aged (under 25). It is negatively related to childlessness and statistically significant at 5% level. A 95% confidence interval is recommended to reduce the efficiency level from 5.19% to 59.67%. The odds ratio suggests that husbands aged (35-39) is 69% less likely to be childlessness compared with husbands aged (under 25). It is negatively related to childlessness and statistically significant at 1% level. A 95% confidence interval is recommended to reduce the efficiency level from 32.29% to 85.59%.

Age at first marriage is statistically significant at 1% level and it is positively related to childlessness. The odds ratio suggests that women who got marriage at age groups (20-24, 25-29 and 30 and above) are 4.02, 17.35 and 45.53 times more likely to be childlessness compared to women who got marriage at age 15-19 respectively. A 95% confidence interval suggests that magnitude of the effect can be increased from 2.62 times to 6.20 times for age 20-24. A 95% confidence interval suggests that magnitude of the effect can be increased from 8.40 times to 35.82 times for age 25-29. A 95% confidence interval suggests that magnitude of the effect can be increased from 13.22 times to 156.84 times for age 30 and above.

The coefficient of 5-9 years' marital duration is statistically significant at 1% level and it is negatively related to childlessness. The odds ratio suggests that women who have 5-9 years' marital duration are 68% less likely to be childlessness compared to women who have under five years' marital duration. A 95% confidence interval suggests that magnitude of the effect can be anywhere from a 40.34% decrease to a 83.21% decrease.

The coefficient of urban place of residence is statistically significant at 1% level and it has positively related to childlessness. The odds ratio suggests that woman who live in urban areas are 1.53 times more likely to be childlessness compared with women who live in rural areas. A 95 % confidence interval proposes that magnitude of the effect can be increased from 1.11 times to 2.09 times.

5.2 Comparison among Variables on Childlessness by Specific Regression Models

In this section, comparison of the significance of the variables and the signs of parameters estimates for childlessness and the selected specific regression are presented.

Table (5.7) Distribution of Significant Variables and Signs in Models for Childlessness

Variable	Probit	Logit	C log-log
Woman's educational attainment			
Primary	(+)*	(+)*	(+)*
Secondary	(+)**	(+)**	(+)**
Higher	(+)*	(+)**	(+)**
Husband's educational attainment			
Primary	-	(+)*	(+)*
Secondary	(+)**	(+)**	(+)**
Higher	(+)**	(+)**	(+)**
Woman's employment status			
Employed	(+)*	(+)*	(+)*
Woman's occupation			
Skilled manual	-	(+)*	(+)*
Unskilled manual	(+)**	(+)**	(+)**
Wealth quintile			
Fourth	-	(+)*	(+)**
Highest	(+)*	(+)*	(+)*
Woman's age			
20-24	(-)***	(-)***	(-)***
25-29	(-)***	(-)***	(-)***
30-34	(-)***	(-)***	(-)***
35-39	(-)***	(-)***	(-)***
40-49	(-)***	(-)***	(-)***
Husband's age			
20-24	(-)**	(-)**	(-)**
25-29	(-)**	(-)**	(-)**
30-34	(-)***	(-)***	(-)***
35-39	(-)*	-	-

Table (5.7) Distribution of Significant Variables and Signs in Models for Childlessness (Continued)

Variable	Probit	Logit	C log-log
Age at first marriage			
20-24	(+)***	(+)***	(+)***
25-29	(+)***	(+)***	(+)***
30 and above	(+)***	(+)***	(+)***
Marital duration			
5-9	(-)***	(-)***	(-)***
Place of residence			
Urban	(+)**	(+)*	(+)***

Source: Table (5.4), (5.5), (5.6)

Factors influenced on childlessness in each regression model are denoted by "***" at 1% level or "**" at 5% level or "*" at 10% level.

According to Table (5.7), woman's educational attainment is statistically significant and positive effects on childlessness in three models. Primary educational attainment levels are statistically significant at 10% level and secondary and higher educational attainment is statistically significant at 5% level. Husband's primary educational attainment is statistically significant at 10 % level in the logit and complementary log-log models. In the probit model, the coefficient of primary educational attainment is not statistically significant and the coefficients for secondary and higher educational attainment levels are statistically significant at 5% level in three models.

Woman's employment status is statistically significant at 10% level and it has positive relation with childlessness in all three models. In the logit and complementary log-log models, woman's occupation is statistically significant. The coefficient of skilled manual is not statistically significant in the probit model and that is statistically significant at 5% level in the logit model and complementary log-log model. The coefficient of unskilled manual is statistically significant in all three models and that is statistically significant at 5% level. Husband's occupation is not statistically significant in all three models. The coefficients for fourth and highest wealth quintiles are statistically significant at 10% level in three model. In the complementary log-log model, those coefficients are statistically significant at 5% level and 10% level. Those coefficients are positively related to childlessness.

Woman's age is statistically significant at 1% level in three models and it has negative relation with childlessness. The coefficients of husbands' age groups 20-24 and 25-29 are statistically significant at 5% level and that for age group 30-34 is statistically significant at 1% level in three models. Those coefficients are negatively related to childlessness. In the probit model, the coefficient of age group 35-39 is statistically significant at 10% level but it is not statistically significant in the other two models. Age at first marriage and marital duration are statistically significant at 1% level in three models. Age at first marriage is positively related to childlessness and marital duration is negatively related to childlessness. Place of residence of probit model, logit and complementary log-log model are statistically significant at 5%, 10% and 1% respectively and it has positive relation to childlessness in all three models.

In all three models, woman's educational attainment, woman's employment status, age at first marriage, and place of residence have positive effects on childless and woman's age and marital duration have negative effects on childlessness.

5.3 Comparison of Model Selection Criteria for Probit, Logit and Complimentary Log-Log Models

The values of model selection criteria of regression for all three models are shown in following Table (5.8).

Table (5.8) Model Evaluation Criteria for Specific Regression Models

Model	Probit	Logit	C log-log
Likelihood Ratio (Omnibus Test)	995.59	1007.79	1009.10
Cox & Snell R- Square (Pseudo R-Square)	0.4095	0.4145	0.4194
-2Log Likehood	717.8644	711.7685	711.1132
Akaaike I.C(AIC)	1513.729	1501.537	1500.226
BIC	1785.59	1773.399	1772.088

Source: Own Calculation

According to Table (5.8), the results of likelihood ratio are 995.59, 1007.79 and 1009.10 for the probit, logit and complementary log-log model, respectively. The LR shows more preference to complementary log-log model than other two models in the current data set. The variation of childlessness is explained by independent variables are 40.95%, 41.45% and 41.94%, respectively. These results are little

difference but the variation of complementary log-log model is more explanation than that of other two models. Likelihood statistics of the three models are 717.8644, 711.7685 and 711.1132, respectively. It can be found that the value of the LR statistic for the complementary log-log model is higher than that of the logit and probit models. Complementary log-log model has the smallest AIC (1500.226) and BIC (1772.088) compared with that value of the probit and logit models. Besides, the probability of childlessness is very small (0.037) or (3.7%) and the curve of cumulative distribution function for the complementary log-log model is asymmetric. According to these results, the complementary log-log model is chosen as the most appropriate model to determine the factor influencing the voluntary childless among currently married women in Myanmar.

CHAPTER 6
CONCLUSION

This chapter includes findings of the study, discussions, recommendations and suggestions and needs for further study.

6.1 Findings

This study analyses the voluntary childlessness among currently married women and inspects the effect on their social, economic and demographic characteristics in Myanmar. Based on the data from the 2015-16 MDHS, 12885 ever-married women who aged 15-49 were interviewed. Among those, currently married women were 7870 and after weighting 7759 were used as currently married women. In descriptive statistics, it can be seen that nearly four percent of the currently married women are childless women. Regarding woman's educational attainment, most of the currently married women have attained primary educational level, followed by secondary educational level, no education and higher educational level. Similarly, most of the husbands have attained primary educational level, followed by secondary educational level, no education and higher educational level. The number of employed women is more than that of unemployed women. The highest percentage of the currently married women is not working and the highest number of currently married women is unskilled manual among working women.

The second highest percentage of currently married women is working for sales. The percentages of the rest types of occupation are less than 10%. In contrast, the number of husbands working as unskilled manual is largest, followed by skilled manual and agricultural self-employed. Currently married women have nearly the same wealth quintile.

Most of the currently married women are at age group (40-49). The age second and third highest percentages of currently married women are at age group (30-34) years and (35-39) years. Moreover, most of the husbands are at age group (45 and above). The second highest percentage of husbands is at age group (35-39)

followed by age group (30-34), (40-44) and (25-29). The lowest percentage of husbands is at age group (under 25). Most of the currently married women got first marriage at age group 15-19 and the second highest number of the currently married women got first marriage at age group 20-24. Most of the currently married women are (20 and above) years marital duration, followed by (under 5), (5-9), (10-14) and (15-19) years. The number of currently married women who live in urban area are less than the number of currently married women who live in rural area.

According to spatial variation of childless women, the highest percentage of childlessness is found in Yangon Region, followed by Bago Region, Ayeyawaddy Region**,** Mandalay Region, Sagaing Region, Magway Region and Naypyitaw Region. In state wise, the highest percentage of childlessness is found in Rakhine State, followed by Mon State, Shan State, Kachin State and Kayin State. There is no childlessness in Kayah State, Chin State and Taninthayi Region.

Regarding childless women, the highest percentage of childless women have attained secondary educational level. Similarly, the percentage of their husbands who have completed secondary educational level is highest. It has been found that the percentage of employed women is more than that of unemployed women. According to woman's occupation, the highest percentage of childless women is working as unskilled manual, followed by Clerical, sales, domestic service and services, not working, sales, skill manual and agriculture. The lowest number of childless women has been found in Professional/technical/managerial. According to husband's occupation, the highest percentage of their husband is unskilled manual as skilled manual, followed by agriculture, clerical, sales, domestic service and services and professional/ technical/managerial. Concerning wealth quintile, the highest and second highest percentages of childless women are found in fourth and highest wealth quintiles. The third highest percentage of childless women is in lowest wealth quintile. According to the age of women, the highest percentage of childless women can be found in age group 20-24, followed by 15-19 and 25-29 years. The highest percentage of husband's age is under 25, followed by 25-29 and 30-34 years. Most of the childless women have firstly married under 25 years. Almost all childless women have less than 5 year's marital duration. Childless women who are living in rural areas are more than those who are living in urban areas. As regards to the results of association, educational attainment of woman and husbands, employment status, woman's occupation, husband's education, wealth quintile, woman's age, husband's

age, age at first marriage and place of residence are statistically significant and related to childlessness.

As the results of the logit, probit and complementary log-log models, the educated women are more likely to be childlessness as compared to the uneducated women. Like women, it can be seen that the educated husbands are more likely to be childlessness as compared to the uneducated husbands in logit and complementary log-log models. Higher the level of educational attainment, more the chance to be childlessness. As comparing unemployed women, employed women have more chance being childless. According to the results of three models, women who are working in unskilled manual are more likely to be childlessness as compared to women who are not working. But, childless women who are skilled manual are more likely to be childlessness in the logit and complementary log-log models.

According to the logit and complementary log-log models, childless women in fourth and highest wealth quintiles are more likely to be childlessness as compared to women in lowest quintile. In the probit model, wealth quintile is not statistically significant. Women aged 20-24, 25-29, 30-34, 35-39, 40-49 years are less likely being childless as compared to women aged between 15-19 years in the all three models. In husbands aged 20-24, 25-29, 30-34 are less likely being childless as compared to husbands aged between 15-19 years in the all three models. But, husband's aged 35-39 is less likely being childless as compared to women aged between 15-19 years in probit model. Age at first marriage can be found statistically significant and it is more likely being childless. Concerning marital duration, women whose marital duration is 5-9 years are less likely to be childlessness as compared to women whose marital duration is under 5 years. Women living in urban areas are more likely to be childlessness than women living in rural areas. Model selection criteria show that there is no much more different AIC and BIC values among these three models.

6.2 Discussions

This study indicates prevalence of voluntary childlessness among currently married women in Myanmar. In this study, the higher educational attainment is significant effect on voluntary childlessness and this result is consistent with the findings of Krishnan (1993), Poston & Cruz (2016) and Rovi (1994).

Most of childless women tend to progress their life careers as first priority whereas they also believe in being higher the educational level which can support the

better job opportunities to be got in their life. Many women who pursue an advanced education delay or postpone marriage and childbearing until their education is complete. If the occupation of the husband and/or wife becomes more important and satisfying than the prospects of having children, they may continue postponement of childbearing. Besides, their income is usually spent in promoting of their skills than in rearing their children. Although some educated women with job tend to be better in growing up their children, particularly their education and health, they cannot spend a lot of time on their children. These women can be found in working status such as skilled manual occupation. This result is not consistent with findings of Abma and Martinez (2006), Bachu (1999), Veevers (1979), Waren and Pals (2013).

In this study, rich women who have fourth and highest wealth quintiles can be found as voluntary childless women as well as the finding of McAllister and Clarke (1998) and Praween et al. (2012). The older women have less chance to be voluntary childlessness compared with the younger women because the latter may focus on their education, jobs and they cannot look after their children well. However, they may be willing to have child at the time they are ready for that. Therefore, this type of childlessness is known as temporarily childlessness. It is obvious that a woman who marries late has fewer fertile years of marriage. The older women at first marriage may take less responsibility on rearing their children and also, other effects of these women's physical and mental health are crucial to take into account for having children. This result is consistent with the findings of Veevers (1979) and Rubinstein (1987).

Another factor of childlessness among women in this study is marital duration of couples. It can be noted that many couples mainly emphasize on standing their life without any help from other people and trying hard to promote their skills and wages to be having children above five years of marital duration. This result is reliable with the findings of Rao (1974).

Urban communities may be more favorable to voluntary childlessness than rural areas because there are availability of better medical care, a higher standard of living and more chance to get contraceptive methods easily compared to rural areas. Moreover, women do not tend to have any children due to insufficient time and income to be spent on rearing their children and extra person who cares their children. These findings are in line with that of Veevers (1973b, 1979). As contrast, some of the reasons such as woman's age less than 25 year and marital duration less than 5

years towards to be voluntary childlessness may cover only for short term. It may lead to be temporarily childlessness among these women.

Krishnan (1993) used data drawn from Canada's first national fertility survey, Canadian Fertility Survey (CFS), conducted in April-June, 1984. The 5,315 women in the reproductive ages of 18 to 49 years who were interviewed constitutes a nationally representative sample. Estimates of the effects of different independent variables indicate that voluntary childlessness is less prevalent among women who are less educated.

Poston & Cruz (2016) use data from the 2006-08 National Survey of Family Growth to examine the degree of voluntary, involuntary, and temporary childlessness among the women. They estimate multinomial regression equations predicting the likelihood of a woman being in each of the childlessness groups versus being in the group of women having children. They found that an important predictor of whether a woman was childless versus having children was her level of education. The higher level of education for a woman, the more likely she was to be in one of the childless categories, as opposed to being childed.

Susan L. D. Rovi (1994) using 11 years of the General Social Survey and a Trichotomous Logit the resulting model simultaneously assesses the effects of the independent variables probabilities that the married women in this sample are childless. Surveys are currently married women between the ages of 18 and 44, resulting in a sample size of 2,914 cases. The model suggests that the chances of intending to parent increase relative to intending not to parent as education increases.

Abma and Martinez (2006) used the data from Population Survey of the U.S. Census Bureau that is conducted by the National Center for Health Statistics. The data were collected from a nationally representative sample of noninstitutionalized women between the ages of 15 and 44. The sample sizes for women aged 15 - 44 in the all cycles are 10,847 women. Thus, perhaps the voluntarily childless are becoming increasingly composed of women who are satisfied with their situation rather than those feeling they have sacrificed for the sake of a career.

Waren and Pals (2013) used data from the National Survey Family Growth (2002) to compare voluntarily childless men to other men and to voluntarily childless women in an effort to determine the distinctions between groups. Because they will estimate the effects of education and labour force experience on the likelihood of voluntary childlessness. Voluntarily childless women have higher education, a smaller

percentage of them have no have no work experience or have ever been out of work. Voluntary in person for 7,643 women 15-44 years of age and men and 4,289 men 18-44 years of age.

6.3 Recommendations and Suggestions

Childlessness and infertility are forgotten issues in reproductive health programs in Myanmar. The limitation of this study was the difficulty in reaching voluntarily childless women and voluntary childlessness is only viewed from a women's perspective. It is recommended that survey based on childlessness should be conducted to provide much more information and an assessment be made on how the decision of childlessness is reflected in the relationship between spouses. Cultural and religious factors should be considered as effect on voluntary childlessness. However, those factors are not collected in the 2015-16 MDHS. So, two factors are not included in this study. One of the important factors for postponement childbearing and voluntary childlessness is to keep maintains achieving higher education. It is also important that young couple become aware of the relationship between age and fecundity and biological risks of postponing motherhood due to causing higher involuntary sterility as the result of the longer postponements. Understanding the factors and attitudes of childless people and couples in our society might encourage society to prepare for this growing population of childlessness which has many advantages and disadvantages for society as a whole.

Thus, as cohorts with high proportions childless reach the old ages, family-centered approaches to aged care become less effective. In the late twentieth century, many of the aged in industrialized countries had few close relatives, which brought to the fore questions about their access to support. The decline of childlessness among later cohorts is now reducing the prevalence of such problems. However, by the 2020s, similar concerns about the adequacy of personal resources will confront the 1950s cohorts, as childlessness continues to shape their destiny. The proportions childless are unlikely to fall below 10 percent in any of the more developed countries for which data are available. Indeed, Hakim, C (2018) forecasts "a stable plateau in most rich modern societies" of 20 percent childless.

Currently, developed countries are facing the problems of declining birth rate, shortages of labour and an increasing number of older persons. At the same time, less

developed countries are struggling hard to meet the demand of growing populations. Some countries are facing an increasing number of senior citizens based on a fewer number of population rate in addition to shortages of labour.

It is also recommended more research should be needed to study with other important measurable variables or factors in considering the rise in childlessness.

6.4 Needs for Further Study

In future studies, it is needed to understand the characteristics, the motivations and the role of the husband in the couple's decision to be voluntary childless. This study is recommended to work as couples for a wider view and in order to reveal the experiences of both spouses without children. Research on the voluntary childlessness should further be conducted because it may have significant influences on relationship issues, religious issues, social issues, educational issues and a number of other considerations that have a direct impact on society as a whole. For areas that have the highest percentage of voluntary childlessness should be studied separately. Besides, both qualitative and quantitative research should be carried out in order to gather information on how to reduce the voluntary childlessness among married women is on a region or state basis.

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APPENDIX-A

Survey Methodology of MDHS (2015-16)

Survey objectives, sampling design and Questionnaire Design of the 2015-16 MDHS are presented in the followings.

Survey Objectives

The primary objective of the 2015-16 MDHS was to deliver up-to-date estimates of basic demographic and health indicators. The specific objective was to collect information on fertility levels, marital status, fertility preferences, awareness and use of family planning methods, breastfeeding practices, nutrition, mother and child mortality and health, HIV/AIDS and other Sexually Transmitted Infections (STIs), and other health-related issues, such as smoking and knowledge of tuberculosis.

Sampling Design

The sampling frame consisted of 76,990 primary sampling units across the country. A Probability Sampling Unit (PSU) is either a census enumeration area or a ward or village tract in an area not covered during the census. The sampling frame included population from internally-displaced population camps except institutional populations, such as persons in hotels, barracks, and prisons. The master sample is consisting of 4,000 PSUs drawn from the entire census frame. It was selected by a stratified random sampling with probability proportional to size. A separate sampling stratum was formed by separating each state or region into urban and rural areas. The total sampling strata were 30 and samples were selected from each stratum.

The 2015-16 MDHS employed a stratified two-stage sample design. At the first stage, a total of 442 clusters (123 urban and 319 rural) were selected from the master sample. At the second stage, the fixed number of 30 households was selected from each of the selected clusters (a total of 13,260 households), using equal probability systematic sampling. The sampling units were all women age 15-49 who were either permanent residents of the selected households or visitors who stayed in the households the night before the survey. In half of the selected households (every second household), all men age 15-49 who were either residents or visitors who stayed in the household the night before the survey were eligible to be interviewed. During the course of the fieldwork, 4

clusters were identified as insecure and were replaced with other clusters in the vicinity. In addition, one urban cluster had to be dropped due to worsening security. Overall, the survey was successfully carried out in 441 clusters.

Questionnaire Design

A household questionnaire, a woman's questionnaire, and a man's questionnaire were used in the 2015-16 MDHS.

The Household Questionnaire also collected information on the household's dwelling characteristics, such as water source, toilet facilities, fuel use, and flooring materials, and on possessions, such as durable goods and mosquito nets. In addition, a small sample of salt was requested from each household and was tested for iodine content using a rapid test kit. Measurements of height, weight, and mid-upper arm circumference were taken, and results of blood testing for anemia were entered.

The Woman's Questionnaire was used to collect information from all women age 15-49. These women were asked questions on the following topics: (1) Background characteristics (including age, education, and media exposure) (2) Complete birth history and child mortality (3) Knowledge and use of family planning methods (4) Fertility preferences (5) Antenatal, delivery, and postnatal care (6) Breastfeeding and infant feeding practices (7) Vaccinations and childhood illnesses Introduction and Survey Methodology (8) Women's work and husbands' background characteristics (9) Knowledge, awareness, and behavior regarding HIV/AIDS and other sexually transmitted infections (STIs) (10) Adult mortality, including maternal mortality (11) Knowledge, attitudes, and behavior related to other health issues (e.g., tuberculosis) (12) Domestic violence (questions asked of one woman per household in the subsample of households selected for the male survey).

The Man's Questionnaire was administered to all men age 15-49 in half of the selected households. The questionnaire was similar to the Woman's Questionnaire but shorter because it did not contain the complete birth history, sections on maternal and child health, or the section on domestic violence.

APPENDIX-B

Table (B-1)

Woman's Educational Attainment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No education	1193	15.4	15.4	15.4
	Primary	3656	47.1	47.1	62.5
	Secondary	2286	29.5	29.5	92.0
	Higher	624	8.0	8.0	100.0
	Total	7759	100.0	100.0	

Table (B-2)

Husband's Educational Attainment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No education	1149	14.8	14.8	14.8
	Primary	3205	41.3	41.3	56.1
	Secondary	2915	37.6	37.6	93.7
	Higher	490	6.3	6.3	100.0
	Total	7759	100.0	100.0	

Table (B-3)

Woman’s Employment Status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unemployed	2821	36.4	36.4	36.4
	Employed	4938	63.6	63.6	100.0
	Total	7759	100.0	100.0	

Table (B-4)

Woman's Occupation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not working	2270	29.3	29.3	29.3
	Professional/technical/managerial	351	4.5	4.5	33.8
	Clerical	81	1.0	1.0	34.8
	Sales	1356	17.5	17.5	52.3
	Agricultural - self employed	748	9.6	9.6	62.0
	Agricultural – employee	447	5.8	5.8	67.7
	Household and domestic	14	.2	.2	67.9
	Services	46	.6	.6	68.5
	Skilled manual	459	5.9	5.9	74.4
	Unskilled manual	1986	25.6	25.6	100.0
	Total	7759	100.0	100.0	

Table (B-5)

Husband's Occupation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Professional/technical/managerial	573	7.4	7.4	7.4
	Clerical	88	1.1	1.1	8.5
	Sales	546	7.0	7.0	15.6
	Agricultural - self employed	1403	18.1	18.1	33.6
	Agricultural - employee	577	7.4	7.4	41.1
	Household and domestic	22	.3	.3	41.4
	Services	89	1.1	1.1	42.5
	Skilled manual	1509	19.4	19.4	62.0
	Unskilled manual	2952	38.0	38.0	100.0
	Total	7759	100.0	100.0	

Table (B-6)
Wealth Quintile

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Lowest	1486	19.2	19.2	19.2
	Second	1622	20.9	20.9	40.1
	Middle	1586	20.4	20.4	60.5
	Fourth	1556	20.0	20.0	80.5
	Highest	1509	19.5	19.5	100.0
	Total	7759	100.0	100.0	

Table (B-7)
Woman's Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	15-19	228	2.9	2.9	2.9
	20-24	834	10.7	10.7	13.7
	25-29	1258	16.2	16.2	29.9
	30-34	1505	19.4	19.4	49.3
	35-39	1482	19.1	19.1	68.4
	40-49	2452	31.7	31.7	100.0
	Total	7759	100.0	100.0	

Table (B-8)
Husbands' Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Under 25	673	8.7	8.7	8.7
	25-29	1089	14.0	14.0	22.7
	30-34	1375	17.7	17.7	40.4
	35-39	1437	18.5	18.5	58.9
	40-44	1313	16.9	16.9	75.9
	45 and above	1872	24.1	24.1	100.0
	Total	7759	100.0	100.0	

Table (B-9)

Woman's Age at First Marriage

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	15-19	3636	46.9	46.9	46.9
	20-24	2699	34.8	34.8	81.6
	25-29	943	12.2	12.2	93.8
	30 and above	481	6.2	6.2	100.0
	Total	7759	100.0	100.0	

Table (B-10)

Marital Duration

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Under 5	1492	19.2	19.2	19.2
	5-9	1436	18.5	18.5	37.7
	10-14	1390	17.9	17.9	55.6
	15-19	1340	17.3	17.3	72.9
	20 and above	2101	27.1	27.1	100.0
	Total	7759	100.0	100.0	

Table (B-11)

Place of Residence

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Rural	5737	73.9	73.9	73.9
	Urban	2022	26.1	26.1	100.0
	Total	7759	100.0	100.0	

Table (B-12)

Woman's Educational Attainment * Childlessness Cross Tabulation

			Childless		
			not childless	childless	Total
Woman's educational attainment	No education	Count	1183	10	1193
		Expected Count	1149.6	43.4	1193.0
		% within Highest educational level	99.2%	0.8%	100.0%
		% within Childless	15.8%	3.5%	15.4%
		% of Total	15.2%	0.1%	15.4%
	Primary	Count	3571	85	3656
		Expected Count	3523.1	132.9	3656.0
		% within Highest educational level	97.7%	2.3%	100.0%
		% within Childless	47.8%	30.1%	47.1%
		% of Total	46.0%	1.1%	47.1%
	Secondary	Count	2135	151	2286
		Expected Count	2201.9	83.1	2285.0
		% within Highest educational level	93.4%	6.6%	100.0%
		% within Childless	28.6%	53.2%	29.5%
		% of Total	27.5%	1.9%	29.5%
	Higher	Count	587	37	624
		Expected Count	601.3	22.7	624.0
		% within Highest educational level	94.1%	5.9%	100.0%
		% within Childless	7.9%	13.1%	8.0%
		% of Total	7.6%	0.5%	8.0%
Total		Count	7476	283	7759
		Expected Count	7476.0	283.0	7759.0
		% within Highest educational level	96.4%	3.6%	100.0%
		% within Childless	100.0%	100.0%	100.0%
		% of Total	96.4%	3.6%	100.0%

Table (B-13)

Chi-Square Test for Woman's Educational Attainment and Childlessness

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	109.916[a]	3	.000
Likelihood Ratio	112.230	3	.000
Linear-by-Linear Association	90.085	1	.000
N of Valid Cases	7759		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 22.68.

Table (B-14)

Husband's Educational Attainment * Childlessness Cross Tabulation

			Childless		
			not childless	childless	Total
Husband's educational attainment	No education	Count	1140	9	1149
		Expected Count	1106.1	41.9	1148.0
		% within Husband/partner's education level	99.2%	0.8%	100.0%
		% within Childless	15.2%	3.2%	14.8%
		% of Total	14.7%	0.1%	14.8%
	Primary	Count	3129	76	3205
		Expected Count	3088.1	116.9	3205.0
		% within Husband/partner's education level	97.6%	2.4%	100.0%
		% within Childless	41.9%	26.9%	41.3%
		% of Total	40.3%	1.0%	41.3%
	Secondary	Count	2745	170	2915
		Expected Count	2808.7	106.3	2915.0
		% within Husband/partner's education level	94.2%	5.8%	100.0%
		% within Childless	36.7%	60.1%	37.6%
		% of Total	35.4%	2.2%	37.6%
	Higher	Count	462	28	490
		Expected Count	472.1	17.9	490.0
		% within Husband/partner's education level	94.3%	5.7%	100.0%
		% within Childless	6.2%	9.9%	6.3%
		% of Total	6.0%	0.4%	6.3%
Total		Count	7476	283	7759
		Expected Count	7476.0	283.0	7759.0
		% within Husband/partner's education level	96.4%	3.6%	100.0%
		% within Childless	100.0%	100.0%	100.0%
		% of Total	96.4%	3.6%	100.0%

Table (B-15)
Chi-Square Test for Husband's Educational Attainment and Childlessness

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	87.163[a]	3	.000
Likelihood Ratio	94.703	3	.000
Linear-by-Linear Association	76.836	1	.000
N of Valid Cases	7759		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 17.87.

Table (B-16)
Woman's Employment Status * Childlessness Cross Tabulation

			Childless		
			not childless	childless	Total
Woman's employment status	Unemployed	Count	2739	82	2821
		Expected Count	2717.1	102.9	2820.0
		% within Respondent currently working	97.1%	2.9%	100.0%
		% within Childless	36.6%	29.0%	36.3%
		% of Total	35.3%	1.1%	36.3%
	Employed	Count	4737	201	4938
		Expected Count	4757.9	180.1	4938.0
		% within Respondent currently working	95.9%	4.1%	100.0%
		% within Childless	63.4%	71.0%	63.7%
		% of Total	61.1%	2.6%	63.7%
Total		Count	7476	283	7759
		Expected Count	7476.0	283.0	7759.0
		% within Respondent currently working	96.4%	3.6%	100.0%
		% within Childless	100.0%	100.0%	100.0%
		% of Total	96.4%	3.6%	100.0%

Table (B-17)
Chi-Square Test for Woman's Employment Status and Childlessness

	Value	Df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.903[a]	1	.009		
Continuity Correction[b]	6.577	1	.010		
Likelihood Ratio	7.134	1	.008		
Fisher's Exact Test				.008	.005
Linear-by-Linear Association	6.903	1	.009		
N of Valid Cases	7759				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 102.87.
b. Computed only for a 2x2 table

Table (B-18)
Woman's Occupation * Childlessness Cross Tabulation

			Childless		Total
			not childless	childless	
Woman's occupation	Not working	Count	2215	55	2270
		Expected Count	2187.2	82.8	2270.0
		% within Respondent's occupation (grouped)	97.6%	2.4%	100.0%
		% within Childless	29.6%	19.4%	29.3%
		% of Total	28.5%	0.7%	29.3%
	Professional/technical/managerial	Count	334	18	352
		Expected Count	339.2	12.8	352.0
		% within Respondent's occupation (grouped)	94.9%	5.1%	100.0%
		% within Childless	4.5%	6.4%	4.5%
		% of Total	4.3%	0.2%	4.5%
	Clerical,Sales,services and HH&DM	Count	1436	61	1497
		Expected Count	1442.4	54.6	1497.0
		% within Respondent's occupation (grouped)	95.9%	4.1%	100.0%
		% within Childless	19.2%	21.6%	19.3%
		% of Total	18.5%	0.8%	19.3%
	Agriculture	Count	1158	37	1195
		Expected Count	1151.4	43.6	1195.0
		% within Respondent's occupation (grouped)	96.9%	3.1%	100.0%
		% within Childless	15.5%	13.1%	15.4%
		% of Total	14.9%	0.5%	15.4%
	Skilled manual	Count	422	37	459
		Expected Count	442.3	16.7	459.0
		% within Respondent's occupation (grouped)	91.9%	8.1%	100.0%
		% within Childless	5.6%	13.1%	5.9%
		% of Total	5.4%	0.5%	5.9%
	Unskilled manual	Count	1911	75	1986
		Expected Count	1913.6	72.4	1986.0
		% within Respondent's occupation (grouped)	96.2%	3.8%	100.0%
		% within Childless	25.6%	26.5%	25.6%
		% of Total	24.6%	1.0%	25.6%
Total		Count	7476	283	7759
		Expected Count	7476.0	283.0	7759.0
		% within Respondent's occupation (grouped)	96.4%	3.6%	100.0%
		% within Childless	100.0%	100.0%	100.0%
		% of Total	96.4%	3.6%	100.0%

Table (B-19)

Chi-Square Test for Woman's Occupation and Childlessness

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	39.186[a]	5	.000
Likelihood Ratio	33.910	5	.000
Linear-by-Linear Association	8.303	1	.004
N of Valid Cases	7759		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 12.84.

Table (B-20)
Husband's Occupation * Childlessness Cross Tabulation

			Childless		Total
			not childless	childless	
Husband's occupation	Professional/technical/managerial	Count	545	28	573
		Expected Count	552.2	20.8	573.0
		% within Husband/partner's occupation (grouped)	95.1%	4.9%	100.0%
		% within Childless	7.3%	9.9%	7.4%
		% of Total	7.0%	0.4%	7.4%
	Clerical,Sales,services and HH&DM	Count	716	29	745
		Expected Count	717.9	27.1	745.0
		% within Husband/partner's occupation (grouped)	96.1%	3.9%	100.0%
		% within Childless	9.6%	10.3%	9.6%
		% of Total	9.2%	0.4%	9.6%
	Agriculture	Count	1916	63	1979
		Expected Count	1907.1	71.9	1979.0
		% within Husband/partner's occupation (grouped)	96.8%	3.2%	100.0%
		% within Childless	25.6%	22.3%	25.5%
		% of Total	24.7%	0.8%	25.5%
	Skilled manual	Count	1430	78	1508
		Expected Count	1453.2	54.8	1508.0
		% within Husband/partner's occupation (grouped)	94.8%	5.2%	100.0%
		% within Childless	19.1%	27.7%	19.4%
		% of Total	18.4%	1.0%	19.4%
	Unskilled manual	Count	2868	84	2952
		Expected Count	2844.7	107.3	2952.0
		% within Husband/partner's occupation (grouped)	97.2%	2.8%	100.0%
		% within Childless	38.4%	29.8%	38.1%
		% of Total	37.0%	1.1%	38.1%
Total		Count	7475	282	7757
		Expected Count	7475.0	282.0	7757.0
		% within Husband/partner's occupation (grouped)	96.4%	3.6%	100.0%
		% within Childless	100.0%	100.0%	100.0%
		% of Total	96.4%	3.6%	100.0%

Table (B-21)

Chi-Square Test for Husband's Occupation and Childlessness

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	19.281[a]	4	.001
Likelihood Ratio	18.353	4	.001
Linear-by-Linear Association	3.623	1	.057
N of Valid Cases	7757		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 20.83.

Table (B-22)

Wealth Quintile* Childlessness Cross Tabulation

			Childless		
			not childless	childless	Total
Wealth quantile	Lowest	Count	1425	61	1486
		Expected Count	1432.6	54.4	1487.0
		% within Wealth index combined(G)	95.8%	4.2%	100.0%
		% within Childless	19.1%	21.8%	19.2%
		% of Total	18.4%	0.8%	19.2%
	Second	Count	1585	37	1622
		Expected Count	1562.6	59.4	1622.0
		% within Wealth index combined(G)	97.7%	2.3%	100.0%
		% within Childless	21.2%	13.0%	20.9%
		% of Total	20.4%	0.5%	20.9%
	Middle	Count	1545	41	1586
		Expected Count	1528.0	58.0	1586.0
		% within Wealth index combined(G)	97.4%	2.6%	100.0%
		% within Childless	20.7%	14.4%	20.4%
		% of Total	19.9%	0.5%	20.4%
	Fourth	Count	1484	71	1555
		Expected Count	1498.1	56.9	1555.0
		% within Wealth index combined(G)	95.4%	4.6%	100.0%
		% within Childless	19.9%	25.0%	20.0%
		% of Total	19.1%	0.9%	20.0%
	Highest	Count	1437	73	1510
		Expected Count	1454.7	55.3	1510.0
		% within Wealth index combined(G)	95.2%	4.8%	100.0%
		% within Childless	19.2%	25.7%	19.5%
		% of Total	18.5%	0.9%	19.5%
Total		Count	7476	283	7759
		Expected Count	7476.0	283.0	7759.0
		% within Wealth index combined(G)	96.3%	3.7%	100.0%
		% within Childless	100.0%	100.0%	100.0%
		% of Total	96.3%	3.7%	100.0%

Table (B-23)
Chi-Square Test for Wealth Quintile and Childlessness

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	24.565[a]	4	.000
Likelihood Ratio	25.630	4	.000
Linear-by-Linear Association	6.026	1	.014
N of Valid Cases	7759		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 54.42.

Table (B-24)
Woman's Age* Childlessness Cross Tabulation

			Childless		
			not childless	childless	Total
Woman's age	15-19	Count	158	70	228
		Expected Count	218.7	8.3	227.0
		% within Respondent's current age(G)	69.2%	30.8%	100.0%
		% within Childless	2.1%	24.7%	2.9%
		% of Total	2.0%	0.9%	2.9%
	20-24	Count	704	129	833
		Expected Count	802.6	30.4	833.0
		% within Respondent's current age(G)	84.5%	15.5%	100.0%
		% within Childless	9.4%	45.6%	10.7%
		% of Total	9.1%	1.7%	10.7%
	25-29	Count	1205	53	1258
		Expected Count	1212.1	45.9	1258.0
		% within Respondent's current age(G)	95.8%	4.2%	100.0%
		% within Childless	16.1%	18.7%	16.2%
		% of Total	15.5%	0.7%	16.2%
	30-34	Count	1491	15	1506
		Expected Count	1451.1	54.9	1506.0
		% within Respondent's current age(G)	99.0%	1.0%	100.0%
		% within Childless	19.9%	5.3%	19.4%
		% of Total	19.2%	0.2%	19.4%
	35-39	Count	1469	13	1482
		Expected Count	1427.9	54.1	1482.0
		% within Respondent's current age(G)	99.1%	0.9%	100.0%
		% within Childless	19.7%	4.6%	19.1%
		% of Total	18.9%	0.2%	19.1%
	40-49	Count	2449	3	2452
		Expected Count	2362.6	89.4	2452.0
		% within Respondent's current age(G)	99.9%	0.1%	100.0%
		% within Childless	32.8%	1.1%	31.6%
		% of Total	31.6%	0.0%	31.6%
Total		Count	7476	283	7759
		Expected Count	7476.0	283.0	7759.0
		% within Respondent's current age(G)	96.4%	3.6%	100.0%
		% within Childless	100.0%	100.0%	100.0%
		% of Total	96.4%	3.6%	100.0%

Table (B-25)
Chi-Square Test for Woman' Age and Childlessness

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	959.938[a]	5	.000
Likelihood Ratio	628.166	5	.000
Linear-by-Linear Association	612.022	1	.000
N of Valid Cases	7759		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 8.28.

Table (B-26)
Husband's Age* Childlessness Cross Tabulation

			Childless		
			not childless	childless	Total
Husband's age	Under 25	Count	525	148	673
		Expected Count	648.4	24.6	673.0
		% within Husband/partner's age(G)	78.0%	22.0%	100.0%
		% within Childless	7.0%	52.1%	8.7%
		% of Total	6.8%	1.9%	8.7%
	25-29	Count	1009	80	1089
		Expected Count	1049.1	39.9	1089.0
		% within Husband/partner's age(G)	92.7%	7.3%	100.0%
		% within Childless	13.5%	28.2%	14.0%
		% of Total	13.0%	1.0%	14.0%
	30-34	Count	1340	34	1374
		Expected Count	1323.7	50.3	1374.0
		% within Husband/partner's age(G)	97.5%	2.5%	100.0%
		% within Childless	17.9%	12.0%	17.7%
		% of Total	17.3%	0.4%	17.7%
	35-39	Count	1429	9	1438
		Expected Count	1385.4	52.6	1438.0
		% within Husband/partner's age(G)	99.4%	0.6%	100.0%
		% within Childless	19.1%	3.2%	18.5%
		% of Total	18.4%	0.1%	18.5%
	40-44	Count	1305	8	1313
		Expected Count	1264.9	48.1	1313.0
		% within Husband/partner's age(G)	99.4%	0.6%	100.0%
		% within Childless	17.5%	2.8%	16.9%
		% of Total	16.8%	0.1%	16.9%
	45 and above	Count	1868	4	1872
		Expected Count	1804.5	68.5	1873.0
		% within Husband/partner's age(G)	99.7%	0.3%	100.0%
		% within Childless	25.0%	1.8%	24.1%
		% of Total	24.1%	0.1%	24.1%
Total		Count	7476	283	7759
		Expected Count	7476.0	283.0	7759.0
		% within Husband/partner's age(G)	96.3%	3.7%	100.0%
		% within Childless	100.0%	100.0%	100.0%
		% of Total	96.3%	3.7%	100.0%

Table (B-27)
Chi-Square Test for Husband' Age and Childlessness

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	822.204[a]	5	.000
Likelihood Ratio	560.719	5	.000
Linear-by-Linear Association	498.680	1	.000
N of Valid Cases	7759		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 24.63.

Table (B-28)
Woman's Age at First Marriage * Childlessness Cross Tabulation

			Childless		
			not childless	childless	Total
Woman's Age at first marriage	15-19	Count	3535	101	3636
		Expected Count	3503.4	132.6	3636.0
		% within Age at first cohabitation(G)	97.2%	2.8%	100.0%
		% within Childless	47.3%	35.7%	46.9%
		% of Total	45.6%	1.3%	46.9%
	20-24	Count	2576	123	2699
		Expected Count	2599.6	98.4	2699.0
		% within Age at first cohabitation(G)	95.4%	4.6%	100.0%
		% within Childless	34.4%	43.5%	34.8%
		% of Total	33.2%	1.6%	34.8%
	25-29	Count	899	44	943
		Expected Count	908.6	34.4	943.0
		% within Age at first cohabitation(G)	95.3%	4.7%	100.0%
		% within Childless	12.0%	15.5%	12.2%
		% of Total	11.6%	0.6%	12.2%
	30 and above	Count	466	15	481
		Expected Count	463.5	17.5	481.0
		% within Age at first cohabitation(G)	96.9%	3.1%	100.0%
		% within Childless	6.2%	5.3%	6.2%
		% of Total	6.0%	0.2%	6.2%
Total		Count	7476	283	7759
		Expected Count	7476.0	283.0	7759.0
		% within Age at first cohabitation(G)	96.4%	3.6%	100.0%
		% within Childless	100.0%	100.0%	100.0%
		% of Total	96.4%	3.6%	100.0%

Table (B-29)
Chi-Square Test for Age at First Marriage and Childlessness

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	17.368[a]	3	.001
Likelihood Ratio	17.396	3	.001
Linear-by-Linear Association	6.076	1	.014
N of Valid Cases	7759		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 17.55.

Table (B-30)
Marital Duration * Childlessness Cross Tabulation

			Childless		
			not childless	childless	Total
Marital duration	Under 5	Count	1235	256	1491
		Expected Count	1436.6	54.4	1491.0
		% within Years since first cohabitation	82.8%	17.2%	100.0%
		% within Childless	16.5%	90.5%	19.2%
		% of Total	15.9%	3.3%	19.2%
	5-9	Count	1422	14	1436
		Expected Count	1383.6	52.4	1436.0
		% within Years since first cohabitation	99.0%	1.0%	100.0%
		% within Childless	19.0%	4.9%	18.5%
		% of Total	18.3%	0.2%	18.5%
	10-14	Count	1380	10	1390
		Expected Count	1339.3	50.7	1390.0
		% within Years since first cohabitation	99.3%	0.7%	100.0%
		% within Childless	18.5%	3.5%	17.9%
		% of Total	17.8%	0.1%	17.9%
	15-19	Count	1339	1	1340
		Expected Count	1291.1	48.9	1340.0
		% within Years since first cohabitation	99.9%	0.1%	100.0%
		% within Childless	17.9%	0.4%	17.3%
		% of Total	17.3%	0.0%	17.3%
	20 and above	Count	2100	2	2102
		Expected Count	2025.3	76.7	2102.0
		% within Years since first cohabitation	99.9%	0.1%	100.0%
		% within Childless	28.1%	0.7%	27.1%
		% of Total	27.1%	0.0%	27.1%
Total		Count	7476	283	7759
		Expected Count	7476.0	283.0	7759.0
		% within Years since first cohabitation	96.4%	3.6%	100.0%
		% within Childless	100.0%	100.0%	100.0%
		% of Total	96.4%	3.6%	100.0%

Table (B-31)
Chi-Square Test for Marital Duration and Childlessness

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	963.008[a]	4	.000
Likelihood Ratio	737.858	4	.000
Linear-by-Linear Association	529.206	1	.000
N of Valid Cases	7759		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 48.87.

Table (B-32)
Place of Residence * Childlessness Cross Tabulation

			Childless		
			not childless	childless	Total
Place of residence	Rural	Count	5558	179	5737
		Expected Count	5527.7	209.3	5737.0
		% within Type of place of residence(G)	96.9%	3.1%	100.0%
		% within Childless	74.3%	63.3%	73.9%
		% of Total	71.6%	2.3%	73.9%
	Urban	Count	1918	104	2022
		Expected Count	1948.3	73.7	2022.0
		% within Type of place of residence(G)	94.9%	5.1%	100.0%
		% within Childless	25.7%	36.7%	26.1%
		% of Total	24.7%	1.3%	26.1%
Total		Count	7476	283	7759
		Expected Count	7476.0	283.0	7759.0
		% within Type of place of residence(G)	96.4%	3.6%	100.0%
		% within Childless	100.0%	100.0%	100.0%
		% of Total	96.4%	3.6%	100.0%

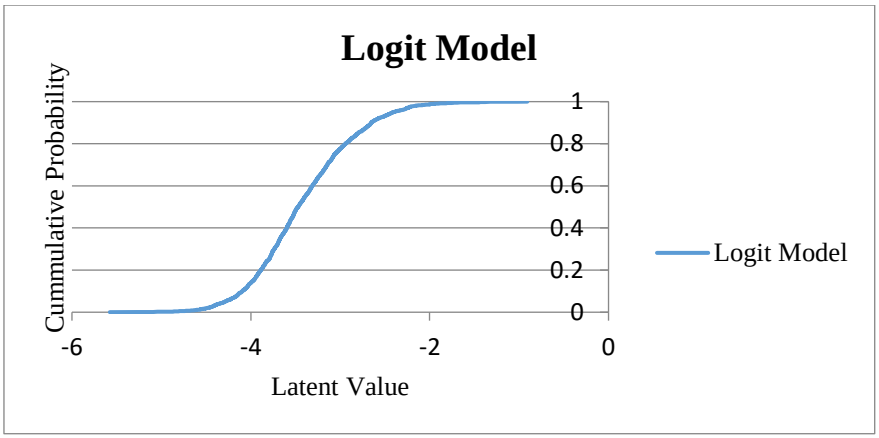
Table (B-33)
Chi-Square Test for Place of Residence and Childlessness

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	17.416[a]	1	.000		
Continuity Correction[b]	16.845	1	.000		
Likelihood Ratio	16.230	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	17.414	1	.000		
N of Valid Cases	7759				

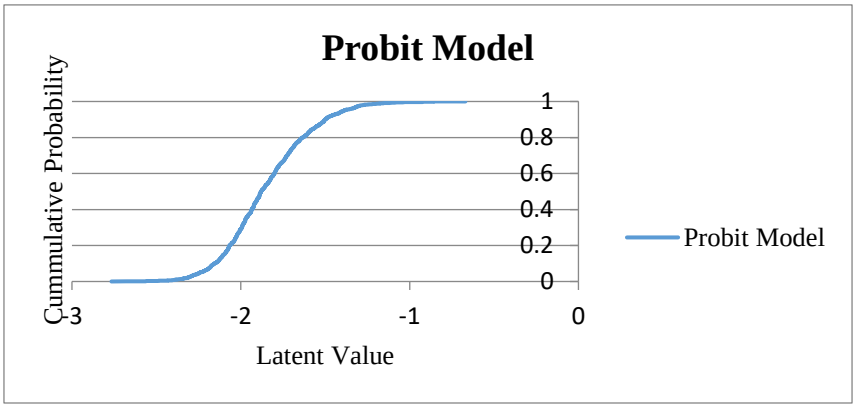
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 73.75.

APPENDIX – C

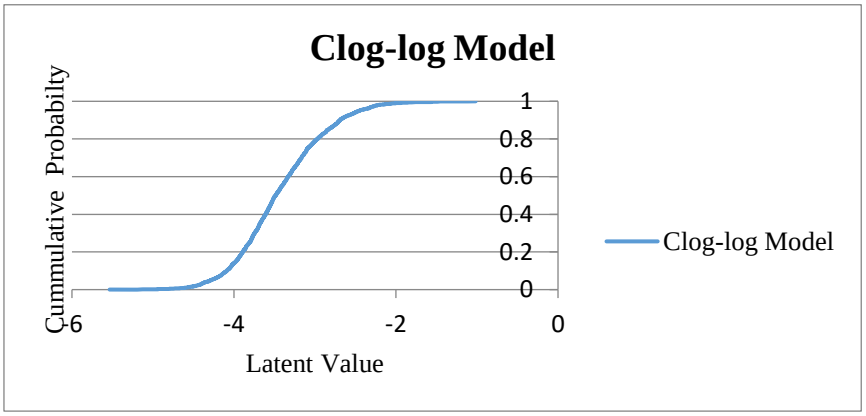
Appendix Figure (C-1) Cumulative Distribution of Logit Model



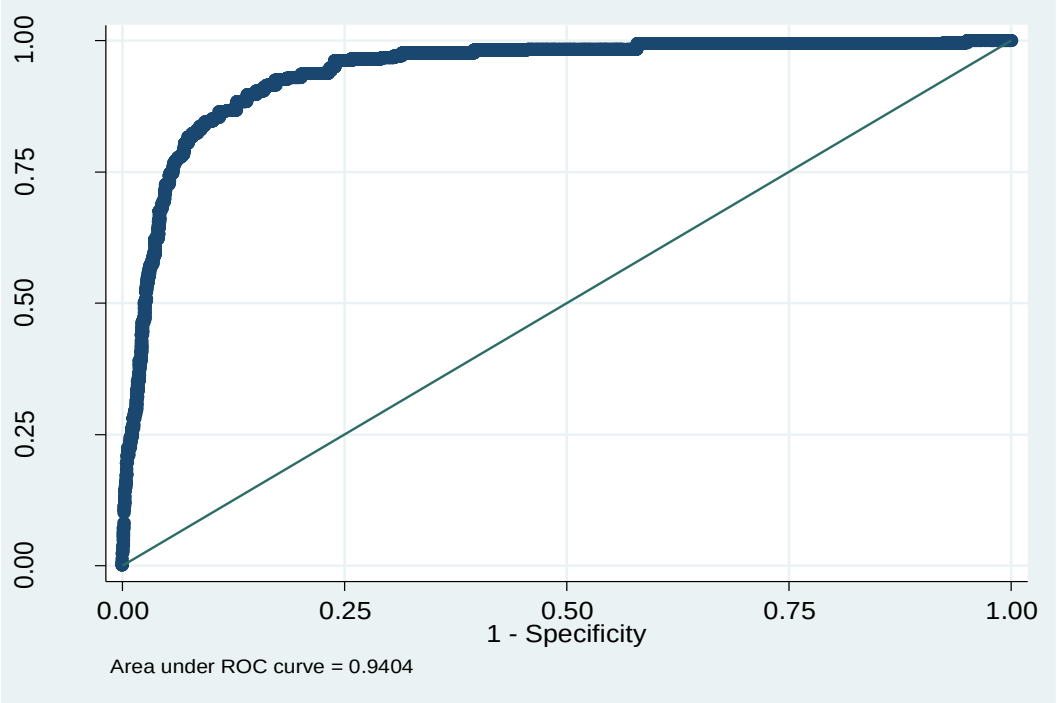
Appendix Figure (C-2) Cumulative Distribution of Probit Model



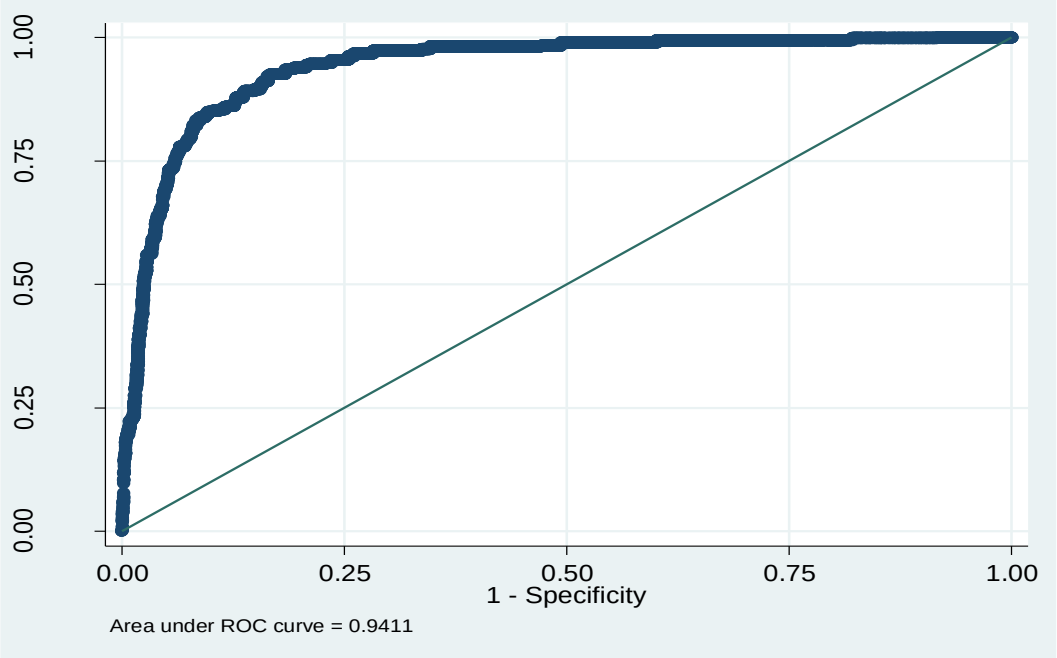
Appendix Figure (C-3) Cumulative Distribution of Complementary Log-Log Model



Appendix Figure (C-4) ROC Curve of Logit Model



Appendix Figure (C-5) ROC Curve of Probit Model



Appendix Figure (C-6) ROC Curve of Complementary Log-Log Model