FERTILITY, CHILD MORTALITY AND MATERNAL LABOUR PARTICIPATION IN NIGERIA

BY

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ABSTRACT

The relationship between fertility, child mortality and maternal labour participation remains inconclusive because of the interrelationship among them and also consequences of health, productivity on welfare of individuals and households. Several studies have examined the relationship between pairs of these variables, but few evidence exist on the simultaneous relationship among the three. While studies have found significant effect of child mortality on fertility, calculating the replacement rate for births to a child death remains an unfilled gap in Nigeria. This study, therefore, examined the interrelationship among fertility, child mortality and maternal labour participation by estimating their determinants.

The theoretical framework rests on the economic theory of time allocation between two substitute roles - motherhood and working. Data were obtained from the recent 2010 Harmonised Nigeria Living Standard Survey conducted by the National Bureau of Statistics. The survey covered 332, 928 individuals from 77, 390 households. A total of 41, 575 women (9,798 urban and 31,777 rural), within the reproductive ages of 15 - 49 with at least one child ever born was used. A simultaneous equation model comprising three equations of determinants of fertility, child mortality and maternal labour participation was estimated. Following endogeneity tests, two-stage estimation technique was employed for each of the equations at national, urban and rural levels. The Olsen method was used to calculate the replacement rate for births to a child death. Data were analysed at $p \leq 0.05$.

The average age was 32.6 ± 8.1, 24.0%, 6.0% and 54.0% indicated women with primary, post secondary and no western education respectively. Significant relationships were observed among fertility, child mortality and maternal labour participation at all levels. Child mortality had a positive effect on fertility nationally (β= 2.59), in urban (β= 2.81) and rural (β= 2.20) locations. Mothers employed in the formal sector, with at least secondary education, had fewer births than those with no education (β= -0.37). Women outside the labour force, having less than post secondary education, had higher fertility than others. The replacement rate for births to a child death was 0.57 nationally, 0.59 in urban, and 0.56 in rural locations.

There was a negative effect of fertility on child mortality at the national level if mothers were educated (β= -0.04), in urban (β= -0.11) and rural (β= -0.02) locations. Mothers employed in the formal sector had less number of child deaths than other women (β= -0.05). Mothers experiencing high number of child deaths were less likely to seek formal sector employment (β= -0.00) but more likely to seek informal sector employment (β= 0.01). Post secondary education increased maternal labour participation (β= 0.57); age at first childbirth had a negative effect on fertility (β= -0.00); and hospital delivery reduced child mortality (β= -0.43).

There were clear strong interrelationships among fertility, child mortality and maternal labour participation in Nigeria. Higher maternal educational attainments should be encouraged to increase maternal labour participation as this would reduce child mortality.

Key words: Child mortality, Maternal labour participation, Fertility, Child replacement rate

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CERTIFICATION

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ABBREVIATIONS

ADB	African Development Bank
OLS	Ordinary Least Squares
FIML	Full Information Maximum Likelihood
LISREL	Linear Structural Relations
GMM	Generalised Method of Momment
IV	Instrumental Variable
SSA	Sub-Saharan Africa
TFR	Total Fertility Rate
PCI	Per Capita Income
UNICEF	United Nations International Children’s Emergency Fund
MDGs	Millennium Development Goals
CBR	Crude Birth Rate
CMR	Child Mortality Rate
NDHS	Nigeria Demographic and Health Survey
HNLSS	Harmonised Nigeria Living Standard Survey
SNA	Systems of National Accounts
HCA	Home Care Allowance
LDCs	Least Developed Countries
ARDL	Autoregressive Distributed Lag
OECD	Organisation for Economic Cooperation and Development
CWR	Child to Women Ratio
DHS	Demographic and Health /Surveys
2SLS	Two Stage Least Squares
CML	Conditional Maximum Likelihood
MIMIC	Multiple Indicators- Multiple Causes
NBS	National Bureau of Statistics
FCT	Federal Capital Territory
EAs	Enumeration Areas

HUs	Housing Units
DFID	Department of International Development
LGAs	Local Government Areas
PSUs	Primary Sampling Units
NPC	National Population Commission

CHAPTER ONE

INTRODUCTION

1.1 Problem Statement

High fertility level, high child mortality rate and low maternal labour participation rate are challenges in developing countries, especially in Sub-Saharan Africa (SSA), particularly in Nigeria. One of the results of these challenges is poor health of women and children as well as the reduced income earning opportunity for women, leading to high poverty levels in households. Tackling the challenges associated with the level of any of the three variables without addressing the other two problems would not yield the desired results because of their interrelationship. The relationship among the three variables is such that the favourable or unfavourable level of any of the three variables can be explained by variations in any one or a pair of them as shown in Benefo and Schultz (1996), Handa (2000) and Jara *et al*. (2013), that fertility increases are explained by rising child mortality rates. This is as a result of the replacement and anticipatory effects of child mortality on fertility (Olsen, 1980). The death of a child is likely to influence the fertility decision of a woman in favour of an additional birth to replace the dead one. This is to provide consolation and maintain the desired number of children. A woman's fertility decision can also be influenced by the number of child deaths she experiences or by the experiences of other women such that in anticipation of such an occurrence, she gives birth to more than she desires. Thus, in the event of any loss(es), the number of children does not fall below her desired number. High child mortality has also been associated with increases in fertility levels because it leads to shorter birth intervals which increase the risk of mortality for mother and child (Canning and Schultz, 2012, Kozuki *et al.*, 2013, Bhuyan, 2000).

While high fertility reduces the participation of women in the labour force as a result of their trade-off relationship (Ackah *et al.*, 2009, Perticara, 2006) it could also increase the labour participation of mothers, especially in developing countries where the compatibility of work and childbearing is higher in rural areas or in the informal sector (Desta, 2013). Employment has also been shown to reduce fertility among women especially when the employment is in the formal sector (Nwakeze, 2007) and in the case of high employment intensity which cause women to postpone births as well as quit early from childbearing (Klasen and Launov, 2003). However, in some other cases a positive effect exist because working women could purchase childcare services or enjoy surrogate parenting from relatives and friends (Bratti, 2003, Togunde, 1988, Fapohunda, 1982).

Concerning the interrelationship between maternal labour participation and child mortality, while labour participation increases the number of child deaths as a result of less time allocation for child care (Tanaka, 2005, Ruhm, 2000, Tulasidhar, 1993), the income effect of employment produces more surviving children (Eswaran, 2002, Tulasidhar, 1993). From the interrelationship among fertility, child mortality and maternal labour participation discussed above, it is evident that an understanding of the relationship among them would provide useful insights towards addressing challenging issues on any one of them.

According to the Population Reference Bureau 2014, Nigeria's total fertility rate (TFR) in 2013 was 5.6 births per woman, which places her as the third highest in West Africa behind Niger and Mali with 7.6 and 6.1 respectively, while the lowest TFR of 2.6 was in Cape Verde. In 2013, Nigeria was ranked 13th out of 222 countries with a high TFR of 5.31 births per woman (Central Intelligence Agency World Factbook, 2014). This was close to Niger, with the highest TFR of 7.6 births per woman and quite a distance from Singapore that had the lowest TFR of 0.79 births per woman.

High fertility is a challenge because of the negative effects it has on an economy, one of which is population growth explosion. If population grows too fast relative to output growth as in most developing countries, the Malthusian theory explains that per capita income (PCI) is bound to decline and poverty will increase. High fertility also skews the age structure in favour of the young dependent population such that the working population become fewer than their dependents, suggesting that they will find it difficult to cater adequately for them, the result being a reduced total output per head and welfare. Meanwhile, the optimists' theory of population associates population growth with economic development because with new developments and technologies, it is possible to overcome environmental constraints to development so that total output increases even with population growth. Notably, such new developments and technologies may not be easily available or employed in some developing countries. According to the Central Intelligence Agency World Factbook (2014) estimates, with a population growth rate of 2.54%, the age structure of Nigeria is such that the population within the ages of 0 and 14 years accounts for 43.8 per cent. The health of women and children are at risk with high fertility levels as a result of the accompanying short birth intervals that leave mothers with less time for recuperation before the next conception. This could result in high maternal deaths and poor child health.

Nigeria is characterised by a high child mortality rate such that with an under-five mortality rate of 124 deaths per 1,000 live births in 2012, she is ranked as the 9th out of 194 countries, with the highest under – five mortality rates compared to Ghana, Kenya and Rwanda with 72, 73 and 55 deaths per 1,000 live births, respectively (UNICEF State of the World's Children, 2014). Despite the progressive decline in mortality rate, the very slow pace makes achieving the Millennium Development Goals (MDGs) of reducing child mortality by a third by 2015 unrealisable.

The female labour force participation rate as presented in the World Development Indicators, (2012) has experienced a minimal but consistent yearly increase from 1990 until 2009, when a decline was recorded. It rose from 34.5 per cent in 1990 to 37 per cent in 1995 and 40.1 per cent in 2000 and further to 43.4 in 2004. It however declined to 43.0 in 2009 and further declined to 42.8 per cent in 2010 and 2011. It has always been lower than the male labour force participation rate. From the Harmonised Nigeria Living Standard Survey, 2010, out of a sample of 41,575 women used in this study who are within the reproductive ages of 15 and 49 and are mothers of at least a child, 82 per cent are in the labour force while 18 per cent are not. However, among those in the labour force, 53% are employed while 47% are unemployed, showing a significant number of unemployed mothers.

The overall highlights above reveal a high fertility rate, a high child mortality rate and a relatively low maternal labour force participation in the country. The interplay of these three variables was thus empirically examined.

This study examined the interrelationship among fertility, child mortality and maternal labour participation in Nigeria. The following questions apply: What impact does an additional child death and the rate of maternal labour participation have on fertility in Nigeria? Is the child mortality rate in Nigeria influenced by fertility levels and the rate of maternal labour participation? What effect does fertility and child mortality have on the labour participation of mothers? What other factors explain fertility, child mortality and maternal labour participation? What is the replacement rate for births to a child death in Nigeria?

1.2 Objectives of the Study

The major objective of the study is to examine the interrelationship among fertility, child mortality and maternal labour participation in Nigeria. Specifically, this study will attempt to:

1. Examine the determinants of fertility.
2. Examine the determinants of child mortality.
3. Identify the determinants of maternal labour participation.
4. Calculate the replacement rate for births to a child death.

1.3 Justification for the Study

There have been several studies on the relationship between fertility and child mortality, they have shown that child mortality and fertility are interrelated (Jara *et al*., 2013; Herzer *et a*l., 2012; Benefo and Schultz, 1996; Handa, 2000; Rosenzweig and Schultz, 1983; Blackburn and Cipriani, 1998; and Chowdhurry, 1988). These studies reveal a positive and bi-causal relationship. Nonetheless, there remains the need for a current empirical evidence for the Nigerian case. Some studies have attempted to calculate the replacement rate of birth to a child death, for instance, Benefo and Schultz (1996), Maglad (1994), Handa (2000) and Ben-Porath (1974) calculated the replacement rates for Ghana and Cote d'ivoire, Sudan, Jamaica and Israel, respectively. This study contributes to literature on the empirical evidence on the nature of their relationship; it also calculates the replacement rate of births to a child death in Nigeria.

Several studies have also examined the relationship between labour force participation of women and fertility in developing countries (Desta, 2013; Wusu, 2012; Feyisetan, 1985; Togunde, 1988; Fapohunda, 1982; and Mason and Palan, 1981); while some found a negative relationship as a result of the role incompatibility hypothesis and the trade-off in time allocation between work and childbearing, others noted a positive relationship as well as a situation of no relationship. These contradictions buttress the argument against the applicability of the incompatible negative relationship as obtained in Western countries to the case of developing countries. This is because unlike the west, some labour force activities are compatible with childcare and there is substantial availability of parental surrogates (Mason and Palan, 1981). The contradictions and argument call for an increasingly broader examination of this relationship. Thus, this study examines the relationship between maternal labour force participation and fertility not only for women employed in the formal and informal sectors as well as those unemployed (limitations of the above studies), but also for women who are outside the labour force and thus are not working nor searching for a job.

The interrelationship between fertility and child mortality as well as between fertility and maternal labour participation leaves a question on what then could be the relationship between child mortality and maternal labour participation. Little attention has been given to this question. Most studies have only examined the relationship between two out of the three variables and have shown that a significant relationship exists between each pair of the three variables. Specifically, studies such as Handa (2000), Herzer *et al.* (2012), Benefo and Schultz (1996), examined the relationship between fertility and child mortality; Longwe *et al*. (2013), Wusu (2012), Kreyenfeld (2009), Vikat (2004) and Togunde (1988) examined the relationship between fertility and female labour participation; and Tulasidhar (1993) examined the effect of female labour force participation on child mortality. Therefore, this leaves a possibility of an interrelationship among the three variables, this is what this study is out to examine. This study contributes to literature by examining the relationship among fertility, child mortality and maternal labour participation.

1.4 Scope of the Study

This study covers the whole of Nigeria and provides an analysis of the relationship among fertility, child mortality and maternal labour participation for urban and rural locations, for the six geopolitical zones, and for seven age groups of women. The women covered are of childbearing age (15 to 49 years) and have at least a child. The coverage for child mortality is children between 0 and 5 years. Three measures were used for maternal labour participation to capture women within the labour force (employed or unemployed) and those outside the labour force. The formal and informal sectors of employment are considered. The three measures are the probability of formal sector employment, the probability of informal sector employment, and the probability of being out of the labour force. The study covers the period 2009/2010 coinciding with the period covered by the Harmonised Nigeria Living Standards Survey (HNLSS).

1.5 Organisation of the Study

The rest of the study is organised as follows: chapter two presents the background to the study, chapter three reviews related literature, chapter four presents the theoretical framework and methodology, chapter five contains the empirical analysis while chapter six presents the summary of findings, recommendations and conclusions.

CHAPTER TWO

BACKGROUND TO THE STUDY

2.0 Introduction

An overview of the trend and developments on the total fertility rate (TFR), child mortality rate (CMR) and the labour force participation rate of women are presented and discussed in this chapter.

2.1 Total Fertility Rate in Nigeria – Historical Trend

The total fertility rate is the average number of children a woman would have at the end of her reproductive years assuming the age-specific fertility rate is constant throughout her lifetime, thus it is the average number of children per woman. It is measured as the number of live births per 1,000 female population between the ages of 15 and 49 years in a year. The total fertility rate is a useful measure for examining the overall level of fertility. It refers to the number of live births a woman would have in her lifetime if she were subject to the current age-specific fertility rates throughout her reproductive years (15-49 years). The measures of fertility include age-specific fertility rates, the TFR and the crude birth rate (CBR). Age-specific fertility rates measure the annual number of births to women of a specified age or age group per 1,000 in that age group. It shows the age pattern of fertility. The CBR is the number of live births during the year, per 1,000 population.

Table 2.1 presents the trend in total fertility over the years from different Nigerian data sets. The TFR according to the World Fertility Survey for 1965, 1970, 1971 to 73 and 1975 were 6.6, 6.5, 7.3 and 7.0, respectively. It declined to 5.9 between 1980-82 as reported by the 1981/82 Nigeria Fertility Survey and between 1988 and 1990, the TFR was 6.0 according to the 1990 Nigeria Demographic and Health

Survey (NDHS). The 1999 NDHS showed a decline to 5.2. However, there was an increase in TFR to 5.7 in the 2003 NDHS. The 2008 and 2013 NDHS had a total fertility rate of 5.7 and 5.3 respectively. According to the United Nations, (2011) World Population Prospect, the TFR between 2005 and 2010 was 5.61 and between 2010 and 2015 it was 5.43. Overall, there was a modest decline in fertility at the national level over the years, from a TFR of 6.6 in the World Fertility Survey between 1981 and 82 through 5.7 in the 2008 NDHS to currently 5.6, according to the Population Reference Bureau, 2014.

Table 2.1 Trend in Total Fertility Rates in Nigeria

Year/Source	Total Fertility Rate
1965 World Fertility Survey (WFS)	6.6
1970 World Fertility Survey (WFS)	6.5
1971-73 World Fertility Survey (WFS)	7.3
1975 World Fertility Survey (WFS)	7
1981/82 National Fertility Survey (NFS)	5.9
1990 Nigeria Demographic and Health Survey (NDHS)	6
1999 Nigeria Demographic and Health Survey (NDHS)	5.2
2003 Nigeria Demographic and Health Survey (NDHS)	5.7
2008 Nigeria Demographic and Health Survey (NDHS)	5.7
2011 Population Reference Bureau (PRB) 2012	5.6
2012 Population Reference Bureau (PRB) 2013	6.0
2013 Population Reference Bureau (PRB) 2014	5.6
2013 Nigeria Demographic and Health Survey (NDHS)	5.5

Source: Author's compilation from the various sources stated

2.1.1 Estimates and Projections of Total Fertility Rate, Crude Birth Rate and Mean Age of Childbearing in Nigeria

Table 2.2 and Figure 2.1 show estimates and projections of the TFR, CBR and female mean age of childbearing for Nigeria from 1950 to 2050. The TFR was constant at 6.35 from 1950 to 1970, it increased to 6.61 between 1970 to 1975, there was a further increase to 6.76 from 1975 to 1985. It began to decline between 1985 and 1990 to 6.56 births per woman. It further declined to 6.23 between 1990 and 1995, then 5.99 between 1995 and 2000 and 5.79 between 2000 and 2005. It has continued to decline though slightly, recording 5.61 from 2005 to 2010. It is projected to continue to fall to 5.43 births per woman from 2010 to 2015 and 3.41 between 2045 and 2050. Despite the projected decline, the rate is still too low to prevent Nigeria from moving from the seventh most populous country to replace the United States as the third most populous country by 2050 (United Nations World Population Prospects, 2011). Crude birth rate rose from 46 births per 1,000 population between 1950 to 1970 to 47 between 1970 and 1980. It declined thereafter to 46, and it is projected to decline further even by 2050. The mean age of childbearing for females is an average of 29 years since 1995, and even as projected till 2050.

Table 2.2 Total Fertility Rate, Crude Birth Rate and Mean Age of Childbearing

Year	Total Fertility Rate	Crude Birth Rate	Female Mean Age of Childbearing
1950-1955	6.35	46	NA
1955-1960	6.35	46	NA
1960-1965	6.35	46	NA
1965-1970	6.35	46	NA
1970-1975	6.61	47	NA
1975-1980	6.76	47	NA
1980-1985	6.76	46	NA
1985-1990	6.56	45	NA
1990-1995	6.23	43	NA
1995-2000	5.99	42	29.49
2000-2005	5.79	41	29.54
2005-2010	5.61	40	29.66
2010-2015	5.43	39	29.59
2015-2020	5.22	38	29.51
2020-2025	4.86	35	29.38
2025-2030	4.52	33	29.26
2030-2035	4.2	32	29.14
2035-2040	3.9	30	29.03
2040-2045	3.64	28	28.94
2045-2050	3.41	27	28.85

***Source*:** United Nations, Department of Economic and Social Affairs, Population Division (2011). World Population Prospects: The 2010 Revision, CD-ROM Edition.

Note:
Total fertility rate (number of children per woman)
Crude birth rate (births per 1,000 population)
Female Mean Age of Childbearing (years)

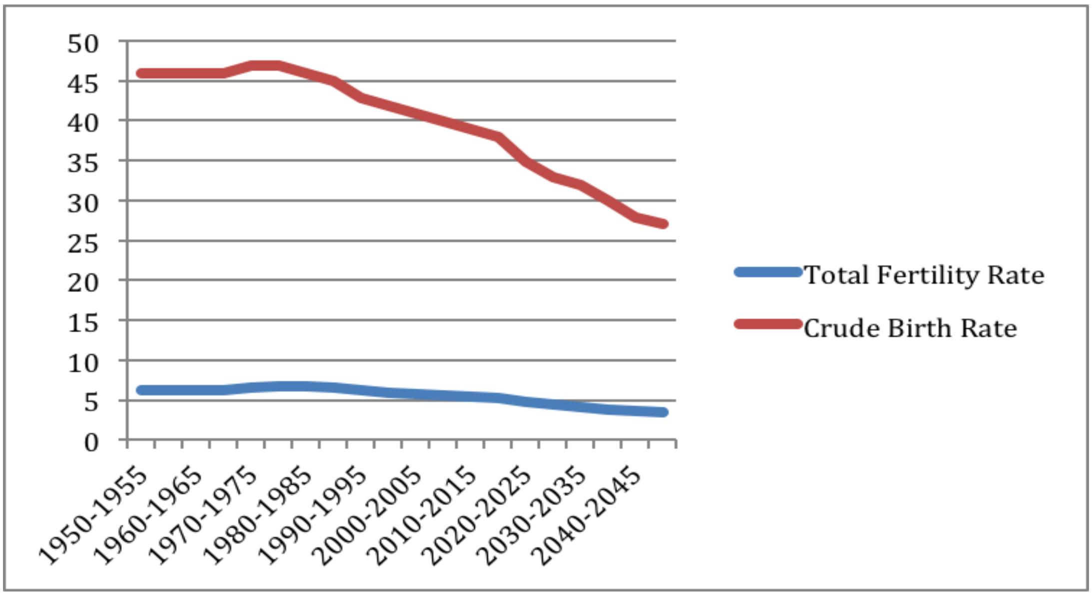

Figure 2.1 Total Fertility Rate and Crude Birth Rate in Nigeria

Source: United Nations, Department of Economic and Social Affairs, Population Division (2011). World Population Prospects: The 2010 Revision, CD-ROM Edition.

2.1.2 Age – Specific Fertility Rates in Nigeria

From Table 2.3 and Figure 2.2, the highest fertility rates were found among women between the ages of 25 and 29 years for all the periods reported. The lowest fertility rates were recorded for women close to the end of their reproductive years, that is 45 to 49 years. As shown in Table 2.3, generally, women between 20 and 39 years had the highest fertility rates. Thus, as women of 15 years grow older, their fertility rates increase sharply; it peaks between 25 and 29 years and subsequently begins to decline slowly until the age of 45 when a drastic decline takes place, probably due to menopause.

Table 2.3 Age-Specific Fertility Rates in Nigeria

	Age-Specific Fertility Rate						
Year	15-19	20-24	25-29	30-34	35-39	40-44	45-49
1995-2000	135.2	246.1	276.3	244.7	171	89.6	34.2
2000-2005	127.2	234.2	270.5	242	166.5	84.9	33
2005-2010	118.3	223.2	264.6	238.5	161	83.9	32.8

***Source*:** United Nations, Department of Economic and Social Affairs, Population Division (2011). World Population Prospects: The 2010 Revision, CD-ROM Edition.

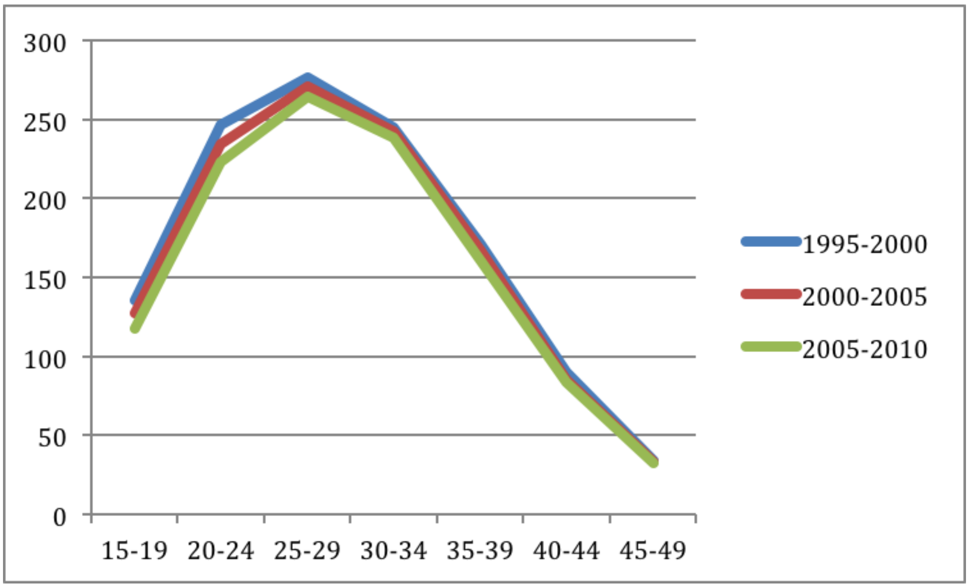

Figure 2.2 Age-Specific Fertility Rates in Nigeria

Source: United Nations, Department of Economic and Social Affairs, Population Division (2011). World Population Prospects: The 2010 Revision, CD-ROM Edition.

2.1.3 Differentials in the Total Fertility Rate By Region, Education and Residence

Table 2.4 shows the TFR as 5.7 births per woman in 2003 and 2008 but by 2013, it declined to 5.5. Among the geopolitical zones, only the North Central zone records a continuous decline in TFR from 5.7 in 2003 to 5.4 in 2008 and 5.3 in 2013. All other zones except the South West recorded an increase in TFR from 2003 to the year 2008 but experienced a decline by 2013. The South West however maintained a continuous increase in TFR from 2003 to 2013. The highest TFR were found in the North East and North West. In 2003, 2008 and 2013, the highest TFR was recorded among women with no education and it declined as the level of educational attainment increased. The TFR was highest among rural women than urban women in 2003, 2008 and 2013.

Table 2.4 Total Fertility Rate by Region, Education and Residence

Variable	Total Fertility Rate (Number of children ever born per woman (2003)	Total Fertility Rate (Number of children ever born per woman) (2008)	Total Fertility Rate (Number of children ever born per woman) (2013)
Nigeria	5.7	5.7	5.5
North Central	5.7	5.4	5.3
North East	7	7.2	6.3
North West	6.7	7.3	6.7
South East	4.1	4.8	4.7
South South	4.6	4.7	4.3
South West	4.1	4.5	4.6
No Education	6.7	7.3	6.9
Primary Education	6.3	6.5	6.1
Secondary or higher Education	4.2	4.2	4.6
Rural Residence	6.1	6.3	6.2
Urban Residence	4.9	4.7	4.7

Source: Nigeria Demographic and Health Survey, 2003, 2008 and 2013

2.2 Child Mortality in Nigeria

Child mortality is a proxy for the poor state of health of human capital, it shows the existence of human suffering; lack of basic health infrastructure and education to keep the populace well - informed. It shows the level of child survival. The various measures of child mortality differ with respect to the age range of a child within which death occurs and they include early neonatal mortality (during the first one week of life), neonatal mortality (during the first 28 days of life), infant mortality (between 0 and 1 year) child mortality (between 1 and 5years) and under-five mortality (between 0 and 5years). Child mortality rate is measured by the number of deaths within each age range per 1000 live births in a year. Childhood mortality is the probability of a child dying within a certain age range.

2.2.1 Child Mortality Rate in Nigeria Using Various Measures

A steady but slight decline over the years was observed in child mortality rate as shown in Table 2.5. Between 1990 and 2011, neonatal mortality declined from 51.40 to 39.40. Infant mortality declined from 126.60 to 78.00 while under-five mortality rate declined from 213.60 to 124.10. Despite the general decline, these rates are still alarmingly high and a challenge on child survival in the country.

Table 2.5 Child Mortality Rate in Nigeria Using Various Measures

Year	Neonatal mortality	Infant mortality	Under-five mortality
1990	51.40	126.60	213.60
1991	51.40	126.70	213.80
1992	51.50	127.00	214.30
1993	51.50	126.80	214.10
1994	51.30	126.10	212.80
1995	51.20	125.30	211.30
1996	50.70	123.00	207.20
1997	50.30	120.90	203.40
1998	49.90	118.90	199.60
1999	49.20	115.60	193.60
2000	48.50	112.50	187.90
2001	47.70	109.00	181.30
2002	46.80	105.40	174.60
2003	46.00	102.10	168.30
2004	45.20	98.70	162.00
2005	44.30	95.50	156.00
2006	43.50	92.40	150.30
2007	42.60	89.30	144.60
2008	41.80	86.30	139.10
2009	41.00	83.40	133.90
2010	40.20	80.80	129.20
2011	39.40	78.00	124.10

Source: Level and Trends in Child Mortality. Estimates Developed by the UN Inter-agency Group for Child Mortality Estimation (UNICEF, WHO, World Bank, UN DESA, UNDP)

2.2.2 Mean Number of Child Deaths by Urban and Rural Locations and Geopolitical Zones

From Table 2.6, the mean number of child deaths was greater in rural than urban locations. It was highest in the North West, followed by the North East and South South. The lowest mean number of child deaths was observed in the South West zone, followed by the North Central. Thus, more children died in the North West than in other zones. Rural locations also recorded more number of child deaths than urban locations.

2.2.3 Estimates and Projections of Child Mortality Rates in Nigeria

According to the United Nations World Population Prospects (2011) as shown in Table 2.7 and Figures 2.3 and 2.4, infant mortality rate had been on the decline between 1950 and 1955 from 189 deaths per 1,000 live births to 153 between 1965 and 1970 and as low as 122 and 96 between 1995 and 2000 and between 2010 and 2015 respectively. It is projected to further decline to 71 between 2020 and 2025 and 40 between 2045 and 2050. The under-five mortality rate was 213 deaths per 1,000 births between 1980 and 1985, it declined to 177 between 2000-2005. A further decline of 111 is projected between 2020 and 2025 and 67 between 2045-2050. Despite the consistent decline experienced and expected, the rates are still too high for the health and safety of children as well as the population at large.

Table 2.6 Mean Number of Child Deaths by Urban and Rural Locations and Geopolitical Zones

Residence	Mean Number of Child Deaths
National	0.41
Urban	0.30
Rural	0.44
North Central	0.29
North East	0.46
North West	0.57
South East	0.37
South South	0.39
South West	0.17

Source: Author's compilation from the Harmonised Nigeria Living Standard Survey (HNLSS), 2010

Table 2.7 Estimates and Projections of Child Mortality Rates in Nigeria

Year	Infant Mortality Rate	Under-five Mortality Rate
1950-1955	189	NA
1955-1960	176	NA
1960-1965	164	NA
1965-1970	153	NA
1970-1975	141	NA
1975-1980	132	NA
1980-1985	127	213
1985-1990	127	212
1990-1995	126	212
1995-2000	122	204
2000-2005	107	177
2005-2010	96	156
2010-2015	88	141
2015-2020	79	125
2020-2025	71	111
2025-2030	64	98
2030-2035	57	86
2035-2040	51	75
2040-2045	45	65
2045-2050	40	67

***Source*:** United Nations, Department of Economic and Social Affairs, Population Division (2011). World Population Prospects: The 2010 Revision, CD-ROM Edition.

Infant Mortality Rate (infant deaths per 1,000 live births)
Under-five mortality (deaths per 1,000 births)

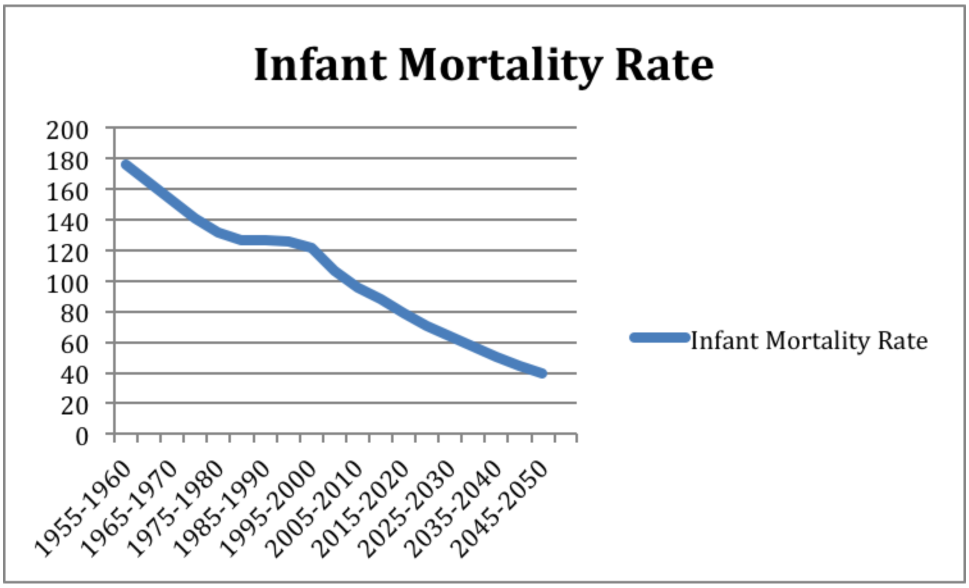

Figure 2.3 Infant Mortality Rate in Nigeria

***Source*:** United Nations, Department of Economic and Social Affairs, Population Division (2011). World Population Prospects: The 2010 Revision, CD-ROM Edition.

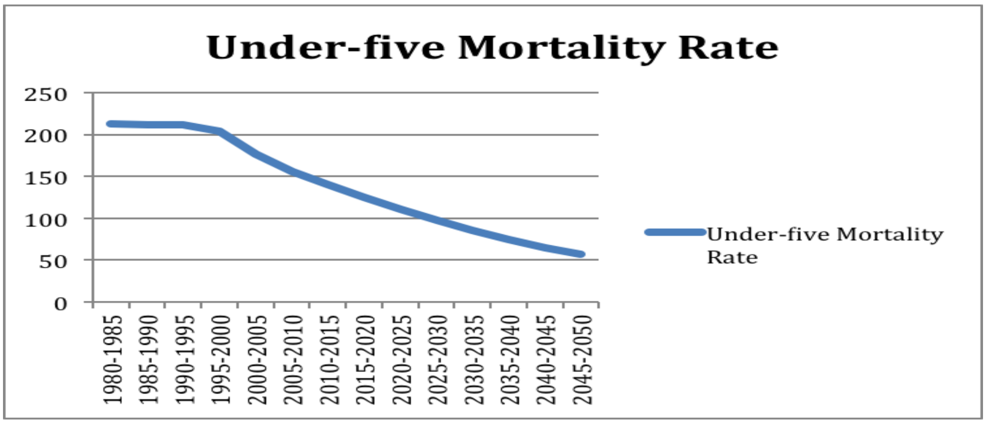

Figure 2.4 Under-five Mortality Rate in Nigeria

***Source*:** United Nations, Department of Economic and Social Affairs, Population Division (2011). World Population Prospects: The 2010 Revision, CD-ROM Edition.

2.2.4 Differentials in the Child Mortality Rate by Region, Education, Residence and Sex

From Table 2.8, wide regional disparities exist in child health indicators with the North East and North West geopolitical zones of the country shown to have had the worst child survival figures. The South West however, recorded the lowest mortality rates. Infant, child and under-five mortality rates were highest among mothers with no education and declined with higher educational attainment. Rural mothers experienced higher infant, child and under-five mortality rates of 86, 89 and 167 deaths per 1,000 live births respectively than urban mothers with as low as 60, 42 and 100 deaths per 1,000 live births respectively. This shows that infant, child and under-five mortality were 43 per cent, 102 per cent and 67 per cent higher in rural than urban locations. Thus, there were more child deaths in the North East zone and among rural mothers than among urban mothers for the period reported. The mortality rates among children were higher for males than females.

Table 2.8. Child Mortality Rate by Region, Education, Residence and Sex

Variable	Infant Mortality Rate	Child Mortality Rate	Under-Five Mortality Rate
Zone			
North Central	66	36	100
North East	77	90	160
North West	89	105	185
South East	82	54	131
South South	58	35	91
South West	61	31	90
Mothers' Education			
No Education	89	100	180
Primary Education	74	57	128
Secondary Education	58	35	91
Above Secondary	50	13	62
Residence			
Rural Residence	86	89	167
Urban Residence	60	42	100
Child Sex			
Female	70	72	137
Male	84	73	151

Source: Nigeria Demographic and Health Survey (NDHS), 2013

***Note*:** Mortality rates are for ten year period preceding the survey
Estimates are for deaths per 1,000 live births except for child mortality which is deaths per 1,000 live children age 12-59 months

2.3 Maternal Labour Participation in Nigeria

The labour force or economically active population refers to all persons of either sex who furnish the supply of labour for the production of goods and services, within the production boundary as defined by the systems of national accounts (SNA) during a specified time-reference period (African Development Bank, 2012). According to the SNA 2008, the relevant production of goods and services includes all production of goods, the production of market and non-market services, and the production for own final consumption of household services by employing paid domestic staff. The labour force is the sum of the employed and the unemployed. The labour force participation rate is an indicator of the level of labour market activity. It reflects the extent to which a country's working age population (people from 15-64 years) is economically active. It is defined as the ratio of the labour force to the working age population expressed in percentage terms (African Development Bank, 2012). Female labour participation rate can be defined as the percentage of female working-age persons in an economy who are in the labour force. The maternal labour participation rate refers to the labour force participation rate of mothers with non-adult children. The World Bank (2015) shows that the female labour participation rate (%) in Nigeria was 39 in 1990, 42 in 1995, 45 in 2000, 48 from 2004 to 2012, and 49 in 2013. The employment rates by gender in the Federal Civil Service as recorded by the Federal Office of Statistics (various issues) show that female staff were only 13 per cent in 1985 and 1989, 22 per cent in 1994 and 14 per cent in 1998, 2001 and 2005 (Lawanson, 2008). The highest female staff recruitment was 47,908 out of a total of 200,018 in 1995, only 24 per cent, leaving 76 per cent male recruitment (Lawanson, 2008).

2.3.1 Employment Status of Women by Sector

Table 2.9 shows the employment status of women by sector in urban and rural locations. A larger percentage of women worked in the informal sector than in the formal sector, this obtained at the national level and in urban and rural locations. At the national level, 52.7 per cent of women were employed (either in the formal or informal sector) and 47.3 per cent were unemployed, thus though more women were employed than unemployed, the difference is not substantial. Also, while more women were employed in urban locations, there were more unemployed women in rural areas. Women who were out of the labour force constituted 18.1 per cent at the national level showing that there are more women in the labour force than there are outside. The percentage of women out of the labour force was higher in rural than urban locations.

2.3.2 Nigeria's Total Labour Force

Table 2.10 shows the proportion of the working population that are employed or unemployed, which makes up the total labour force. It also shows the female and male distributions. From 1990, a slight but consistent increase in the total labour force from a total of above 30 million employed and unemployed people to a little above 50 million people in 2010 was observed. Females were only 34.5 per cent of the total labour force in 1990, leaving a 65.5 per cent male representation. As shown also in Figure 2.5, the female labour force increased consistently to 43.4 per cent in 2004 while the male labour force declined to 56.6 per cent. Thereafter, the female labour force declined from 43.3 per cent in 2005 to 42.8 per cent in 2010 while the male labour force experienced an upward trend of 56.7 per cent in 2005 to 57.2 per cent in 2010.

Table 2.9 Employment Status of Women by Sector (%)

Sector	National	Urban	Rural
Working in the formal sector	7.6	14.7	5.4
Not working in the formal sector	92.4	85.3	94.6
Working in the informal sector	52.7	62.4	49.7
Not working in the informal sector	47.3	37.6	50.3
Unemployed	47.3	36.6	50.7
Employed	52.7	63.4	49.3
Out of the labour force	18.1	15.4	18.9
In the labour force	81.9	84.6	81.1

Source: Author's compilation from the HNLSS, 2010

Table 2.10 Total Labour Force in Nigeria

Year	Total Labour Force	Female Labour Force (% of Total Labour Force)	Male Labour Force (% of Total Labour Force)
1990	30,578,273.90	34.5	65.5
1991	31,421,554.60	34.9	65.1
1992	32,234,616.70	35.5	64.5
1993	33,126,614.00	35.9	64.1
1994	33,978,817.10	36.5	63.5
1995	34,845,521.80	37	63
1996	35,725,128.40	37.5	62.5
1997	36,617,684.20	38.1	61.9
1998	37,524,454.50	38.7	61.3
1999	38,379,114.00	39.5	60.5
2000	39,248,273.10	40.1	59.9
2001	40,133,163.70	40.9	59.1
2002	40,959,413.40	41.6	58.4
2003	41,795,634.40	42.4	57.6
2004	42,561,456.70	43.4	56.6
2005	43,729,560.10	43.3	56.7
2006	45,002,451.20	43.2	56.8
2007	46,221,549.90	43.1	56.9
2008	47,558,734.50	43	57
2009	48,851,361.00	43	57
2010	50,280,306.00	42.8	57.2
2011	51,669,300.00	42.8	57.2

Source: The World Bank, World Development Indicators (2012). International Labour Organization Using World Bank Population Estimates

2.3.3 Labour Force Participation Rate in Nigeria

Table 2.11 and Figure 2.5 present the labour force participation rate in Nigeria. Out of the total labour force participation rate of 56.8 per cent in 1990, only 39 per cent were females while 74.7 per cent were males. However, by 2000, the percentage of women in the labour force had risen to 44.8 per cent while the percentage of males declined to 66.8 per cent. By 2011, the percentage of females in the total labour force was 47.9 while males constituted 63.3 per cent. Despite the consistent increase recorded over the years, it had only been slight such that female labour force participation was only as high as 47.9 per cent in 2011 and consistently lower than the male labour force participation rate. Overall, the total labour force participation rate declined from 56.8 in 1990 to 54.9 in 2006 and began to increase again steadily but rather slightly from 55 per cent in 2007 to 56 per cent in 2011.

Table 2.11 Labour Force Participation in Nigeria

Year	Total (Labour force/Working Population in %)	Female(% of female Population ages 15+)	Male(% of male population ages 15+)
1990	56.8	39	74.7
1991	56.8	39.5	74.1
1992	56.7	40.1	73.5
1993	56.7	40.6	72.8
1994	56.6	41.2	72.1
1995	56.5	41.7	71.4
1996	56.4	42.3	70.6
1997	56.3	42.9	69.7
1998	56.2	43.5	68.8
1999	56	44.2	67.8
2000	55.8	44.8	66.8
2001	55.6	45.5	65.7
2002	55.3	46.1	64.4
2003	55	46.8	63.1
2004	54.6	47.5	61.7
2005	54.7	47.5	61.9
2006	54.9	47.6	62.1
2007	55	47.6	62.3
2008	55.2	47.7	62.6
2009	55.3	47.8	62.8
2010	55.5	47.8	63
2011	56	47.9	63.3

Source: United Nations, Department of Economic and Social Affairs, Population Division (2011). World Population Prospects: The 2010 Revision, CD-ROM Edition.

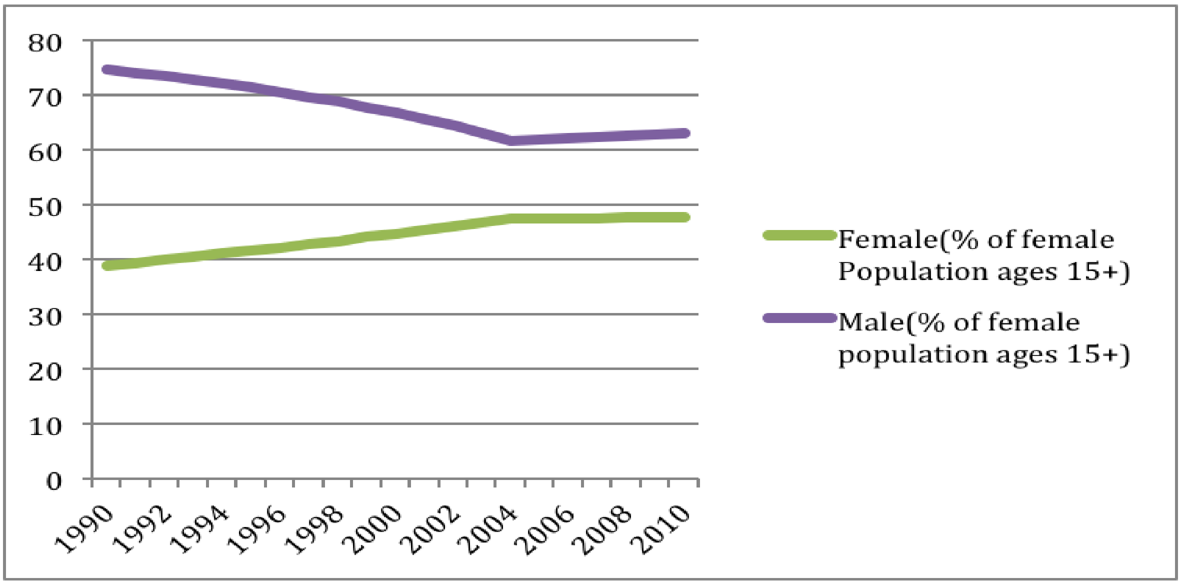

Figure 2.5 Labour Force Participation Rate in Nigeria

***Source*:** United Nations, Department of Economic and Social Affairs, Population Division (2011). World Population Prospects: The 2010 Revision, CD-ROM Edition.

Summary

The trends and developments discussed above reveal a relatively high total fertility rate despite the decline evidenced from 1977 to 2013. Fertility was shown to be higher among women who experienced more number of child deaths, while educated women had lower fertility than women with no education. Child mortality is higher among rural than urban women and also among women with no education. It is lowest in the South West zone but highest in the North West zone. Thus fertility was found to be highest in the North West zone where child mortality rate is highest. Education reduced fertility and child mortality. Rural women had higher number of childbirths and consequently, higher number of children ever born. A greater number of women in the country participated in the informal sector than the formal sector and though more women are in the labour force than outside the labour force, a significant number are unemployed.

CHAPTER THREE

LITERATURE REVIEW

3.0 Introduction

In this chapter, a review of some related literature is presented. The review discusses some theoretical issues, empirical findings and methodological issues as it concerns the contributions and limitations of some previous related studies.

3.1 Review of Theoretical Issues

3.1.1 Economic Theories of Fertility

The microeconomic theory of fertility describes consumer behaviour when children are seen as consumer durable goods from which parents obtain utility from having them given the household income, the price or cost of children and their relative prices (in comparison to price of other goods). Children are seen as consumption goods (normal or inferior) and provide utility from parenting and child labour income. As investment goods, children provide future benefits in form of financial support to parents after retirement or in old age. Income and substitution effects apply.

Several theories that have helped explain fertility behaviours include Caldwell (1976) wealth theory of intergenerational wealth flows, the new home economics model by Becker (1960) who applied consumer theory and the quantity-quality principle to the task of understanding fertility and by Willis (1973) who considered the concepts of household production and time allocation, Leibenstein (1975) theory on income, Easterlin (1975) model that focused on relative income, Becker and Barrow (1988) reformulated theory on altruism, Malthus theory, Becker (1965) theory of the allocation of time, and Schultz (1974).

From these theories, fertility decisions are a function of individual preferences and the cost of children, given an income constraint. Each theory attempted to explain cost and the income fertility relationship. There was a general consensus on a positive income effect, however, Becker (1960) and Willis (1973) stressed the role of female wages in explaining a possible negative income effect. Easterlin (1975) explained the negative income effect in the light of relative income so that an individual's personal income could be termed low when compared to his or her childhood lifestyle. Becker (1960) distinguished the cost of children from real expenditures per child stating that the cost of children is fixed, however real expenditures per child differed amongst the rich and poor because of the former's preference for high quality children. Leibenstein (1975) argued that shifts in the utility function due to changes in per capita income, explain the income-fertility negative relationship. Becker and Barrow (1988) reformulated theory of fertility focused on the altruistic behaviour of parents and a dynastic utility that extends from one generation to another. The Malthus theory however explained the impact of population growth on output growth. The study expounds on each theory below.

Caldwell (1976) wealth flows theory proposed a link between costs of children and fertility. The theory explained that family structure has a direct link with fertility. According to this theory, there are only two major forms of family structure, differing principally in the direction of wealth flows among generations - the primitive and traditional societies which have net wealth flows, primarily upward from young to old generations, and individual interests are subjugated for corporate ones (Caldwell, 1982). In developed nations, family structures have downward wealth flows where parents are expected to provide for children's economic wellbeing. The theory proposes that fertility decisions are rational responses to family wealth flows. In traditional societies, the economically rational decision is to have as many children as possible because each additional child adds positively to a parent's wealth, securities in old age (when aging parents receive economic benefits and support from adult children), and social as well as political wellbeing. In societies with net downward wealth flows the economically rational decision is to have no children or the minimum number couples prefer to have for the pleasure of parenting.

Two primary models have been developed to explain the common assumption of an underlying positive relationship between income and fertility, while explanations have also been made for the negative relationship observed in modern experience. The two models are the New Home Economics Model ('Price of Time' Model) and the Easterlin Model. The New Home Economics Model ('Price of Time' Model) emphasised the role of female wages/ female labour force participation on fertility decline. The major contributors to this model are Becker (1960) and Willis (1973). In the New Home Economics model, fertility decisions are a function of individual preferences and the costs of children, given an income constraint. Since parents receive utility from increased child 'quality' and 'quantity', the cost of children is endogenous in the models. The cost of children includes opportunity costs (female wage loss from reduced labour supply), childcare costs (including the availability of childcare) and time costs of raising and educating a child (including the domestic division of labour) (Engelhardt and Prskawetz, 2002). Female wages are seen to have income effects (positive) so that when income increases, the demand for children increases as well; and substitution effects (negative) which implies that when income increases, the opportunity cost of having more children increases thus reducing fertility (Willis, 1973).

Becker (1960) proposed a simple model of fertility behaviour in which parents had preferences for the number of children and the quality per child. He also proposed a framework of quantity-quality of children such that if the income elasticity of quality of children exceeds that of quantity, an increase in income leads to a fewer number of children. In Becker's (1960) economic analysis of fertility, he showed that the demand for consumer durables is a useful framework in analysing the demand for children. He described the quality of children as being determined by how much is spent on them, so that high quality children are the more expensive. He described children as consumption goods that provide utility to parents as well as production goods since they may sometimes provide money income through child labour. Just like normal durable goods, an increase in income in the long run would increase the amount spent on children. Meanwhile, the quantity elasticity would be small compared to the quality elasticity.

Contradicting Malthus' two propositions which are first, that an income increase would increase fertility by encouraging early marriages and less abstinence in marriage; and second, that an income increase would increase family size by causing a decline in child mortality, Becker (1960) argued that if child mortality rate is so low, changes in it would only have little effect on the number of survivors. Also, if parents were primarily interested in survivors not in births, a decline in child mortality would induce a decline in births. They would rather concentrate on increasing expenditures per child to guarantee their survival, thus, family size would not rise. Concerning the possibility of income increasing fertility due to early marriage and non-abstinence, he argued that since births can now be controlled without abstinence, an income increase would increase the effective demand for contraceptives. The Malthusian theory explained that the level of fertility rises as income increases which shows a positive relationship between population growth and level of income per capita. Micevska (2001) stated that if population growth rises faster than output growth, this would lead to scarcity and fertility would begin to decline. Hence, a positive relationship exists between fertility and total output/income. However, the theory of a highly elastic demand for children is unable to explain the large decline in Western countries during the last hundred years in the average number of children per family as family income rose dramatically (Becker 1991). Hence, the Malthusian theory ignored quality and assumed that the demand for births (or number of children) is highly responsive to changes in income since total income has to be shared between expenditures on children and expenditures on other commodities.

Becker (1960) defined the net cost of children as the present value of expected outlays plus the imputed value of the parents' services, minus the present value of the expected money return from children plus the imputed value of the children's services. If the net costs were positive, children would be consumer durables (that is, parents have children and spend freely on them just for the utility or satisfaction). However, if net costs were negative, children would be producer durables to parents since having them would bring more benefits than costs. In summary, his framework explains that the factors determining fertility include income, cost, knowledge of birth control, uncertainty (such as their sex) and taste of parents (which depends on a family's religion, race, and age among others). In a developing country context, the latter two elements of Becker's definition (uncertainty and taste of parents) come into play.

Becker (1965) theory of the allocation of time analysed the choices of individuals to comprise the cost of time, and the cost of market goods. He posited that an individuals' total time was shared between work and other activities. He further explained that there is a positive relationship between income and fertility as a result of the income effect. However, as the value of a mothers' time increases, the relationship between income and family size becomes negative because a woman would have to allocate her time between labour market and family activities with a view to maximising her preference function given the market wage and the opportunity cost of family activities. The market wage an individual receives equals the opportunity value of his/her time in non - market activities. Hence, as income increases, there is a decline in the number of children per family. This is because increased income is associated with more hours of work and less demand for leisure. If birth control knowledge and some other variables were held constant, economic theory suggests a positive relationship. The theory emphasised the role of female labour participation and female wage on fertility, notably, it narrows its scope to only Western industrialised countries where labour is mostly in the formal sector and there is a great incompatibility between childcare and labour force activities unlike in developing countries. Willis (1973) showed that the wife's labour force participation decisions depend on whether her marginal wage exceeds her price of time; she will always do some market work if her marginal wage exceeds the upper limit of the price of time. With the assumption that children are relatively goods intensive, he explains that childless women would have the lowest participation rates and as the total child quality (child services) increases and the price of the woman's time declines, participation rates would rise. From neoclassical theory, maternal labour participation and fertility rates are negatively related and studies have proved their incompatibility and inverseness when the roles of mother and worker conflict (Ackah *et al*., 2009). Mincer, (1962) posits that children are relatively time intensive by the negative relationship between the number of children in the household and the labour force participation rates and hours of work of married women.

The Easterlin (1975) model explained the negative relationship between income and fertility using the concept of relative income, which it defines as young adults' earnings relative to their material aspirations – their desired/preferred standard of living. He focused specifically on preference formation among young adults: those just making initial and often formative decisions on labour force entry, household formation, marriage and fertility. Amongst a multitude of influences that affect young adult preferences – those associated with peers, geographical area and socio-economic state, Easterlin focused on one which he suggested is highly significant and fairly easy to quantify, that is the standard of living enjoyed in one's parents' home. Thus, in an attempt to close the gap between income and aspirations (high relative income), couples tend to increase their female labour force participation, postpone marriage, and choose to have few children.

Another economic theory of fertility is Leibenstein (1975) theory on income where the value of a mother's time plays no role whatsoever. It focused on the central notion that people determine the number of births they desire by balancing the utilities to be derived from an additional birth to the cost (monetary and psychological) of having an additional child. Three types of utility to be derived from an additional birth are: the utility to be derived from the child as a 'consumption good', namely, as a source of personal pleasure to the parents; the utility to be derived from the child as a productive agent, that is, at some point the child may be expected to enter the labour force and contribute to family income; and the utility derived from the prospective child as a potential source of security, either in old age or otherwise. The costs of having an additional child can be divided into direct costs (conventional current expenses of maintaining the child such as feeding and clothing) and indirect costs (inability of mothers to work if they must tend to children, lost earnings during the gestation period, or the lessened mobility of parents with large family responsibilities).

The reformulated theory of fertility by Becker and Barrow (1988) was based on the assumptions of altruism towards children and that the utility of parents depend directly and positively on the utility of their children from one generation to another. Therefore the utility of parents is a function of their own consumption and the utility of their children. The degree of altruism towards children has a constant elasticity with respect to the number of children. Altruism towards children implies a linking of the welfare of all generations of a family using a dynastic utility which is a time-separable function of consumption, fertility and number of descendants in all generations. Hence, a dynamic utility is maximised subject to a dynastic resource constraint that depends on the wealth inherited by the head, the cost of rearing children, and earnings in all generations.

Schultz (1974) explained the demand for children with a suggestion that reproductive behaviour is likely to be a significant determinant of parent welfare since childbearing and rearing activities consume a substantial fraction of a family's available time and market income. He states that beyond some level of fertility specified for a couple by its economic environment, wealth and tastes, additional births are likely to diminish parental wellbeing and cause a desire to avert further births. This assertion he based on Mincer (1963) and Becker's (1965) positions that two household consumption inputs that limit a family's choice of final consumption activities are the household's market income and its members' time where market income and its members' time were market-determined and wage opportunities provide the exchange rate between these two scarce inputs. Schultz (1974) further explained that increases in a parent's permanent wage rate generate a positive wealth effect and an offsetting price effect due to the increased opportunity cost of parents's time required in the care and enjoyment of their children. Since this framework is essentially based on comparative statics, these changes in the households' human and non - human wealth position are assumed to be exogenous to the individual decision making unit. Because of the difficulty of measuring a permanent wage rate, particularly for women not in the paid labour force, education has often been assumed to be a satisfaction proxy for lifetime wage rates. Women's education tends to be negatively associated with fertility while men's education has a smaller and less significant effect.

3.1.2 Theories on the Mortality-Fertility Relationship

Several theories on the mortality-fertility relationship exist which support a possible endogeneity bias due to their bi-causal relationship. Some as presented in Chowdhury (1988) include the theory of demographic transition, the choice theory, the Ricardian theory and the modern economic theory. Other theories also discussed include Olsen (1980), Heer (1983) and Lloyd and Ivanov (1998), all of which dwell on the effect of child death on fertility. The theory of demographic transition stated that infant mortality rate falls due to an increase in industrialisation and urbanisation, improvements in literacy and living standards as well as the application of improved medical practices. Such decline in infant mortality leads to a subsequent decline in fertility, suggesting a lagged causal relationship. It argues that a pre-industrial society experiences high death rates associated with high birth rates.

The choice theory posited that high infant mortality lowers the demand for surviving children by raising the costs for each survivor. Choice theory suggested two hypotheses in explaining how infant mortality influences fertility. The child replacement hypothesis stated that parents react to a child's death by raising the number of subsequent births. However, this theory advocates incomplete replacement due to the costliness and physiological difficulties in rapidly increasing the pace of childbearing. Hence, there is an inverse relationship between infant mortality and the number of surviving children. The second is the child survival hypothesis, which stated that a child's probability to survive influenced the number of births.

The Ricardian theory was based on the proposition that economic development is neither necessary nor sufficient for fertility reduction. Thus, a rise in the actual wages above a subsistence level provides better health, greater life expectancy and improved economic conditions for families. This will lead to a net reproduction rate above unity and this increase in fertility rate is expected to cause an increase in mortality rates with some lag because of high risk births such as births to very young and old mothers. This theory suggests that causality runs from fertility to mortality.

The modern economic theory of population also explained the relationship between fertility and mortality. It suggested that infant mortality and fertility are interdependent so that a feedback exists between the two variables. Parents provide for food and healthcare for their child. Hence, the outcomes of the infants' health and number depend on the allocation of resources by the parents and is jointly determined by them. The major distinction between choice theory and modern economic theory of population is that in the former, infant mortality is not a choice variable while in the latter, fertility and infant mortality are choice variables.

Other theoretical insights include Olsen's (1980) explanation of the effect of child deaths on the number of births. He was of the opinion that because of the high level of child mortality in less developed countries (LDCs), couples' decision on the number of children to have may not always be rational or based on the desired number of children but on the number of surviving children. Hence, the death of a child may disrupt the plans of couples and they may try to offset this by having one more birth. This, he refered to as the replacement hypothesis. His study emphasised the importance of understanding the extent of replacement or the rate at which child deaths produce more births when countries take measures on reducing child mortality. The replacement rate is the average number of additional births which occur in response to an additional child death incident. It is the rate at which dead children are replaced; thus it is the average number of new births as a direct result of each child death. The desired number of children is also affected by the anticipation that such deaths may occur, thus; parents in a high child mortality environment will require more births to achieve the desired number of survivors. Thus, parents may produce additional children in anticipation of some deaths which he refers to as hoarding. He explains that using the number of child deaths enables a direct estimation of its effect on fertility rather than an indirect effect which the use of mortality rates and birth intervals offer.

Another contribution to child death effect on fertility is Lloyd and Ivanov (1998) who stated that a general increase in child survival chances would tend to widen average inter-birth intervals because of reduced conception ability due to breastfeeding and this results in a decline in period and cohort fertility rates. They emphasized the insurance and replacement strategies as two family building strategies used by couples to achieve the desired number of surviving children. In anticipation of a probable loss, couples have excess number of births, usually higher during periods of high child mortality rates. Since parents do not know the actual probabilities of death faced by their children, they are likely to be risk averse such that they end up with more surviving children than desired. The replacement strategy is the replacement of children who actually die with an additional birth or births up to the end of a woman's reproductive span.

Heer (1983) also contributed to fertility decisions by looking at the effects of child mortality on fertility in developing countries, which he states is an important factor. Thus, the demand for children is usually a demand for surviving children. Demand is not constant because individual fertility could be inversely proportional to perceived child survival probabilities and the costs of any target number of surviving children are affected by mortality levels. Thus, parents may also attempt to overcompensate for perceived mortality risks. Heer (1983) explained that child mortality increases fertility through some biological effects. The death of an infant interrupts lactation and shortens the postpartum amenorrhea period, making a woman vulnerable to having another conception. However, this biological effect of neonatal death on subsequent fertility does not establish a relationship between infant and child mortality and the demand for subsequent births. This can only be done by looking for differential subsequent fertility behaviour, holding constant the influence of the biological effect. Examining the possible behavioural effects of a reduction in infant and child mortality, he explains eight propositions; the first three address sequential response to actual child death (dependence on the number of prior child deaths among any specified number of births). The other five are related to the effect of the perceived level of child survival.

The first proposition stated that the number of previous child deaths to a married couple would be positively associated, ceteris paribus, with the couple's demand for subsequent births. This association will be stronger at lower than at higher parities and may also depend on the sex composition of existing children.

The second proposition stated that the magnitude of the impact of prior child deaths on the optimal number of subsequent births to married couples would depend on the perceived monetary and psychic costs of birth control (contraception, sterilization and abortion). If these costs are high, the number of prior child deaths will have little or no effect on the optimal number of subsequent births, where they are low, the magnitude of prior child deaths will have strong effect on the optimal number of subsequent births.

The third proposition stated that the magnitude of the impact of prior child survival on the optimal number of subsequent births to married couples will depend on the gap between the number of surviving children demanded and the limit to their maximal supply. If the number of surviving children demanded at each level of prior child loss is less than the maximal supply, the impact of prior child loss on the absolute number of optimal births will be positive and independent of the number of surviving children demanded, however, if this impact relative to the optimal number of births for couples experiencing no child loss will be greater, the fewer surviving children are demanded. This latter point is based on the assumption that the gap between the optimal number of births and maximal supply will always be a constant fraction of the gap between the desired number of births and maximal supply.

The fourth to eighth propositions related to the behavioural effects of the perceived level of child survival. The fourth proposition states that the perceived level of child survival in the community will be negatively associated, ceteris paribus, with the demand by parents for surviving children. In high mortality areas, the desire for a minimum number of surviving children might elevate fertility high enough to make the net reproduction rate and the annual rate of natural increase greater than in low-mortality areas.

The fifth proposition stated that the magnitude of the effect of the perceived level of child survival in the community on the optimal number of births would vary depending on the perceived monetary and psychic costs of birth control. The higher the cost of birth control, the less the effect of the perceived level of child survival on either the absolute number of optimal births, or on that number relative to the optimal number when the perceived level of child survival is low. Under conditions of high perceived mortality there is little difference between the desired number of births and their maximal supply but this gap increases as mortality declines.

The sixth proposition stated that the magnitude of the effect of the perceived level of child survival in the community on the actual number of births per woman will vary depending on the desired number of surviving children. The desired number may be so high that, in conjunction with given birth control technology and a given set of values for the perceived level of child survival, it generates a set of values for the optimal number of births which all exceed the maximal supply; in this case a shift from a low to a high level of perceived child survival will have no effect on actual births. On the contrary, the desired number of surviving children may be lower so that in conjunction with the same birth control technology and the same set of values for the perceived level of child survival, it generates a set of values in which the optimal number of births associated with a high level of perceived child survival is below maximal supply; in this case, a shift from a low to a high level of perceived child survival will reduce the actual number of births per woman.

The seventh proposition posited that for any given set of levels of child survival, the perceived cost of birth control would determine the relative predominance of sequential versus age-at-marriage response to mortality change. Where the perceived cost of birth control is low, the sequential response will predominate; where the perceived cost is high, the age-at-marriage response will predominate. A hoarding response can be defined as any extension of the period of exposure to the possibility of birth with a rise in the level of mortality. The age-at-marriage response discussed above is an example. Another form of hoarding response is possible when contraception, sterilisation, or abortion can be used as birth control. These practices can be initiated as soon as the desired number of surviving children has been attained, or the couple can have additional children on the chance that some of the existing ones will not survive. If sterilization is the only means of birth control, it is impossible to replace any children who might subsequently die; on the other hand, when either contraception or abortion is the means of birth control, a sequential response to future child death is always possible up to the time of menopause or sterility from natural causes.

The eighth proposition stated that under conditions of perfectly effective birth control, at each given level of mortality, the total fertility rate and the intrinsic rate of natural increase will vary inversely with the degree of prevalence of a sequential rather than a hoarding response to child death.

3.1.3 The Fertility-Employment Relationship

According to Robinson (1980), it is difficult to form a very definite opinion regarding the effect of female labour force activity on fertility in the developing world, when such closely related factors as type of work, education, location of residence and family structure are considered. He observed a positive relationship in rural agricultural areas where fertility is also high and a negative relationship in urban industrial areas and nations. As discussed in Standing (1983), to examine the compatibility between women's work and fertility according to the type of childcare, it was perhaps useful to define those conditions under which fertility is least likely to constrain women's work activities.

From Standing (1983), the first was when there is a closely knit extended family. This permits childcare to be shared among large family-based groups or taken over by elderly relatives. A second and related condition was when the cost of the domestic labour needed to provide substitute childcare is low. This can be because low-cost childcare facilities exist; because women have a relatively high opportunity income compared to the cost of domestic servants' wages, as is the case with relatively high-income families or because older children are available to care for younger ones. This use of older children, common in low-income environments, implies that the imputed cost of an additional child may actually be quite small. However, if children attend school up to secondary level, their use for childcare will be reduced; this would in turn increase the incompatibility between fertility and non - domestic work. The degree of incompatibility may also be increased for affluent families by changes in the cost of domestic labour. The wage cost of domestic workers is generally a function of the level of female employment, particularly the opportunity income of women in agriculture. Where rural incomes and employment opportunities are low, many young single women migrate into urban areas where they work as domestics for extremely low wages; this in turn lowers the opportunity cost of activity (or non-domestic work) by relatively educated urban women. Studies such as McCabe and Rosenzweig (1976) have suggested an inverse relationship between the wage rate of domestic servants and the fertility of urban women. At the same time, where these domestics are so desperate for income that they must work whether or not they have children, this weakens the relationship between fertility and female labour force participation generally. On the other hand, if women's employment prospects improve and domestic servants' rates rise, the degree of incompatibility between fertility and labour force work among relatively educated women will increase.

The third condition reducing the constraints imposed by fertility on women's work, as suggested above, was when the desired schooling of children was low (De Tray, 1974) or more generally where the desired input of parental time was small. If the cost of fertility includes the expected cost of raising a child to some normative educational level, and if a woman's domestic contribution reduces that cost, then a low educational norm will reduce the degree of incompatibility. If the family has only a slight ability to raise highly schooled children, or a very low perception of the need to do so, the degree of incompatibility will again be small.

The fourth condition reducing incompatibility was when work was done purely out of financial or economic necessity rather than out of intrinsic interest. If fertility norms are high, additional children will induce women to work more to meet increased consumption requirements. This may help explain high fertility combined with high rates of work activity among low-income women, if it is true that work done out of necessity does not influence fertility decisions (Chai and Myoung, 1976).

The fifth condition related to the arguments cited above suggesting that, for low-income families where women work in ''informal'' jobs, the degree of incompatibility was relatively small, and somehow this facilitated the combination of work and high fertility. Meanwhile, such combinations may actually highlight something more sinister. It is well known that women who have to work are more likely to reduce the period of breastfeeding which in turn reduce the periods of postpartum amenorrhea, reduce birth intervals, and raise fertility. The sixth condition reducing incompatibility was an ability and willingness to adjust the allocation of time to other activities, particularly leisure.

Four hypothesis were put forward by Vikat (2004) from the Finnish context in Finland which is a universalistic type of welfare state that provides relatively generous public support to families with children which undoubtedly reduces the incompatibility between labour force participation and childbearing. Such Finnish policies include support for a dual-earner family in the form of a high level of maternity and parental-leave allowances as well as a long period of its payment; a high level of day care services and the introduction of the child home care allowance (HCA). The hypothesis include:

Nordic Family Formation Pattern Hypothesis: The income replacement character of parental-leave allowance and the general value orientation towards a dual-earner family lead most women to complete their education and gain eligibility to these benefits and a certain acceptable level of income before they plan to have the first child. Therefore, first birth rates increase with income and are very low for women in education.

Woman's Income Effect Hypothesis: Through a contribution to the total family income, a woman's higher income helps couples to cope with the costs of rearing a two-child family and speed up the assignment of the two-child norm. A positive income gradient is expected in the risk of second births.

Uncertainty Reduction Hypothesis: Women whose alternative pathways for reducing uncertainty are limited or blocked are more likely to quickly move into parenthood. Thus women with poor prospects in the labour market have higher first-birth risk because they seek uncertainty reduction by motherhood. Other women, by contrast, reduce uncertainty through their work career and for them, motherhood would not mean uncertainty reduction to the same extent.

Childcare Leave Hypothesis: Women who make use of extended childcare leave related to the child (HCA) are either more family-oriented than those who do not take up this benefit or do not have high career aspirations. This is manifested in their higher propensity to have a second and third child.

3.1.4 The Fertility-Employment Relationship: Arguments for the Case of Developing Countries

Economic theories for industrialised societies have observed a negative relationship between women employment and fertility (Becker, 1965, Willis, 1973, Waite and Stolzenberg, 1976), but there have been criticisms about such Western theories and their applications to the realities of the African society stating that they are less suitable since some findings on African studies appear contradictory. These contradictions are in the form of no relationship between fertility and maternal labour force participation and a positive relationship (Togunde, 1988, Fapohunda, 1982, Mason and Palan, 1981). These deviations from the negative association between fertility and maternal labour participation have revealed the peculiarity of African societies such that women's market activities might not necessarily reduce their time for childcare. Togunde (1988) explained that the presence of relations and family members (such as older siblings, grandmother and mother-in-law who reside with a woman or with whom she can keep her child) act as support for women with children so that they can increase their time for work. He also stated that socio-cultural factors sustaining high fertility also account for the contradictory findings. According to Togunde (1988), two reasons for the non-consistent negative impact of women employment on fertility in Africa compared to Western countries are the extended organisation of an African family which provides mothers with child rearing alternatives, thereby reducing the costs associated with children of working mothers. The second reason is the patriarchial structure of most African societies such that women have little contributions to decisions on the number of children while husbands and or their relatives have greater contributions.

Mason and Palan (1981) also argued that an inverse relationship exists between the number of children and the working hours of a woman in developed nations and the industrial sectors of some developing countries but in the Third World, her work is often unrelated to her fertility or is positively related to it. The first reason for this is that the organisation of production in the rural Third World is kin and household-based. Women typically work on the family's farm or in a family-run business, grow or make goods at home for sale or do occasional work as domestic servants, tailors or market traders. These jobs do not necessarily restrict closeness to their children, thus they enjoy proximity to their children while they work and greater flexibility of scheduling work than women in the industrial sector. Second, there is a greater availability of parental surrogates, for instance, servants and extended family members, usually female that provide inexpensive and reliable babysitting support than is seen in Western countries. They also argue about other factors apart from the role incompatibility hypothesis, for instance, the impact of a formal educational system on a woman's fertility behaviour. With the presence of formal schooling, children are more likely to be sent to school rather than left at home to care for younger siblings. Educated mothers could appreciate more the benefits of personally providing childcare which include maintaining higher hygiene levels for increased child health and participating in the cognitive development of a child in the early years of childhood which have lasting impacts.

Many empirical investigations of the relationship between female labour force participation and fertility on LDCs show that economically active women have lower birth rates than non-economically active women, although the inverse association between female economic activity and fertility does not seem to be nearly as strong in rural as it does in urban areas; in fact in some rural studies, birth rates are positively correlated with female economic activity (McCabe and Rosenzweig, 1976). According to McCabe and Rosenzweig (1976), the choice variables available to a household in a LDC may be greater in number than those available to a household in an industrialised nation. For example, rather than being relegated essentially to the mother as is the case in Europe and the United States, a great deal of the childcare responsibility will be accepted by relatives and older children in LDCs. Moreover, unlike the industrialised nations, a large portion of the female labour force in less developed countries is employed in retailing and cottage-industry, an occupation in which on-the-job childcare is commonplace. Thus, differences in occupational (child rearing) compatibility may play an important role in fertility decisions and in the choice of the wife's occupation. They therefore state that the intensity of the wife's time in child services relative to other commodity services depends on a number of technical factors which may vary more among low-income countries than among more developed countries and these factors include: a) the ability to substitute purchased inputs for the wife's time in child rearing relative to other activities; b) the extent to which the rearing of younger children can be taken over by older children and /or adult relatives; and c) the compatibility of a particular female occupation with child rearing.

3.1.5 Economic Theories of Child Mortality

Several theories have attempted to explain the determinants of child mortality amongst which are the Mosley and Chen's (1984) analytical framework and the macro-social change theories (Frey and Field 2000). The Mosley and Chen (1984) framework incorporated social and biological variables and integrates research methods, employed by social and medical scientists. It assumed that all social and economic determinants of child mortality operate through a common set of biological mechanisms, or proximate determinants to finally impact on mortality. The theory argued that socio-economic determinants do not directly explain mortality; while the medical science approach makes use of proximate determinants, which have direct impacts on mortality (disease, infection and malnutrition which reflect environment contamination and dietary intakes that directly cause death). Therefore, a more comprehensive approach would involve a merge of both approaches.

The macro-social change theories explained the impact of macroeconomic and social policy variables on child mortality. They include modernisation theory, dependency/world-systems theory, gender stratification theory, economic disarticulation theory and developmental state theory. The theory of economic disarticulation explained that the problem of disarticulation which results in economic stagnation and uneven development is highly responsible for child mortality. Disarticulation exists when the various sectors of an economy are disconnected and unevenly developed. It attributed the primary cause of disarticulation to over-reliance on external markets and foreign capital. Developmental state theory attributes reductions in child mortality to activists because they allocate and redistribute resources in ways that promote public health and education for the masses as well. Economic growth fosters improvements in education, housing, nutrition, health care, sanitation and various public services that reduce child mortality. Hence the modernisation theory canvassed that economic growth can be achieved through industrialisation while the dependency theory emphasized overcoming economic overdependence relations between countries and low productive activities in order to achieve economic growth. The economic disarticulation theory promoted proper articulation of economic policies and strategies as a high determining factor of the child mortality reduction. Gender stratification theory related improvements in female status through improved female empowerment, education, nutrition and health care on child mortality. It advocated for increased economic, political and educational development for women who in turn are better equipped to cater for their child’s health.

Other economic theories include that of Maitra (2004) amongst others that emphasised the recent divergence from the unitary household or common preference model to collective or bargaining models which attempt to model an individual utility function that incorporates the various and conflicting preferences of different family members. Theories that have emphasised the role of parental leave or time away from work for childcare in determining child health outcomes include Ruhm (2000) and Tanaka (2005). Parental leave influences child health through the amount of time investments of parents. This time investments could be in the form of increased frequency and duration of breastfeeding which improves child health in the long run. Schultz (1984) explains that the health outcome of a child (mortality and morbidity) depends directly on the biological endowments of the child and on the proximate biological inputs to child health. Further, a child's health inputs depends on his/her biological endowments, outside the family's influence because it is a function of genetic and environmental conditions, called health heterogeneity, as well as economic endowments of human and non-human capital, prices, health programmes and education of the mother.

3.1.6 Economic Theories of Maternal Labour Participation

According to the price of time model as theorised by Willis (1973) and Becker (1965), there exists a positive and negative relationship between fertility and labour force participation of females. This is as shown in the income effect, where a mother who works more earns more wages to increase the household income and is more likely to have as many children as she desires. Nonetheless, there is the price effect such that since wage earnings increase with more hours of work, the price of time (opportunity cost of time) increases with having an additional child (since more time is spent on childbearing and rearing and a resulting wage loss).

Becker (1965) posited a negative relationship between income and family size because a woman would have to allocate her time between labour market and family activities with a view to maximising her preference function given the market wage and the opportunity cost of family activities. Hence, as income increases, there is a decline in the number of children per family. This is because increased income is associated with more hours of work and less demand for leisure. However, if birth control knowledge and some other variables were held constant, economic theory suggests a positive relationship. Willis (1973) showed that a wife's labour force participation decision depends on whether her marginal wage exceeds her price of time; she will always do some market work if her marginal wage exceeds the upper limit of the price of time.

Mincer (1962) was of the view that children are relatively time intensive by the negative relationship between the number of children in the household and the labour force participation rates as well as hours of work of married women. He explained that a positive substitution effect and a negative income effect exist in explaining the impact of wage rate variations on hours of work. Using the backward-bending supply curve of labour, he explains that the income effect is stronger than the substitution effect, suggesting that an increase in the wage rate will give rise to a decline in hours of work in the long run as labour could afford to purchase leisure as income increases at a given wage rate. In a family context, the assumption of a backward-bending supply curve does not guarantee a decrease in total hours of work for a particular earner, if wages of other family members are fixed. This importantly explains the unique labour force behaviour of married women.

3.2 Review of Empirical Issues

Examining the relationship between fertility, child mortality and maternal labour participation for a developing country, Siah and Lee (2014) investigated the short run and long run relationship and causality between female labour force participation rate, infant mortality rate and fertility in Malaysia. Employing a Granger-causality test and a cointegration test using the autoregressive distributed lag (ARDL) approach on data from 1970 to 2010, they found a cointegrating relationship when total fertility rate is treated as a dependent variable. The Granger-causality test finds causality running from female labour force participation to infant mortality in the short run without feedback. Also, fertility was found to Granger-cause infant mortality in the short run. In the long run, childbearing decision is Granger-caused by the infant mortality rate. Their long run ARDL result shows a positive lagged causal relationship between infant mortality and the fertility rate. Thus, with high infant mortality rates, couples tend to have more children to account for the possibility of child deaths. They found no evidence of the role incompatibility hypothesis in Malaysia since their result shows that having more children at home does not discourage women from participating in the labour force, neither do working women tend to have fewer children. This reveals the absence of an interrelationship between fertility and maternal labour participation. They concluded that female labour force participation has adverse effect on child health and fertility does not hinder female employment. They explained the absence of an interrelationship between fertility and female labour force participation as owing to the prevalence of informal childcare services in Malaysia, which enhances the return to work by mothers after childbirth. Though the study provides information on the existence and direction of their relationship, it does not provide information as regards the magnitude of the relationships. Also, only infant deaths are considered.

Considering the fertility behaviour that emanates from the uncertainty child mortality brings, some studies have shown that positive and negative relationships exist depending on parental preference for quality or quantity of children. Wolpin (1984) shows that life-cycle fertility within an environment where infant survival is uncertain has implications for the number, timing and spacing of children. Explaining the replacement effect of child mortality on fertility responses, his results showed that an infant death induces an increase in the number of children ever born. Therefore, the survival probability of a child has a negative effect on fertility.

Schultz (1973) divided the effect of child mortality on desired fertility into two such that child mortality affects first, the demand for survivors by increasing the expected cost per survival and second, the derived demand for births by increasing the number of births required to obtain a survivor. The positive relationship between the incidence of child mortality and the derived demand for births can be explained by parents being inelastic to changes in expected cost per survivor since they focus more on the future benefits expected from their mature surviving child.

Applying the perspective of economic growth and capital accumulation effects on fertility, Barro and Becker (1989) show that fertility tends to reduce with a high cost of raising children, however, only through an indirect channel when interest rates on capital are low. In explaining changes in the cost of rearing children, they identify an empirical example that a reduced rate of child mortality lowers the expected cost of raising a surviving child thus increasing fertility.

Investigating the effect of child mortality and access to land on fertility in rural Sudan, Maglad (1994) incorporated the wage from child labour since his study focused on a rural sector in a low-income country where agriculture is a major source of livelihood. Education was taken as a proxy for the wage rate because of the difficulty in measuring the wage variables, particularly for women who are not in the labour force. Assuming the mortality rate to be random and uncorrelated with fertility, the mortality rate is used as an instrument for the number of child deaths and the results show that child mortality is a highly significant factor influencing fertility, while the replacement effect coefficient is less than the OLS estimate replacement effect though both coefficients are positive. Considering the possibility of correlation between fertility and mortality rate, the number of child deaths was instrumented by a regional health dummy variable, which shows the presence of health care facilities in various regions. The result showed that the coefficient is negative but not significant. He explains the insignificance by the fact that health facility marginally affects the number of child deaths. Child death, woman's age and amount of land cultivated by the household have positive significant associations with fertility, with child mortality and age having the most influence. Using the Olsen method to correct for bias in the OLS estimate from the regression of the number of child deaths on fertility, the replacement rate was put at 0.63. The replacement rate coefficient from the IV estimation was 0.56, though not precisely estimated.

Some studies have evaluated the relationship between child mortality and fertility and have shown significant results. Surprisingly, high fertility directly reduces child mortality and delay in childbearing increases mortality rate (Rosenzweig and Schultz, 1983). However, a positive effect is observed when Bhuyan (2000) found that high parity women have high child loss in north-eastern Libya in the examination of the differentials in child mortality by fertility among 1,252 couples of childbearing ages in selected localities using the OLS method. Blackburn and Cipriani (1998) also proposed that fertility and mortality are positively related and a decline in fertility is usually preceded by a decline in mortality. Meanwhile, fertility tends to rise with PCI during the early stages of development in the United Kingdom.

Olsen and Wolpin (1983) examined the impact of exogenous child mortality on fertility using 1,262 households in Peninsular Malaysia and found families with high endowed mortality rates ultimately having more children so that families who choose to have high mortality by reducing their purchases of productive inputs also choose to have high fertility.

Benefo and Schultz (1996) found that high child mortality rates significantly increase fertility in Ghana and Cote d'ivoire. Using the OLS and the two stage least squares (2SLS), the effect of child mortality was statistically significant only when child mortality was assumed exogenous.

Handa (2000) also found that increasing rates of infant mortality significantly induce high fertility using a 1989 Jamaica Survey of Living Conditions. The influence of infant mortality however was non linear. Education and income also had a strong negative effect on births with the impact of education being higher.

Herzer *et al*. (2012) examined the long run relationship between fertility, mortality and income by estimating the long run effects of mortality and income per capita on fertility using Panel cointegration techniques for a 100-year, from 1900 to 1999 and 400 observations from some 20 countries geographically dispersed around the world. Fertility was measured as the CBR, mortality was measured as the crude death rate (CDR) while GDP per capita was used as a measure of economic development. Estimating the long run elasticities of fertility with respect to mortality and PCI, they find mortality was highly significant and positive while GDP per capita had a highly significant negative effect. Splitting all the countries used into two sub-samples of developed (OECD) and developing (Non-OECD), the result are still the same, showing no significant differences in the associations of mortality and economic development with fertility between rich and poor countries. Controlling for sample selection bias from using only 20 countries, they re-estimated for a second sample with 1,190 observations for 119 countries from 1950 to 1999. The positive significant relationship between fertility and mortality and the negative significant relationship between fertility and income are still recorded. Using infant mortality as an alternative measure of mortality, they find that the long run associations of mortality and GDP per capita with fertility are still positive and negative respectively. Thus, regardless of the sample and mortality measure used, the results were robust to different samples and measures of mortality. Conducting a Granger-causality test, they found that the growth of income per capita leads to reduced fertility. A decline in fertility also causes income growth to rise further. Thus, low fertility is a cause and consequence of successful economic development. Education was also found to be an important explanatory variable with increased average years of primary schooling significantly associated with reduced fertility.

Explaining fertility levels with respect to the effects of maternal labour participation, Waite and Stolzenberg (1976) showed that maternal labour participation has a substantial effect on the total number of children a woman has. Female autonomy and empowerment are enhanced by increased female labour participation, which in turn will increase the relative bargaining power of the mother within the household.

Eswaran (2002) showed that a couple's fertility decreases with a rise in a mother's relative bargaining power since they bear a greater share of the opportunity cost. Women's status and position are also seen to impact significantly on fertility decisions in a household (Makinwa-Adebusoye and Kritz, 1997). Killingsworth and Heckman (1986) also showed that female labour supply determines fertility in the United States.

Supporting the incompatibility hypothesis on the conflicting roles of being a mother and worker, in the relationship between maternal labour participation and fertility, Feyisetan (1985) examined the interrelationship between fertility and female employment in urban Lagos, Nigeria. Female employment in the formal and informal sectors was found to have a negative impact on the number of children ever born. Only female employment in the formal sector was statistically significant. On the other hand, fertility was found to have a statistically significant negative effect on female employment in the formal sector but a significantly positive effect in the informal sector.

Togunde (1988) is of the opinion that increased female employment is not a solution to the high fertility in Nigeria where strong cultural norms exist which promote fertility rather, increased women education is; since his multinomial logistic regression analysis shows a positive and highly significant employment effect on current fertility. This positive effect was found in formal and informal sectors of employment. Education however was negatively significant.

Emphasising the positive relationship between fertility and maternal labour participation, Mason and Palan (1981) estimated the effect of women employment on fertility with ever-employed women classified into employee, employer, self-employed and family worker in order to examine the comparisons between women who have never worked and those in incompatible versus compatible occupations. Their result showed little confirmation for the role incompatibility hypothesis because they do not find more negative employment-fertility relationships in all urban groups than in all rural groups; also women with adult female relatives in the home still do not show less negative employment-fertility relationships. They also find that unpaid family work is associated with low fertility in Malaysia. However, their only result that conforms to a priori expectation is a less negative employment-fertility relationship in households with girls who are between 10 and 15 years old than in other households. Female education is also associated with fertility decline. They however did not consider the effect of the bi-causal relationship established in the literature and control for the possible bias.

Desta (2013) also found a positive effect of fertility on the number of hours of work for women in Ethiopia on investigating the effect of the number of children on the mothers' time allocation in productive work participation. He did not consider the case for women outside the labour force. The data comprised 254 households of rural and urban married women with at least two live children. Employing the 2SLS method, the results show that when all households are considered, women with large number of children work for longer hours, this positive effect was observed in urban and rural areas. When households were categorised by the age group of children, it was observed in urban areas that there was a negative effect in households with large number of young children but a positive effect for households with more adult children. In rural areas, a positive effect is observed in households with large number of young children but a negative effect is observed when a household has more adult children. Therefore, more flexible work hours, proximity of workplace such as farm being close to the house and the need for large manual labour to help with farm and domestic chores explained the positive effect in rural areas.

Using a 1973 survey of 6,606 Nigerian women in Ibadan, Arowolo (1978) examined the factors that determine fertility and the degree of the effect. He notes that unskilled women workers such as petty traders and businessmen had higher fertility than skilled workers. Meanwhile, women who earned high income had high fertility while illiterates were seen to exhibit a low level of reproductive performance. He concludes that female employment status bears little relation to fertility in a transitional economy.

Examining cross-national patterns in the relationship between female labour force participation and fertility, Kasarda (1971) used aggregated census data from 50 countries and finds an inverse relationship exists between female labour force participation outside the home and fertility while there is an indirect relationship between unpaid family work and fertility. Heer and Tuner (1965) found an inverse relationship between labour force participation and fertility but were not able to control for marital status in a study involving 18 Latin American countries using child to women ratio (CWR) as a measure of fertility.

Bratti (2003) estimated a reduced form purist model of female marital fertility and labour force participation in order to examine the effect of formal education on both fertility and labour force participation behaviour. Data used was a sample of 1420 women from the 1993 survey of household income and wealth of the Bank of Italy. Accounting for the potential endogeneity of education, he estimated a multinomial logit model using a non-linear instrumental variables estimation strategy. The results show that increasing education has a positive effect on marital fertility. This positive effect he explains was as a result of the income effect and the greater opportunity of access to external private childcare for highly educated women. Notably, highly educated women postponed fertility for higher labour market attachment. The study however found no evidence of endogeneity of education with labour force participation and fertility.

Using a national survey data from Philippines, Rosenzweig (1976) employed a sequential choice framework for looking at the work-fertility relationship. The framework included current work status, past work experience, parity and birth expectations. He noted that parity and work experience influence current labour force participation and, to a lesser extent, birth expectations. Women working more in the labour force at every stage expect fewer children only in the later stages of childbearing.

Wusu (2012) examined the effect of female education and employment on fertility in Nigeria using data from four Nigeria Demographic and Health Surveys to cover over 18 years and only women of reproductive ages, 15 to 49 years. Education was measured using the highest educational attainment. Female labour participation was measured using whether a woman works at home or away and who she works for (an employee or self-employed). Fertility was measured using the number of living children and children ever born. Comparing the results using the four surveys separately, he observes that education had a negative effect on children ever born in all the four surveys, secondary education had the most influence on children ever born up to 2003 but by 2008, post-secondary education exhibited a greater effect than secondary education and concludes that post-secondary education had the strongest negative effect on fertility among women. Working away from home had a negative relationship with children ever born, so that women who worked away from home were likely to have a lower fertility than those working at home. This was obtained using all surveys except the 1999 survey. Self-employed women were found to have higher number of children ever born than women who were employees. Similar results were obtained using the pooled data. Using the number of living children as a measure of fertility, education was found to have a negative effect in the 1990 survey. Post-secondary education had the greatest effect. Working away from home was found to increase fertility while being self-employed also increased the number of living children. The study did not provide information based on the sector of employment nor considered women outside the labour force.

Analysing the relationship between women's labour market attachment and childbearing in Finland between 1988 and 2000 using data from the Finnish Longitudinal Fertility Register, Vikat (2004) found that the price of time effect, that is the opportunity cost in the form of forgone income and human capital accumulation would dominate among women such that those with higher earning potential would have a lower childbearing probability but this domination would decline as the labour market and family roles of men and women get increasingly similar. Also, the less incompatible employment and childbearing are, the smaller the price of time effects. The income effect which implies that higher earnings help the couple with the direct costs of childbearing and child rearing is more likely to be prominent among men but the smaller the differences between the wages of men and women, the larger the income effect of women would be. Examining the risk of first birth among 20 to 30 year old women, the result shows that full time education inhibits childbearing in Finland with the first-birth risk of women who study being less than half of the risk of employed or unemployed women. Non-active women also displayed a low rate of entry into motherhood compared to the employed and unemployed. Unemployed women between 20 to 30 years had the same propensity to become a mother as employed women did; however, the unemployed had a notably higher relative risk when earnings and education level were controlled for. Unemployed women with low secondary education had more risk of entry into motherhood among all the combined categories by activity and level of education of 20 to 30 year old women. The various categories of activity include employed, unemployed, studying and non-active. Women who studied also had low risk of second and third birth. Women who were neither participating in the labour force nor studying had a slightly elevated risk of second and third births. Unemployed women faced the same second-birth risk as employed women did, though their third-birth risk was higher than that of the employed and at the same level with the non-active women. The study concludes that a woman's earnings have positive effect on her giving birth to a first and second child in Finland and on the whole, her unemployment has a weak relationship with childbearing risks.

Kreyenfeld (2009) investigated the effect of uncertainties in female employment careers on the postponement of family formation or first-birth rates using data from the German socio-economic panel from 1984 to 2006. Unemployment was used as an objective measure of uncertainty while the subjective measures include, whether the respondent is worried about her economic situation and if she is worried about the security of her job. He finds that the relationship between economic uncertainty and first birth varies by level of education. Thus, highly educated women postpone parenthood when subject to employment uncertainties but women with low levels of education often respond to these situations by becoming mothers. Female employment was categorised into the employed; the unemployed, not in the labour force (which included housewives), and women who were into other activities.

Emphasising the endogeneity bias that exist in the fertility-employment relationship, several studies have shown that while employment affects fertility, fertility also affects employment. Waite and Stolzenberg (1976) examined the causality between fertility and maternal labour participation in the United States using a simultaneous equation model and found that while fertility has a small impact on labour participation, maternal labour participation has a substantial effect on the total number of children a woman has. Eckstein and Liftshitz (2009) used a time series data and their findings revealed that the arrival of a newborn child is likely to deter labour participation of women in the United States. Solomon and Kimmel (2009) tested the inverseness of fertility and labour supply and found it insignificant and rather positive for the Ethiopian case, while addressing the endogeneity of fertility by using the husband's desire for children as an instrument.

McCabe and Rosenzweig (1976) examined the relationship between fertility and female labour force participation in LDCs based on a household production framework in which the endogenous or household choice variables (such as desired family size and the hours the mother works) are jointly determined by a common set of exogenous variables. Using a large individual household sample for one LDC, Puerto Rico, the 1970 Public Use Sample with 3000 households, and an inter-country cross-section sample of 29 developing countries, their results show that from the Puerto Rico study, an exogenous rise in the female wage rate increases family size at the same time that it increases the amount of work performed by women in total and outside the home but female schooling reduces family size and the amount of work performed by women in total and outside the home. Thus, female educational attainment was found to have a direct negative linear effect on fertility, perhaps because of its association with contraceptive knowledge, but has an exponentially positive influence through the wife's wage. They also found that wives with high wages and thus with high fertility levels, tend to choose occupations with higher compatibility indices. The wage rate had a positive effect on the number of relatives in the household, showing that the substitution of relatives' time for mothers' time also occurred when wages rise but it was not significant. They explained the insignificance by the fact that a rise in all female wage rates raises the potential wage of the mother and of adult female relatives. The predicted female wage had a positive effect on children ever born, representing a greater preference and taste for children even while working rather than an increasing opportunity cost which a negative effect would have implied. From the inter-country results, using the CBR and urban child-woman ratio as dependent variables for fertility and the female proportion of the total non agricultural labour force as a dependent variable for labour participation, their results show that the predicted ratio of service to total female non agricultural labourers is highly significant in determining the CBR differences and urban child-woman ratios across countries but it is not significant to explain the share of women in the non agricultural labour force. They concluded that the substitution effect of a change in the wife's wage rate on her fertility, if negative, may be expected to be weaker in developing than in developed areas and indeed, under certain conditions, it may be expected to be positive in LDCs.

Longwe *et al.*, (2013) analysed the effects of the number of recent births and the spacing between the last two children on women's labour force participation in non-agricultural employment in Africa. Their data was from the Demographic and Health Surveys (DHS) of the various studies used and comprised over 200,000 married women with at least one child below six years from 242 districts in 26 African countries. Accounting for endogeneity in fertility and employment decisions, they instrument the number and spacing of recent births by unmet need for family planning. Their result shows that the number of recent births and short birth spacing negatively affected women's employment. Moreover, highly educated and urban women suffer most from these negative effects. They conclude that investments in family planning are likely to enhance the opportunities for women to work for pay. Other factors that they found to be significant in determining labour participation are education and urban residence. Both factors increase labour participation in non-farm employment.

Canning and Schultz (2012) were of the opinion that fertility declines are likely to have little effect on the female labour supply in the poorest developing countries, since almost all women in these countries already work, most work at home in rural areas and are generally self-employed or do unpaid work for their family. Thus, in such settings, childcare can be combined with work, which might be why the family programme in rural maternal labour had only a small effect on female labour market participation.

A contrary opinion is seen for developed countries, for instance, Japan as shown by the findings of Griffen et al. (2014). Using an annual panel data sample of 53,575 Japanese babies born between January 10 and17 as well as July 10 and 17 2001 from the Longitudinal Survey of Newborns in the 21st century, they employed the use of twins as an instrument for the total number of children and found that while exogenous increase in fertility as a result of twins initially reduces maternal labour supply, mothers with twins actually begin to supply more labour than non-twins mothers from around the time of entry of the twins into school. They also found that the presence of a child less than age six in the household increases the negative association between the number of children and maternal labour supply by approximately 50% when family size and other observables are held constant. They thus explain that the widely accepted negative relationship between fertility and maternal labour supply does not characterise the trade-off faced in Japan. They concluded that current policy agenda to increase the fertility rate and maternal labour force participation in Japan are actually not in conflict. The study however did not examine their interrelationship and examined a short period of less than a year.

On the compatibility of employment and fertility, Von Jacobi (2014) noted that women with high level of social participation in terms of active participation in community life through memberships in groups or sporadic civic engagement are less vulnerable because they achieve employment security and are better able to combine employment security and fertility. Using a multilevel analysis, factors associated with higher employment security in Ghana are high average schooling, social participation and high average wealth. Employment security did not correlate with fertility, in Mali, employment security was negatively correlated with high fertility levels.

Empirical findings on the impact of various other determinant variables on fertility are discussed below. The determinants of fertility can be categorised into intermediate and indirect determinants. Intermediate determinants have a direct influence on fertility. It includes the use of contraceptives and frequency of intercourse; indirect determinants include socio economic, cultural and environmental variables such as income and education (Bongaarts, 1978). Portner *et al*. (2011) investigated the effect of family planning on fertility in Ethiopia using a sample of 2,000 women from survey data and employing the OLS and the instrumental variables estimation techniques. The result suggested that access to family planning reduced the total number of children born to women without education.

Some economic determinants of fertility include income, female wage, education and household assets. Education is termed an indirect determinant of fertility (Bongarts, 1978). It has been identified as having a strong control for fertility rates, especially among women in the United States (Newman, 1983) and in Korea (Kim *et al.,* 2006). Education is found to have a strong negative effect on births with an impact larger than other variables (Handa, 2000).

Benefo and Schultz (1996) found women education associated with lower fertility in Ghana and Cote d'Ivoire. Household assets per adult was positively related to fertility in Cote d'Ivoire and negatively related in Ghana. Mothers' height used as a measure of her health status and productivity is positively related to her fertility in Cote d'Ivoire but has no relation in Ghana. Distance to the market predicts higher levels of fertility in Ghana.

Using a 1998 Family and Fertility Survey in Czech Republic, Klasen and Launov (2003) found that education and employment intensity have negative impacts on the number and timing of children as they raise the opportunity cost of women's time. The higher a woman's educational ambitions, the higher the opportunity cost of her time, hence, the less time she devotes to childbearing.

A study on Nigeria by Fagbamigbe and Adebowale (2014) found that employment status, educational attainment, age, region, marital duration, wealth quintile and age at first marriage affect fertility levels among women of childbearing age. They used the 2008 Nigeria Demographic and Health Survey (NDHS) consisting of 33,385 women. Examining the differentials in rural and urban fertility levels in Cross River

State, Ushie *et al*. (2011) noted that education; differences in age at marriage among rural and urban residents and contraceptive use are significant in explaining such differences. They employed data consisting of 340 rural respondents in Bendi and 540 urban respondents in Calabar involving all married and men and women who have ever married.

Shapiro (2012) examined the effect of women education on fertility in SSA. Using demographic health surveys from countries with multiple surveys to analyse aggregated data on changes in fertility, the generalised estimating equations method was employed. Cumulative fertility was measured as the number of children ever born. The findings were that fertility is low in places where women education is higher. Also, changes in infant and child mortality were significantly related to fertility decline though the study did not control for possible endogeneity. Thus, high educational attainment was a very important factor contributing to fertility decline along with reductions in infant and child mortality.

Higher educational levels are consistently associated with lower fertility rates as shown by Ayoub (2004) using data from the Demographic and Health Survey (DHS) 1996 covering women aged 15 to 49 in Tanzania. Employing the negative binomial regression technique, his findings were that women's schooling significantly reduced the number of children born per woman. Other significant determinants were the use of contraceptives, living in urban areas, and high income, all of which significantly reduced the number of children born per woman. Age and the cultural traits of son preference were found to significantly increase fertility among women.

McDonald (2000) examined the impact of gender equity on fertility and found that high levels of gender equity lead to reduced fertility levels. High levels of gender equity was proxied by high status of women in the form of high economic status of women, high educational attainment of women, high labour force participation rates of women and greater decision-making power of women within the family, (especially with respect to the number of children to have).

Amialchuk *et al*. (2011) examined the determinants of births in Belarus using data from the Belarusian Household Budget Surveys between 1996 and 2007. They focused on women within the ages of 15 and 44, with one year old children. They employed a probit regression to analyse the probability of birth, for all births, and separately for the first, the second and the third births. They controlled for the endogeneity of earnings to avoid biased estimates because at the family level, fertility may be closely related to other lifetime choices of parents, such as the amount of time allocated to work, the investment in the human capital of children, and savings to smooth lifetime earnings. Their empirical strategy was to use group averages of economic variables measured at the time of conception. Group level earnings were used instead of individual level earnings since group-level earnings are unlikely to be influenced by the earnings of any particular individual provided that grouping is done at a sufficiently aggregate level. Their result shows that the probability of having a birth was higher in rural areas, having a first and third births were negatively associated with housing ownership among women below 30 years for the first birth and above 30 years for third births. Total household income was significant with a higher probability of a second birth among younger women with higher income and a lower probability of first and third births among older women with higher income. Thus, there is a positive income effect among young women. They also found a strong effect of economic uncertainty on fertility such that the probability of giving birth among young and older women decreased with increase in household income.

Jara et al. (2013) also examined the determinants of high fertility status in Ethiopia using a sample of women from the Gilgel Gibe Field Research Centre database aged 20 to 49 who were married for at least five years. The logistic regression was employed and the result revealed that high fertility status is strongly associated with child death, monthly family income, age at first marriage, history of still birth experience and number of children desired before marriage. Women who got married earlier than 18 years were more likely than others to have higher fertility status. Women who experienced under-five deaths and those who had stillbirth experience were more likely to have a high fertility status than those with no such experience. Also, women who had a high monthly family income were more likely to have a high fertility status than those with low monthly family income.

The microeconomic theory of fertility explains that children are a special kind of consumption good so that fertility becomes a rational economic response to the consumer’s demand for children relative to other goods (Todaro 2009). Like most commodities, if children are assumed to be normal goods (demand for them rises with income), an increase in household income would increase their consumption by parents but if they are inferior goods (demand for them falls as income rises), the household income effect would be negative. However, the income of a husband or a wife has been found to have different effects on child demand, so that though husband’s income has a positive impact on fertility (Kim et al. 2006) except in cases where preference for quality children is higher (Becker 1960), a woman’s income is expected to have a negative effect since the higher her wage, the higher her productive time at work while postponing childbearing. Lower fertility is thus attributed to a higher cost of women’s time (Kim, 2007). Having an additional child therefore would reduce her time for productive activities and hence, her income. Wealth is found to have a positive relation with fertility and a negative relation with the net cost of rearing children and investing in their human capital (Becker and Barrow, 1988).

Other indirect determinants of fertility could be social, cultural and environmental variables such as cultural norms, birth intervals, and life expectancy. Many African communities that have high levels of infertility are also known to have high rates of fertility as a result of the societal stigma attached to being infertile and as such, high fertility rates are driven in part by the persistently high rates of infertility and the negative cultural norms regarding infertility (Okonofua *et al*., 1997). The contrast could be explained as the desire for women to disassociate themselves from infertility and as such would prefer to have a high parity to prove their fertility. Okonofua *et al*. (1997) explains the social consequences of infertility in Nigeria as consisting of personal grief and frustration, social stigma, ostracism and serious economic deprivation. Thus, fertility gets to be promoted intentionally and unintentionally in Nigeria.

The high value placed on children has encouraged high fertility rate in Nigeria as explained in Ibisomi (2008) who explored the role of desired number of children on the observed fertility changes in Nigeria using a qualitative methodology involving collecting information from 24 focus group discussion conducted using participants from Imo, Kano and Oyo states. The three states represented three geopolitical zones depicting the three main ethnic tribes in the country. The study finds that people desire a high number of children and that economic hardship constraining the provision of quality education and care to a large number of children have caused a revise in the number of children people have. Reasons for the number of children desired centered on the fact that their desires were strongly influenced by the value attached to children and the cost and potential benefits. The study concludes that though most Nigerians are reducing the family size, there could be a reverse with improvements in the living standards and liquidity in the economy.

Milazzo (2014) examined the effect of parental preference for sons than daughters on fertility and family structure in Nigeria. The study found that compared to women with first-born sons, women with first-born daughters have (and desire) more children and are less likely to use contraceptives. Women with daughters among earlier-born children are also more likely to have shorter birth intervals. This poses a high risk for child and maternal health. Data used was from the 2008 NDHS and focuses on women aged 15 to 49, with at least one child ever born.

Women empowerment and independence contributed to reducing fertility levels as shown in Nwakeze (2007) who investigated the determinants of the demand for children in Anambra State of Nigeria, using data from a household survey conducted in 2000 which involved interviewing 1,787 respondents using questionnaires. The study focused on ever-married women within the childbearing age bracket of 15 to 49. The results from the logistic regression employed show that women who contributed more than 50 per cent of household expenditure are less likely to desire more than four children than those who contributed less than 50 per cent. Also, women who contributed more to household expenditures have more decision-making powers on the number of children to have. Women who possess productive resources such as land or landed property are likely to desire more than four children than those who do not. Women economic dependence on men adversely affect their decision-making power in the household on the number of children to have. Women who work in the informal sector are likely to desire more than four children than those working in the formal sector. Urban women are less likely relative to rural women. Religion had a significant effect, while wife's education and age were insignificant. Income had inconsistent result. The study concludes that a fall in the demand for children is possible only if women are economically independent and autonomous in decision-making in the household.

Contributing to the role of women empowerment, Kritz and Makinwa-Adebusoye (1996) measured the effects of women's work and earnings control on the demand for children using two states, Kano and Ondo states to represent two ethnic groups - Hausa and Yoruba and a 1991 survey data of married women aged 14 to 40. They employed the logistic regression to examine the determinants of demand for no more children, a multinomial regression to examine the determinants of desiring more children while the OLS was used to examine the determinants of number of additional children. Their results showed that Yoruba wives are almost twice as likely to say no more children than their Hausa counterparts. The demand for no more children is positively associated with wife's age, urban residence and number of live children. A rural wife, polygamous wives and wives with primary or secondary education are likely to say no more children. The effects of wife's work/earnings control are positive and significant in both groups but more so for the Hausa. This shows that the effects are stronger for the Hausa.

Life expectancy has been identified as one major determinant of fertility in developing countries (Winegarden, 1980). The low survival level leaves parents with no option than to have many children so that they could have some left even if others are lost to the prevailing high mortality risk. Type of marriage union, whether monogamous or polygynous was found to have no effect on fertility levels in Nigeria (Ahmed, 1986). Interest rates and the degree of altruism have a positive relation with fertility but negatively relates to the growth rate of per capita consumption; war and depression have a negative significance on fertility initially and a positive one subsequently (Becker and Barrow, 1988).

Explaining variations in fertility in Israel, Ben-Porath (1974) examined the impact of parent education, cost of time of women and the full price of children. Using the family expenditure survey 1963/64 and the ordinary least squares regression technique, the result showed that categorising his sample into three, based on origin, husband's education does not seem to play any role in one sample, men with no schooling reported having more children than others in the second sample and husbands who acquired little education had lower fertility than those with higher education. Husbands' earnings used as a proxy for household income show no clear direction. Woman's education had a negative effect on the number of children ever born among working and non-working women. He emphasised less on budget-restraint variables or opportunity factors such as wage, income, household productivity as well as price of contraception and more on schooling, age and duration of marriage as proxies for the budget restraints, which would have been responsible for the biases in his estimates as critiqued in the study.

Applying a 2SLS estimator, Rosenzweig and Evenson (1977) analysed a simultaneous equation model of the importance of the economic contributions of children in determining family decisions on fertility in rural India. Their result showed that reducing the inequality of land holdings increases family size, land size has a positive significant effect on fertility. Husbands;, woman's and child's wages are insignificant to explain the number of children per woman for children aged 0 to 4 years. However, the number of children per woman (5-9 years) is significantly influenced by all the wage coefficients, such that, a rise in the wage rates of adult women by ten per cent would decrease the (5-9 years of age) child-women ratio by almost eight per cent, emphasising a substitution effect over an income effect. A rise in the child wage rate by ten per cent would increase the (5-9 years of age) child-women ratio, while an increase in the wages received by adult males would increase the family size by three per cent. Thus while the woman's wage rate has a negative effect, the child and adult male wage rates have positive effects. Women education above the primary level is negatively significant while male education has little relation to family size. The degree of urbanisation is insignificant. Rafalimanana and Westoff (2000) examined the effect of birth spacing preference on fertility in SSA and noted that longer birth spacing is effective in reducing fertility rates. This is because the desire to lengthen birth intervals could drive the fertility transition initially, since if the intervals between births could be extended, the birth rate would be lowered as childbearing is postponed.

According to Lee and Bulatao (1983), the demand for children in developing countries is usually a decision of not just the couple but influenced by the interest of grandparents whose fertility preference is usually higher than that of parents; the interest of husbands who usually favour higher fertility than wives and that of children who usually have the lowest fertility interest. Modernisation plays a significant role in fertility decisions in developing countries, also referred to as development, it covers a broad range of transformations in sociocultural systems, which include improvements in technology, change in labour relations, increases in the effectiveness of administrative systems that provide education and medical care. Two broad interpretations of the effect of modernisation on fertility are; first, it makes latent demand for fertility effective and second, it ultimately if not immediately reduces the demand for children. Since modernisation can affect the supply of children or the costs of regulating fertility, for instance, through family planning programmes, the latent demand for fertility becomes effective when control becomes feasible. One other factor is the benefits from children, from their labour services, which makes them net producers or net contributors. Their economic value whether positive or negative, varies across cultures, institutional settings and socio economic classes, as well as with the availability of agricultural land and other inputs complementary to labour and the state of technology and how this value changes in different modernising societies. Improved child survival increases the net value of surviving children since it reduces the number of births and therefore, the costs necessary to acquire that child.

Fertility reduction is positively significantly associated with old couples, spousal communication on family planning, education and media exposure (Oyediran and Isiugo-Abanihe, 2002).

Some contributions on the relationship between child mortality and labour force participation of mothers showed that household income and female employment cannot be overemphasised for reductions in the number of child deaths since low levels of income which results in absolute deprivation (including lack of food and clean water) adversely affect health. As the family earns more income, the welfare of a child improves thus more expenditure on the food and healthcare of children will reduce child mortality (Eswaran, 2002). Handa (2000) found income significant among rural women but not among urban women.

Explaining the impact of female employment and empowerment on child survival, the probability of a child dying is greater for an employed mother than for one who does not work as a result of the lack of time for childcare, especially among the poorer sections of a population (Basu and Basu, 1991). Other studies argue that infant mortality is less, if mother works, suggesting that the benefits accruing from mother's earnings outweigh any decrease in her time for childcare (Rosenzweig and Schultz, 1983).

Using the 1981 India census data, Tulasidhar (1993) examined the impact of maternal education and female labour participation on child mortality. Education was found to have an effect three times stronger than that of the female labour force participation rate for male and female children. Meanwhile, both variables have a significant negative effect on child mortality. When the education of women is disaggregated, labour force participation rate still had a negative effect on female and male child mortality but it was significant among women who have attained seven years and above of education and insignificant for women who were illiterates or had up to seven years of education. Using the relative excess female child mortality as a measure of child mortality, calculated as the ratio of female child mortality to male child mortality, the length of education and female labour force participation were inversely related with relative excess female child mortality and statistically significant. Female labour force participation had a stronger influence in explaining excess female mortality than in explaining the absolute level of male and female child mortality. Tulasidhar (1993) explained that the impact of female labour force participation on child mortality are in two forms; first it can have an adverse effect on child health due to less than full attention from the mother and a possible denial of the benefits of breastfeeding especially in poor families where a mother has to participate in the labour market soon after delivery to increase household income. Second, a mother's work force participation has a positive effect on child nutrition and health thus reducing child mortality because it increases total household income and consequently, childcare expenditures. The study however did not consider the possibility of endogeneity bias.

On the other hand, poor child health has been found to hinder maternal labour force participation as shown by Frijters *et al*. (2009). They used data from the Longitudinal Study of Australian children for the year 2004 to examine the effect of child development on maternal labour supply. Their findings showed that poor child development decreases maternal labour force participation by approximately 10 per cent. Thus, mothers of poorly developing children may rather stay at home to care for their children. They controlled for the potential endogeneity of child development using an instrumental variables approach, the 2SLS method which involved the use of child handedness as an instrument. The study however was limited to less than 5,000 children aged 4 to 5.

The determinants of mortality could be economic (household income, female employment, wealth), cultural (traditions, beliefs and norms), social (parents' education, mother's employment, mother's birth spacing preference/use of contraceptives), demographic (mother's age, birth order, mother's parity), environmental/sanitary (place of residence, safe water availability, type of toilet facility), or health factors (lack of immunisation, poor nutritional status, presence of disease such as malaria, tetanus, diarrhea, measles and acute respiratory disease). Several studies have found a negative relationship between high maternal educational level and the possibility of infant death (Desai and Alva, 1998; Caldwell, 1979; Adlakha and Suchindran, 1985; Kembo and Van Ginneken, 2009; Caldwell, 1990; Caldwell and McDonald, 1982). Education brings about changes in individual health behaviour in favour of child's health and the use of modern health services. Mothers become more inclined to adhere strictly to hygiene rules, immunisation schedules and to seek safe drinking water, thus promoting child health (Cutler *et al*., 2006).

Examining the differentials in child mortality by fertility in north-eastern Libya among 1,252 couples of childbearing ages in selected localities, Bhuyan (2000) observed a decreasing trend in child loss with an increase in the educational level of mothers. Employing the OLS, the study found that in addition to mothers' education, favourable economic conditions of parents, increased number of earning members in the family and increased age of mother at marriage would reduce the child mortality level.

Emphasising the relevance of the socio economic status of a household for controlling infant and child mortality, studies have shown significant effects of access to toilet and electricity (both used as proxies for household socio economic status), power source, source of water and overcrowding in lowering infant and child mortality (Pant, 1999; Kim, 1988, Bollen *et al*,. 2001, Ahonsi, 1995, Kembo and Van Ginneken, 2009, and Kuate, 1994). It has been found that poor water availability and toilet facilities tend to increase infant and child mortality (Sastry, 1996). Hence, it is important that safe drinking water and adequate toilet facilities that enhance sanitary practices be part of household residence.

Akinyemi *et al*. (2013) identified poor access to potable drinking water, sewage disposal and short birth intervals as important factors increasing childhood mortality risks. Using data from the (NDHS) between 1990 and 2008, the Cox proportional hazards regression was employed to determine the relative contributions of some factors to the under-five mortality risk. Factors associated with a decline in under-five mortality included increase in the proportion of mothers with higher educational qualifications and a decrease in the proportion of births below 24 months. Notably, a reduction in access to improved source of drinking water resulted in a rise in mortality risk during1990 to 2003 and 1990 to 2008.

Amouzou and Hill (2004) also examined the association between socio-economic status and under-five mortality between 1960 and 2000 in SSA. Socio-economic status was proxied by PCI, illiteracy and urbanisation. Using the random effect regression model, they found a negative relationship between under-five mortality and PCI. Illiteracy was positively associated with under-five mortality while urbanisation had a negative association. While the effect of PCI was found to have increased in the past decade, the effects of urbanisation and illiteracy had diminished. They concluded that socio-economic factors have strongly contributed to the decline in child mortality in SSA between 1960 and 2000.

Longer birth intervals and higher mother's age at birth are associated with better health and higher attainment of the child in later years (Gemperli *et al.*, 2004, and Bicego, 1990), hence, longer birth intervals increases the quality of the child (Newman, 1983, Manda, 1999, Dashtseren, 2002, Gubhaju, 1986 and Rafalimanana and Westoff, 2000) and children born to very young and very old mothers have a high probability of dying (Hobcraft et al. 1985 and Dashtseren, 2002). Child mortality increases with an increase in parity after the second birth, because the higher the parity, the shorter the birth interval which has a high risk of death for a child (Hobcraft *et al*., 1985).

Ruhm (2000) finds a stronger negative effect of parental leave on post-neonatal and child mortality than for perinatal mortality and neonatal deaths. Other determinants such as poor health state and the prevalence of illness (Victora and Barros, 2001 and Fikree *et al*, 2002), child's sex (Gemperli *et al.*, 2004; Dashtseren, 2002; Pena *et al*,. 2000 and Olsen and Wolpin, 1983), public policy in terms of the provision of medical care coverage, adequate level of physician density (physician per 1,000 population) and increased health care spending (Farahani *et al.*, 2009; Chung and Muntaner; 2006 and Hanmer *et al.*, 2003), poverty and income inequality (where a particular social class is alienated from basic amenities contributory to hygiene and health) (Schell *et al.*, 2007; Macinko et al. 2006; Waldmann, 1992 and Shi *et al.* 2004) child's place of birth, rural and urban residence (Adetunji, 1994; Adlakha and Suchindran, 1985; Iyun, 2000; and Clarke, Farmer and Miller, 2010) have been identified as significant causes of higher incidence of child mortality.

Ezeh *et al*. (2014), analysing data from the 2008 NDHS consisting of 36,298 households from which they obtained information on 27,147 singleton live-borns, found that factors significantly associated with high child death in Nigeria include short birth intervals, mothers being younger than 20 years, rural residence, low birth weight, male gender and caesarean section delivery. Using the NDHS of 1999 and 2008, Aigbe and Zannu (2012) conducted a spatial analysis of infant and child mortality rates among the six geopolitical zones in Nigeria. Their results showed that the highest under-five mortality rates clustered in the North-West and North-East, the South-East had the medium rates while the lowest cluster of under-five mortality rates were found in the South-West and part of the North-Central zone in 1999. However, in 2008, the cluster of high under-five mortality rates were found in the North-East and North-West, moderate clusters in the South-East and North-Central while the South-West and South-South show clusters of low under-five mortality rates. Generally, high under-five mortality rates were recorded in rural than urban areas.

Examining the determinants of maternal labour participation, Lisaniler and Bhatti (2005) found that the probability of participating in the labour force increases significantly with education, women within working age and area of residence but insignificantly reduces with marital status in North Cyprus. Male income and female wage rates contribute more than 50 per cent of observed variations in labour force participation of married women in the United States while husband's income and fertility (measured as the presence of children under 6 years) have a negative effect, a wife's earning power has a positive effect (Mincer, 1962). Using worked for pay as a measure of labour supply/employment; Solomon and Kimmel (2009) found mother's education, urban/rural residence, religion and household wealth significant to explain labour supply, however, fertility, husband's income, age and adult household member are insignificant in explaining a mother's labour participation in Ethiopia. Ackah *et al.* (2009) found that women's educational attainment and fertility determine their labour force participation in Ghana positively and negatively, respectively. Eckstein and Liftshitz (2009) found that increased years of schooling and rise in female wages will cause a rise in married female employment.

Aromolaran (2004) examined the effect of female schooling on labour market participation of married women and non-market productivity in Nigeria. His result showed that additional schooling increased labour market participation; specifically, primary education increased participation and productivity in non-wage work or self-employment while additional years of post-secondary education increased participation and productivity in wage employment by 15.2 per cent. Having a husband with high educational attainments is likely to strengthen these effects.

Examining the impact of culture and spatial differences on women labour supply in Nigeria, Iwayemi and Olusoji (2013) employed a logit model and a Heckman two-stage procedure. Their results showed that age, education, ethnic origin, income, residing in the South-East zone and PCI are positively related to labour force participation for urban dwellers while living in the North-Central and North-West zones, religion, unemployment rate and having children under six years has negative effects. They also found women aged 45 and above are more likely to participate in the labour force in the urban area compared with those aged 15 to 24. Women with tertiary education are more likely to participate in the labour market than those with no education. Women labour market participation is higher among the Yoruba ethnic group than among the Hausas. It is also higher for women from the South-East compared to those from the South-West, but higher in the South-West than the North-Central and North-West. Labour market decisions of urban women were found to be more affected by PCI than by the unemployment rate. Rural women aged 15 to 24 are more likely to participate in labour market than urban women probably because urban women are more likely to be schooling. The number of hours worked by married women was found to be negatively influenced if a child is female, having a tertiary education, and residing in the North-West zone. Iwayemi and Olusoji (2013) also found that family size and urban location positively influence the magnitude of hours supplied by women. Among non-married women, tertiary education and urban location had negative significant effects.

Perticara (2006) examined the determinants of a woman's decision to enter an inactivity period or to quit working using the 2002 Social Protection Survey in Chile. Evaluating how the birth of a child can affect the woman's decision to work, the study included women strongly attached to the labour market and another group that participates in the labour market on a sporadic basis. The result showed that having a child increases the risk of leaving employment. The hazard of entering an inactivity period after the woman in each generation has given birth to a child increases as the generations get older. Even after one year of the birth of a child, a woman who is still working faces a 50 per cent higher risk of leaving employment. The greater the actual labour experience, the lower the probability of entering an inactivity period; and the greater the number of years the woman has remained inactive in the past, the greater the probability of re-entering an inactivity period. Broader insights would have been provided if the study had considered the sector of employment of the woman and endogeneity issues. Mullahy and Sindelar (1996) find that problem drinking negatively affects the employment status of females.

3.3 Review of Methodological Issues

Fertility studies have made use of measures such as total fertility rate, total number of births (Handa, 2000; Togunde, 1988), number of children born (Benefo and Schultz, 1996), and children ever born (Maglad, 1994; and Feyisetan, 1985). Recent fertility such as whether a woman is pregnant or was pregnant in the last 12 months has been used to analyse flow regressions (Handa 2000). Handa (2000) estimated the determinants of fertility using two common measures of fertility - the total number of surviving births (the stock of children) and whether the woman was either pregnant or had given birth in the last 12 months, representing the flow or addition to the stock. He employed the OLS in estimating the determinants of number of births. He also used the probit regression and instrumental variables estimation in analysing a probit model of the impact of desiring a child on recent/current fertility to control for endogeneity.

The multiple linear regression model is also a useful tool for fertility analysis. It was used in estimating the impact of birth spacing preferences on fertility with statistically significant results; however, this is subject to the absence of endogeneity problems (Rafalimanana and Westoff, 2000).

Milazzo (2014) employed two estimation techniques in examining the effect of parental preference for sons than daughters on fertility and family structure in Nigeria. The first is the OLS method used to estimate the effect of son preference on the number of children ever born. The second is the probit regression used to estimate the effect of son preference on the probability of desiring more children and using contraceptives.

Fertility studies have applied methods varying from the OLS to limited dependent variable models, structural equations and instrumental variables. Examining the relationship between fertility and child mortality, Chowdhury (1988) used the Granger-Causality approach for a study of 35 developing countries and found that child mortality and fertility have a two-way causality effect in Nigeria. This supports the need to control for endogeneity bias.

Statistical biases in the estimate of the impact of child mortality on fertility as a result of the presence of endogeneity can be handled using structural equations that employ instrumental variables (Benefo and Schultz 1996). For instance, Rosenzweig and Schultz (1983) as well as Maglad (1994) corrected for the endogeneity bias caused by the fertility and child mortality relationship by using a 2SLS estimation approach.

Estimating the effect of child mortality on fertility, Olsen (1980) determined a proper measure for child mortality. He argues that using the number of child deaths as a measure leaves the least squares bias caused by endogeneity, however, the mortality rate can be an excellent instrumental variable thus avoiding the bias provided certain conditions hold, that is, the mortality rate is not correlated with (the error term in the fertility model) fertility. He explains that the advantage of using the number of children is that it directly models the behaviour of the effect of an additional child death on fertility unlike the indirect effect derived when mortality rates are used. Also, while the use of mortality rates require that the last child be given birth to before the final response to mortality is made, using the number of child deaths allow a family to follow a sequential adjustment strategy to child mortality. Effects of mortality on fertility decisions can be examined with the assumption that the mortality rate is constant across all women or with a random mortality rate, this is more realistic since some heterogeneity is to be expected if only due to physiological factors.

Trussel and Olsen (1983) evaluated the Olsen (1980) method of estimating the response of fertility to child mortality, which involved the calculation of the replacement rates for births to a child's death. To estimate the extent of child replacement, data on the number of child deaths and the number of children ever born are required. The technique involves first running a regression of the number of child deaths on the number of births using the OLS or IV estimators and then correcting the regression coefficients so that the estimate of replacement obtained is consistent. They found the technique effective when they applied it to a simulated set of reproductive histories for which they knew the true extent of replacement.

Explaining income effect on fertility, Willis (1973) debates on the right proxy for the income variable by emphasising that husband's current income poses as an error-ridden measure of the income variable relevant to fertility decisions. This is because it is usually observed much later in the marital life cycle while fertility decisions take place relatively early. Hence, the expected value of the husbands' life cycle income as at the time childbearing decisions are being taken would be more relevant. Using two measures of husband's income – current income and expected husbands' income at age 40, husbands' current income and wife's education had negative significant effects but husbands' income at age 40 had a positive significant effect. Also, the absolute magnitudes of the coefficients involving current husband income were smaller in magnitude and had lower t-ratios than the corresponding coefficients of the regression involving husbands' income at age 40. He therefore concludes that a long run lifetime income concept is relevant to fertility behaviour.

Using a generalised waiting time regression model, Olsen and Wolpin (1983) estimated the effect of exogenous child mortality on fertility in Malaysia. Fagbamigbe and Adebowale (2014) employed a poisson regression model to predict expected fertility among Nigerian women of childbearing age but did not control for endogeneity issues.

Studying the relationship between fertility and maternal labour participation, Waite and Stolzenberg (1976) employed a simultaneous equations model to examine causality, while a two-stage regression involving the OLS and a probit model was used by Solomon and Kimmel (2009). They addressed the endogeneity of fertility by using the husband's desire for children as an instrument.

Killingsworth and Heckman (1986) expantiated on some methodological issues regarding the labour supply function associated with specification and measurement problems. Most specifications present the hours of work as a function of the market wage, wage of other family members and other demographic variables. Meanwhile, this specification captures the labour supply of only workingwomen, which is not representative of the entire female population, which includes non-working women. Solving this problem would mean using data only on working women but this subject the estimates obtained to sample selection bias. In addition, the fact that the market wage of non-working women cannot be observed constitutes a measurement problem. To minimise measurement problems and avoid specification bias, it would be necessary to estimate not only the labour supply model specified in relation to hours of work but also other models of work behaviour such as the choice/decision to work.

Correcting for endogeneity, Feyisetan (1985) employed the 2SLS in analysing the interrelationships between fertility and female employment in formal and informal sectors using a survey on Household Structure, Family Employment and the Small Family Ideal for 1974. Hotz and Miller (1988) tackle endogeneity by estimating a life cycle fertility using the Generalised Method of Moments (GMM) and a labour supply equation using the Heckman two-stage estimation (which takes care of censored data as a result of mothers with zero labour participation in the hours of work model) and the Full Information Maximum Likelihood (FIML).

Other efforts to control for endogeneity include Longwe *et al*. (2013), Griffen *et al*. (2014) and Frijters *et al*. (2009). Longwe *et al*. (2013) analysed the effects of the number of recent births and the spacing between the last two children on women's labour force participation in non-agricultural employment in Africa using an instrumental variable model and a two-step estimation method which involved an OLS method and a probit method.

Examining the effect of fertility on maternal labour supply, Griffen *et al*. (2014) estimated a linear probability model for maternal employment using the instrumental variables method where a twin birth was the excluded instrumental variable defined as equal to 1, if a mother experienced a twin birth during her first birth in 2001. Frijters *et al*. (2009) also employed a 2SLS estimation method involving the use of child handedness as an instrument to control for the potential endogeneity of child development in a maternal labour participation model.

Some studies have controlled for unobservable heterogeneity and endogeneity by using different estimators including the FIML and GMM in analysing simultaneous equations probit models (Guilkey *et al.*, 1992), and binary outcome models with endogenous explanatory variables (Bollen *et al.*, 1995). The model in Bollen *et al*. (1995) involved a binary measure of contraceptive use and a measure of the family's desired number of children, treated as continuous and susceptible to unobservable heterogeneity bias and use different estimators: probit model, two-step probit estimator, the conditional maximum likelihood (CML), FIML, GMM and LISREL and use the Monte Carlo experiment to determine the performance of all these estimates. Since they found that desired number of children was exogenous, the simple one-step probit model was favoured as more relevant.

Togunde (1988) employed the multinomial logistic regression in estimating the effect of female employment on fertility in Nigeria, categorising women into three - employed in the formal sector, employed in the informal sector and not working. Differentials across ethnic groups, family structure and women's social positions were considered, however, the potential endogeneity of fertility was not controlled for to avoid bias.

McCabe and Rosenzweig (1976) employed a theoretical framework based on the theory of time allocation to examine the relationship between fertility and female labour participation. They modified the theory used to include choice variables that capture the work and childcare peculiarities of households in LDCs where the compatibility of employment and childbearing is usually higher. Such variables include the number of domestic servants employed by the household, number of relatives living in the household, wife's location of occupation (whether her occupation is carried out inside or outside the home) and a compatibility index; that is, some ordinal measure of the childrearing compatibility of the occupation chosen by the wife.

Vikat (2004) analysed the relationship between women's labour market attachment and childbearing in Finland by estimating three models for the risk of a first, second and third lifetime births using an intensity-regression involving proportional hazard models with piecewise constant specification of the baseline intensity.

Various studies have employed different methodologies to analyse the determinants of child mortality. Handa (2000) estimated the determinants of the number of child deaths using the OLS. Logistic regression has been employed to estimate limited dependent variable models of child mortality (Desai and Alva, 1998; Dashtseren, 2002; Adetunji, 1994; Madise and Diamond, 1995; and Adlakha and Suchindran, 1985). The hazards regression has been used to capture the duration (Pena *et al.*, 2000; Maitra, 2004; and Kembo and Van Ginneken; 2009); Chung and Muntaner (2006) employed the GMM and a dynamic regression model to provide short and long term estimates. Oni (1988) used the 'indirect' demographic estimation technique.

Addressing the issue of health unobservability, the multiple indicators-multiple causes (MIMIC) models was used (Shehzad, 2006). Solving heterogeneity bias, longitudinal regression analysis was used by Macinko *et al.* (2006) and Shi *et* *al*. (2004) while panel regression was employed by Ruhm (2000) to analyse parental leave effects on child mortality.

Endogeneity and self-selection bias of health inputs in the child mortality model informed the use of the FIML method in Maitra (2004).

The determinants of maternal labour participation have been studied using various methodologies including a binomial logit analysis employed by Lisaniler and Bhatti (2005), while a simulated method of moment estimation was used by Eckstein and Liftshitz (2009) to correct for the inability to specify the likelihood of observations of each individual, using a cross section data as well as the fact that such data imply that certain parameters are weakly identified and unobserved heterogeneity cannot be estimated.

Aromolaran (2004) used the General Household Survey and employed a linear probability model and a probit model to examine the effect of female schooling on labour market participation of married women and non-market productivity in Nigeria. However, sectoral differences including formal or informal sectors of employment as well as locational influences such as urban-rural residence or geopolitical zone residence were not addressed.

Examining the impact of problem drinking on the probability of employment and unemployment, Mullahy and Sindelar (1996) extended the use of the GMM estimation of a linear probability model to analysing a two equation system in which there is an endogenous regressor to correct for unobserved heterogeneity and endogeneity.

CHAPTER FOUR

THEORETICAL FRAMEWORK AND METHODOLOGY

4.0 Introduction

The theoretical framework employed in this study is presented and discussed in this chapter. The methodology comprising of the model, estimation technique and procedure, as well as the data used and its source are explained in this chapter.

4.1 Theoretical Framework

The theoretical framework employed in this study is based on two theories. The first is the New Home Economics Model, derived from Becker (1965) theory of the allocation of time which examines the role of female employment and wages on fertility. The second is Olsen (1980) theory of child mortality effects on the number of births. Both theories examine fertility behaviour and decisions. This study leans on some simplifications of the Becker (1965) model as presented by Fulop (1977) and Ben-Porath (1974).

The main assumption of the theory is that children are like consumer durable goods from which parents consume a flow of services. The family is attempting to achieve numerous consumption goals with limited resources and parents compare their utility derived from children with that from other goods. The services of children and the parents' standard of living are assumed to be non market commodities produced within the home, with the inputs of the wife's time and market goods according to household production functions, whose properties are determined by the state of technology.

The four main elements of the theoretical structure of the model are: a utility function with arguments that are not physical commodities but home produced bundles of "attributes"; a household production technology; an external labour market environment providing the means of transforming household resources into market commodities; and a set of household resources constraints.

The model begins with a lifetime utility function, in which a number of children, N, and standard of living S, appear as arguments subject to resource constraints which include the prices or the costs of production of the arguments.

$$U^*(C, S) = U^*(\Psi N, S) = U(N, S) \qquad (1)$$

The lifetime utility approach of this model implies that given the optimal level of production of N and S, the expected lifetime level of the utility is maximised subject to budget and time constraints. The arguments of the utility function are produced separately within the household, with the inputs of the husband and wife's time and market purchased inputs.

The production function for children and the consumption commodity is given as:

$$N = f^N (T_{fN}, T_{mN}, X_N) \qquad (2)$$

$$S = f^S (T_{fS}, T_{mS}, X_S) \qquad (3)$$

From equations (2) and (3), the number of children produced and the standard of living depend on the time input and market good inputs of the couple. These production functions are assumed to exhibit constant returns to scale; thus average and marginal input coefficients are equal.

The resource constraints in which the prices or the costs of production of the arguments appear is given as:

$$T_{iN} + T_{iS} + T_{iL} = T_i \qquad i = f, m; \qquad (4)$$

$$V + T_{mL} W_m + T_{fL} W_f = P (X_N + X_S) \qquad (5)$$

Where (4) and (5) are time and budget constraints, respectively. Equation (4) shows that the total time available to an individual consist of the addition of the time input of the individual in the labour market, the time input spent on childcare and the time input spent on improving the standard of living. Equation (5) shows that total household income is made up of labour income of the husband and the wife as well as non labour income received by the household. It is possible to have one basic constraint, since (5) is not independent of (4) because time can be converted into goods by using less time at consumption and more at work. Therefore, substituting (4) into (5), the combination gives:

$$(t_{fN}W_f + t_{mN}W_m + Px_N)N + (t_{fs}W_f + t_{ms}W_m + PX_s)S = V + T_{mL}W_m + T_{fL}W_f$$

$$= \pi_N N + \pi_s S = V + T_{mL}W_m + T_{fL}W_f$$

$$= \pi_N N + \pi_s S = I \qquad (6)$$

From (6), I represents full income. The total resource constraint could be best interpreted as a combination of both constraints and not separately such that it is equal to the maximum money income achievable, referred to as "full income". π_N and π_s are the shadow prices of N and S. π_N represents the full price of N, that is the sum of the prices of the goods consumed by N (Px_N) and the time used in producing per unit of N, rather than at work ($t_{fN}W_f + t_{mN}W_m$). That is, the full price of consumption is the sum of direct and indirect costs. In order to measure real rather than nominal full income, S is chosen as the numeraire commodity and π_s, its shadow price, is set equal to unity.

Thus, in equation (6), total expenditure on N and S must be equal to the full income.

From equations (1) to (6),
C = services from children;

N = number of children;

Ψ = a constant;

S = real consumption level of parents;

π_j = the shadow price of commodity j

P = prices of market goods;

V = non labour income;

I = full income;

W_i = wage rate of individual i;

t_{ij} = total time input of individual i into one unit of commodity j;

T_{ij} = total time input of the individual I into commodity j;

T_{iL} = total time of individual i in the labour market;

T_i = total time input of the individual I;

T_{mL} = total time of the husband in the labour market;

T_{fL} = total time of the wife in the labour market;

x_j = market goods input into one unit of commodity j;

X_j = market goods input into commodity j;

i = f (female), m (male);

j = N, S.

Maximising the utility function (1) subject to the constraint (6) yields the demand functions for N and S.

Maximising the Lagrangian expression:

$$L (N, S, \lambda) = U(N, S) + \lambda(I - \pi_N N - \pi_s S), \qquad (7)$$

We obtain the following first-order conditions for a maximum:

$$\Delta L/\Delta N = U_N + \lambda\pi_N = 0 \qquad (8)$$

$$\Delta L/\Delta S = U_S + \lambda\pi_s = 0 \qquad (9)$$

$$\Delta L/\Delta\lambda = I - \pi_N N - \pi_s S = 0 \qquad (10)$$

Where: λ is the marginal utility of money income.

Rearranging and dividing equation (8) by (9), we obtain the equilibrium functions of the parents; that is in equilibrium, the marginal rate of substitution of N for S equals the ratio of their prices:

$$U_N/U_S = \pi_N/\pi_s \qquad (11)$$

Where: U_N = marginal utility of number of children

U_S = marginal utility of standard of living

π_N = shadow price of number of children

π_S = shadow price of standard of living

Solving for N and S in (11) and substituting their values into (10) gives their demand functions (12) and (13):

$$N(I, \pi) = I \pi_N / \pi^2_N + \pi^2_S \qquad (12)$$

$$S(I, \pi) = I \pi_S / \pi^2_N + \pi^2_S \qquad (13)$$

To generate a testable hypothesis, it is assumed that the production of children is relatively female time intensive and a negative relationship exists between number of children and female opportunity wage rates. The major implication of the model is that because of the high value of female time, families will substitute fewer high quality children (those who have embodied more human capital such as education) for a large number of low quality children.

The Becker (1965) theory of the allocation of time posits that an individuals' total time is shared between work (labour force participation) and other activities including fertility such that as more time is spent on fertility activities of childbearing and childcare, less time is allocated for work. Thus, a negative relationship exists between labour participation and fertility, thus revealing their incompatibility.

There are arguments that the negative effect of labour participation on fertility which obtains in Western and industrialised countries characterised by larger formal sector labour activities does not necessarily apply in developing countries and African societies. This is because developing countries and African societies of which Nigeria is one are usually characterised by large informal sector labour activities and rural agrarian societies in which sometimes, the workplace and home are not distinctly separated so that childcare and work can be simultaneously carried out (Mason and Palan, 1981). Also, there are no restrictions as to the presence of children in the workplace in rural or agricultural communities (Fapohunda, 1982). There are also situations of women who do not work but are housewives or dependants. The extended family strong ties also account for various childcare support which could increase women's work time while at the same time encourage increased childbirth (Togunde, 1988; Wusu and Isiugo-Abanihe, 2006; and Mason and Palan, 1981).

These arguments explain the inconsistency of the negative fertility-employment relationship and the no relationship or positive relationship obtained in some developing country studies (Desta, 2013; Nwakeze, 2007; Togunde; 1998, Fapohunda, 1982; and Mason and Palan, 1981). Thus, the study extends the Becker model to include the informal labour market and non-working women outside the labour force. Following McCabe and Rosenzweig (1996) extension of the theory of time allocation to apply to the case for developing countries, this study extends the model by including some choice variables available to households in developing countries that may not be readily available in industrialised countries. One of such variable is the household size used as a proxy for the presence of surrogate mothers in the form of relatives, older children or paid domestic helpers which altogether increase the number of household members.

The other variables are various measures of maternal labour participation, intended to modify the assumption that labour force activities are totally incompatible with fertility. This is because in developing African countries, a large portion of the female labour force is employed in the informal sector characterised by little or no restrictions as to the presence of children in the workplace, and a substantial number are also not working as a result of the high level of unemployment while others are not working probably due to cultural norms, personal decision or spouse decision and are therefore, out of the labour force. Thus the maternal labour participation variable is presented in the model to capture not only women in the labour force (employed and unemployed) in the formal and informal sectors, but also women who are out of the labour force.

The Olsen (1980) theory of the effect of child mortality on the number of births assumes that because of the high level of child mortality in developing countries, couples decision on the number of children may not always be rational or based on the desired number of children but would depend on the number of surviving children. It predicts that among otherwise identical couples, those suffering one more child death will tend to have one more birth. This is known as the replacement hypothesis. Child mortality reduction is a measure among others taken to influence the development of a country thus, it is important to know the rate at which child deaths (or the prevention of child deaths) produce more or fewer births. The occurrence of a death or the anticipation that such a death may occur also enters into the determination of the number of children ever born.

4.2 Methodology

4.2.1 Model Specification

This study mainly examines the interrelationship among fertility, child mortality and maternal labour participation. Thus, the estimated model takes a simultaneous equation form as presented in equation (14).

$$Y_1 = \boldsymbol{\delta}_f Y_2 + \boldsymbol{\delta}_f Y_3 + \boldsymbol{\delta}_f X_f + \varepsilon_f \qquad \text{(a)}$$

$$Y_2 = \boldsymbol{\delta}_c Y_1 + \boldsymbol{\delta}_c Y_3 + \boldsymbol{\delta}_c X_c + \varepsilon_c \qquad \text{(b)}$$

$$Y_3 = \boldsymbol{\delta}_m Y_1 + \boldsymbol{\delta}_m Y_2 + \boldsymbol{\delta}_m X_m + \varepsilon_m \qquad \text{(c)} \qquad (14)$$

Where: equation (a) represents the fertility equation; (b) is the child mortality equation; and (c) is the maternal labour participation equation. Fertility (Y_1) is a function of child mortality (Y_2), maternal labour participation (Y_3), and the exogenous variables (X_f); ε_f is the error term. Equations (b) and (c) are defined along the same lines. In the fertility equation (a), the exogenous variables (X_f) include the productive capacity of a woman’s time, which depends on her education, household characteristics such as household size and residence, individual characteristics such as age, religion, marital status, age at first childbirth, and household income proxied by household per capita expenditure. The exogenous variables (X_c) in the child mortality equation include a woman’s education, age, individual characteristics of the child including hospital delivery and vaccination use, household characteristics including per capita household expenditure, marital status and household size, and community and environmental characteristics including the source of drinking water and type of toilet facility, use of prenatal and postnatal care, distance to the nearest clinic or hospital and rural-urban residence. The exogenous variables (X_m) in the maternal labour participation equation are the number of hours of work per day, a woman’s educational attainment, per capita household expenditure, individual characteristics consisting of a woman’s age, and her marital status, household characteristics including area of residence and household size.

A priori Expectations

Education is expected to have a negative effect on the demand for births since the more time a woman spends schooling, the more likely she will postpone childbearing. Women with higher education have fewer children (Shapiro, 2012; Wusu, 2012; Ayoub, 2004; and Handa, 2000). Women with higher educational levels are also better able to make use of effective modern birth control methods thus reducing fertility (Rafalimanana and Westoff, 2000).

Household size is expected to have a positive effect on the number of children ever born because the larger the size due to the presence of older children, relatives, and paid workers, as parental surrogates providing childcare support, the more number of children a woman would have. Marital status is expected to positively affect the number of childbirths (Sibanda *et al*. 2003) because a married woman is exposed to sexual intercourse and more likely to desire having children than a single woman.

Child mortality can affect a woman's fertility in two ways. First, it can induce her to replace ex post her children who die either biologically (since shorter periods of postpartum abstinence and shorter durations of breastfeeding could allow the fertility of individuals to compensate substantially for their experience of child mortality) or by adapting her behaviour. Second, in a high child mortality society, it can induce her in anticipation of the levels of child mortality they will experience on average to adapt her fertility behaviour. Therefore, families with high endowed mortality rates ultimately have more children (Herzer *et al.*, 2012; Shapiro, 2012; and Olsen and Wolpin, 1983).

Maternal labour participation in the formal sector is expected to have a negative effect since it increases the opportunity cost of time spent on childbearing and rearing (Longwe *et al*.. 2013). Wages increase with more hours of work, so, if a woman takes some time off for fertility reasons, there is a resulting loss of wage (Becker, 1965). Labour participation in the informal sector is expected to have a positive effect (Nwakeze, 2007; and Fapohunda, 1982) because of the higher level of compatibility of childcare and work and less restrictions on the presence of children in the workplace. Women who are out of the labour market are expected to have more children since they do not face any restrictions nor have work compatibility issues.

Local public services such as the availability of contraceptives and family planning programmes are expected to have a negative impact on the number of childbirths (Portner *et al.* 2011). Per capita household expenditure is expected to be positively related to the demand for children (Amialchuk *et al.,* 2011; and Vikat, 2004) if children are a normal good but if households have preferences for child quality and the income elasticity for quality is greater than the income elasticity for quantity, it may have a depressing effect on the number of childbirths. Handa (2000) finds a negative effect.

In the child mortality equation, fertility is expected to have a positive effect (Bhuyan 2000) since high fertility increases the health risk of mothers and children and also reduces the health expenditures per child.

Maternal labour participation is expected to have a positive relationship with child mortality since the more the time allocated for work, the less the time and attention given to childcare (Tulasidhar, 1993). However, a negative effect is expected in a case where a woman enjoys the presence of surrogate parents such as relatives and friends or earns a high income to be able to afford childcare services (Amouzou and Hill, 2004; and Tulasidhar, 1993).

Education is expected to be negatively related to the probability of a child dying since mothers and fathers with high levels of education are better equipped, aware of child health rules an the use of first aid, more likely to use modern health clinics, better able to express themselves to health professionals and follow prescriptions accurately (Akinyemi *et al.,* 2013; Bhuyan, 2000; and Caldwell, 1990). Higher education increases parental chances of increased wages and thus, higher health expenditures per child.

Age is expected to have a negative effect on the probability of a child dying as older mothers are more capable of taking care of children with less supervision (Dashtseren, 2002). Children born to very young and very old mothers are more likely to die since they lack the optimum reproductive health capacity.

Household income is expected to have a negative relationship with the probability of a child dying since high income increases income per head and thus health and consumption expenditures per head (Amouzou and Hill, 2004; and Bhuyan, 2000). However, the larger the household size, the less income expenditure per head. Children living in urban areas are more likely to survive than their counterparts in rural areas because of the greater availability of modern health and public infrastructure (Amouzou and Hill, 2004; and Adetunji, 1994). Marital status is expected to be negatively related to the probability of a child dying since if a woman has a husband, household income increases and she gets his support for childcare. Hospital delivery reduces the possibility of child mortality. Examining the role of gender on the hazard of child mortality, Maitra (2004) found that boys are more likely to die than girls, though it was insignificant, signifying that child mortality rates between boys and girls are not significantly different. Access to safe drinking water reduces child mortality risks (Akinyemi *et al.*, 2013). Children who get vaccinated have low risks of death. Use of mosquito net is expected to have a depressing effect on the number of child deaths. The availability of toilet facilities at home increases the safety and hygiene conditions, which improves child health (Sastry, 1996). The closer the distance to the health centre, the more likely a child is able to get prompt and better care in the shortest possible time.

In the maternal labour participation equation, fertility is expected to have a negative effect in terms of reduced time allocation for work when a woman has a large number of children (Perticara, 2006). However, a positive effect holds when high fertility provides more labour for farm work, domestic chores in rural areas or an informal sector where a greater compatibility exists in terms of less restrictions on the presence of children in the workplace (Desta, 2013).

Child mortality is expected to have a negative effect on maternal labour participation because women who experience a high level of child mortality are more likely to pay more attention to their children's health by reducing their labour participation.

Education is expected to have a positive effect since higher educational attainment increases the opportunities of employment and the desire to reap the reward of such investment through work (Ackah *et al.*, 2009; Iwayemi and Olusoji, 2013; Solomon and Kimmel, 2009; and Bratti, 2003).

Household expenditure is expected to have a negative effect since poor homes would need increased earnings to meet basic daily expenses. Marital status is expected to have a negative effect due to the cultural norm of dependence on husbands (Lisaniler and Bhatti, 2005). Hourly wage is expected to have positive effect since labour supply would increase with higher wages (Hotz and Miller, 1988). Age is expected to have a positive effect since the probability of labour participation increases as women grow to the working age (Lisaniler and Bhatti, 2005). Urban women are more likely to work because of higher cost of living relative to rural areas. Household size is expected to have a positive effect (Iwayemi and Olusoji 2013). The large the household size, the more the probability that a woman decides to work to increase consumption per head.

4.2.2 Estimation Procedure and Technique

The estimated model is the simultaneous equation model (equation 14) used to examine the relationship among fertility, child mortality and maternal labour participation.

The estimation procedure began with a test for endogeneity of the three main variables of focus; fertility, child mortality and maternal labour participation. Fertility was measured as the number of children ever born, child mortality was measured as the number of child deaths, and maternal labour participation was captured using three measures including- the probability of formal sector employment, the probability of informal sector employment, and the probability of being out of the labour force. The endogeneity test was conducted using the Hausman test. Following Maddala (1992) and Longwe *et al*. (2013), the Hausman test involves obtaining the residual of the potentially endogenous explanatory variables from the first stage regression of their reduced form equations. Thereafter, the actual values of the potential endogenous explanatory variables and their residuals are included in the original equation (as shown in equation (15)) and estimated.

$$Y = \boldsymbol{\delta} Y_a + \boldsymbol{\delta} r_a + \boldsymbol{\delta} Y_b + \boldsymbol{\delta} r_b + \boldsymbol{\delta} X + \varepsilon \qquad (15)$$

Where Y is the dependent variable, Y_a and Y_b are endogenous explanatory variables, r_a and r_b are residuals from the first stage regression of the reduced form equation of the endogenous explanatory variables, and X are the exogenous explanatory variables.

We test the hypothesis that the coefficients of the residual are not significantly different from zero using the T-test. If the hypothesis is rejected, the variables cannot be treated as exogenous. If it is accepted, they can be treated as exogenous. In the fertility equation, we test for endogeneity of the number of child death and the three measures of maternal labour participation (the probability of formal sector employment, the probability of informal sector employment, and the probability of being out of the labour force) by obtaining their residuals from the first stage regression of their reduced form equations. The residuals are then included in the fertility equation and estimated using the OLS method and if the t-statistic of the coefficient of the residuals is statistically significant and different from zero, the null hypothesis of no endogeneity is rejected. In the child mortality equation, we test for the endogeneity of the number of children ever born and the three measures of maternal labour participation. In the equations of three measures of maternal labour participation, we test for endogeneity of the number of children ever born and the number of child deaths.

A test for heteroskedasticity was also conducted using the Breusch-Pagan Cook-Weisberg test. The decision rule states that heteroskedasticity is present if the chi-square value Chi2(1) obtained is statistically significant.

The estimation technique employed is the two-stage estimation method. The two-stage estimation method for models with mixed continuous and qualitative variables was applied because the three equations estimated, that is equation (a) which is the determinants of fertility equation, equation (b) which is the determinants of child mortality equation and equation (c) which is the determinants of maternal labour participation equation, all include continuous and qualitative variables, some of which have potential endogeneity. The two-stage method involved the OLS and the probit methods.

Fertility Equation

For the fertility equation, the first stage estimation involved estimating the reduced form equations of the endogenous explanatory variables and obtaining their predicted values. The OLS method was used to estimate the number of child deaths while the probit method was used to estimate the three measures of maternal labour participation. The predicted values of the endogenous explanatory variables obtained from their first stage regression were then substituted for their actual values in the second stage estimations. The second stage estimations involved employing the OLS method in estimating the determinants of fertility measured by the number of children ever born. The estimation for the determinants of fertility was carried out at the national level, for seven age groups of mothers, for rural and urban locations and for the six geopolitical zones. Some interaction variables are subsequently introduced into the fertility equation and re-estimated.

Birth Replacement Rate

The study proceeded to calculate the replacement rate of births. The following guide for calculating the replacement rate is derived from Trussell and Olsen (1983) which states that there are two regression estimators upon which the calculated replacement rate for births are based:

1) First, is the ordinary least squares (OLS) estimate, denoted by $r_{OLS,}$ obtained by regressing the number of births (n_i) on the number of deaths (d_i); and

2) Second, is the instrumental variables (IV) estimate, denoted by $r_{IV,}$ obtained in a two-step process. In the two-step process, first d_i is regressed on the proportion dead (p_i) = d_i/n_i, then the predicted values of d_i from this regression (d_i^) are employed as regressors; n_i is then regressed on d_i^ and not d_i .

The OLS coefficient is always a biased and inconsistent estimate of the true replacement rate, hence it must be corrected. The IV estimate is sometimes consistent; under some circumstances, however, it too could be corrected where necessary. If n_i and p_i (the mortality rate calculated as d_i/n_i) are uncorrelated, the corrected OLS estimator and the uncorrected IV estimator can be used. However, if n_i and p_i are correlated, either the corrected OLS or the corrected IV coefficients could be used. A finding that the two methods give different results with the IV estimate being substantially greater, the discrepancy may be a sign of random coefficients and in this case, the IV based estimator is preferred.

They also identified five recommendations that guide the selection of the particular estimator that is appropriate for calculating the replacement rate, these recommendations are based on a variety of circumstances centering on the implied within-parity variance of the mortality rate ($б^2_{p/n}$).

1) The first recommendation states that if the observed variance of d_i in the sample is very close to np(1-p) + p^2 Var (n) and the implied within-parity variance of the mortality rate are close to zero or negative, then there is indication that across all women the probability of a child death is constant and the corrected OLS estimator can be used. The IV estimator with no correction can also be used to provide a consistent estimate of r.

2) The second recommendation states that if the observed variance of d_i in the sample is very close to np(l- p) + p^2Var(n) + Var(p/n)[Var(n) + n^2 - n], where Var(p/n) is the average implied within-parity variance of the mortality rate, the mortality rate can be taken as random but uncorrelated with fertility. Instrumental variables (IV) with d_i/n_i as the instrument can be used with no correction. The OLS estimate can also be used with some correction.

3) Under the third recommendation, if the average implied within parity variance in mortality rates is positive but Var(d) is not well-approximated by np(l- p) + p^2Var(n) + Var(pln)[Var(n) + n^2 - n], then there is evidence that the mortality rate is random and correlated with fertility. In this case, the non linear equations in Olsen (1980) must be solved, preferably for both a bivariate lognormal distribution for n and p and a normal-lognormal distribution for n and p.

4) The fourth recommendation states that if the implied average within-parity variance in mortality rates is small or negative and Var(d) is different from its predicted value (calculated using equation (3) in Trussel and Olsen (1983), page 397), then other recommendations may not be suitable and the

better choice of calculating the replacement rate is therefore used. Instrumental variables may also be used but it would not be possible to correct the problems that arise when fertility and the mortality rate are correlated. Using the IV estimator to regress the number of child deaths on births, the replacement rate is the coefficient of number of child deaths using the mortality rate as an instrument.

5) The fifth recommendation states that if the corrected IV estimate is higher than the corrected OLS estimates, it may be a sign of random coefficients. In such an event, the IV estimate (corrected for a correlation between fertility and mortality if necessary) is preferred. The corrected IV estimate should be at least 50 per cent higher than the corrected OLS estimates, otherwise the average of the two is chosen.

The study applied the fourth recommendation because the implied average within parity variance in mortality rates is very small or negative, and the variance of the number of child deaths (d) is different from its predicted value[1]. Here, the corrected OLS estimator and the IV estimator are used since n_i and p_i are correlated, however, the IV estimator cannot be corrected in this case.

Child Mortality Equation

For the child mortality equation, the first stage estimation involves estimating the reduced form equations of the endogenous explanatory variables and obtaining their predicted values. The OLS method was used to estimate the number of children ever born, while the probit method was used to estimate the three measures of maternal labour participation. The predicted values of the endogenous explanatory variables obtained from their first stage regression were substituted for their actual values in the second stage estimations. The second stage estimations involve employing the OLS in estimating the determinants of child mortality measured by the number of child deaths. The estimation for the determinants of child mortality was carried out at the national level, for rural and urban locations and for the six

[1] Calculations for the implied average within-parity variance of mortality rates and the difference between Var (d) and its predicted value are shown in Appendix I. Detailed correction of the OLS estimate is also presented in Appendix I.

geopolitical zones. Some interaction variables are subsequently introduced into the child mortality equation and re-estimated.

The Harmonized Nigeria Living Standard Survey (HNLSS) questionnaire does not explicitly specify an age limit for child deaths; hence there is the possibility that the death of older children may be included in the mortality data. To control for the possible exposure time to death which this problem poses, the child mortality equation is also estimated using the mortality rate as another measure of child mortality (Handa, 2000), to ascertain if the results obtained are significantly different from the results obtained using the number of child deaths.

Maternal Labour Participation Equation

For the maternal labour participation equation, the first stage estimation also involved estimating the reduced form equations of the endogenous explanatory variables and obtaining their predicted values. The OLS was used to estimate the number of children ever born and the number of child deaths. The predicted values of the endogenous explanatory variables obtained from their first stage regression were substituted for their actual values in the second stage estimations. The second stage estimations involve employing the probit method to estimate the determinants of maternal labour participation, captured using three measures; the probability of formal sector employment, the probability of informal sector employment, and the probability of being out of the labour force. The equations for the determinants of maternal labour participation were estimated at the national level, for rural and urban locations and for the six geopolitical zones. Some interaction variables are introduced into the maternal labour participation equation and re-estimated.

4.3 Source of Data, Variable Description and Descriptive Statistics

4.3.1 Data and Source of Data

A total of 41,575 women within the reproductive ages of 15 and 49 with at least a child ever born were used to estimate the fertility and maternal labour participation determinants in the study out of a total number of 332,928 respondents in the HNLSS 2010 after the necessary data cleaning. The unit of observation is the woman (family); women with no births are excluded because they cannot provide information on the relation between fertility and mortality. In estimating the child mortality determinants, 40,382 women out of the 41,575 were used because they had complete information in all the child mortality variables. This study makes use of the HNLSS data of 2010 developed by the National Bureau of Statistics (NBS) and its sponsors, comprising the Federal Government of Nigeria, World Bank, United Nations Children's Funds (UNICEF) and the Department of International Development (DFID). The HNLSS is the latest in a series of poverty survey instruments developed by NBS and its development partners. It consists of two distinctive components, namely HNLSS Part A, which is the same as the Core Welfare Indicator Questionnaire Survey (CWIQ 2006). The other component is HNLSS Part B, which is the same as the Nigeria Living Standard Survey (NLSS 2004). HNLSS is therefore, an abridged survey, combining both CWIQ and NLSS. This study used the HNLSS Part A, which is a social indicator-monitoring tool designed to collect socio-economic data to analyze and interpret social indicators such as health, education, electricity, employment, etc, as well as access, utilization and satisfaction in relation to households (HNLSS Draft Report 2010).

The survey is national in coverage, which includes the 36 states of the federation and the Federal Capital Territory (FCT), Abuja. It was designed to investigate urban and rural areas of all the 774 Local Government Areas (LGAs) of the country. The sample design employed for HNLSS survey 2010 is a 2-stage cluster sample design in which enumeration areas (EAs) or primary sampling units (PSUs) constitute the first stage sample while the Housing Units (HUs) from the EAs make up the second stage sample or the Ultimate Sampling Units (USUs). The EAs as demarcated by the National Population Commission (NPC) for the 2006 population census served as the sampling frame for the HNLSS 2010. The sample size for the survey varies from state to state depending on the number of LGAs in each state. Ten EAs were selected in each local government areas making a total of 7,774 EAs to be canvassed for throughout the federation from the 774 LGAs including the FCT Abuja. The survey selected 7,740 EAs directly from the population of the EAs in the National Population Council with equal probability of selection. Prior to selection, all the contiguous EAs were arranged in serpentine order in each LGA of the state in order to avoid overlapping. A total of 77,390 households were covered from a sample of 77,400 giving the survey coverage rate of 99.9 per cent of which 51 per cent are males and 49 per cent females. Of all the six zones, it was only the

South-West zone that had the least response rate of 99.9 per cent. The response rate in the remaining five zones was 100.0 per cent each. The data is derived from four out of the nine sections included in the survey.

4.3.2 Variable Description

Table 4.1 presents a detailed description of the variables used in this study. From Table 4.1, fertility is measured as the number of children ever born by a woman. This measure helps capture the fertility stock. This measure is used to estimate a stock regression. Child mortality is measured as the number of child deaths a woman has experienced. This measure was used because it takes into consideration the individual or private cost of child mortality experience of each woman. Maternal labour participation is captured using three measures; the probability of a formal sector employment, the probability of an informal sector employment, and the probability of being out of the labour force. These measures help us include all women within the labour force (employed and unemployed) and those outside the labour force such as housewives. The probability is equal to 1 if yes and 0 if otherwise.

The probability of formal sector employment captures whether a woman works in a public or private enterprise. The probability of informal sector employment captures whether a woman is an own account worker/self-employed, engaged in unpaid family work or engaged in farm work. The probability of being out of the labour force captures women outside the labour force, hence are not working and are not searching for work, for instance, housewives. Education is measured as the highest educational level attained and includes no education, primary education, secondary education and post secondary education. No education was used as the reference category. The log of per capita household expenditure is used as a proxy for income and measured as expenditure per head in a household. Age is measured as the age of a woman in years. Age at first childbirth is the age a woman had her first birth notwithstanding whether the child is dead or alive.

Table 4.1 Variable Description

Variable	Description
Fertility equation	
Number of children ever born	Total number of children a woman has had
Number of child deaths	Number of child deaths a woman has experienced
Age	Woman's age
Age squared	Woman's age squared
Household size	Total number of people living in a household
Per capita expenditure	Expenditure per head in a household
Age at first childbirth	Age in which a woman has her first child birth
Age at first childbirth squared	The square of the age in which a woman has her first child birth
No education	Woman is not educated; dummy = 1 if woman has no education and 0 if otherwise
Primary	Woman has a primary education; dummy = 1 if woman has a primary education and 0 if otherwise
Secondary	Woman has a secondary education; dummy = 1 if woman has a secondary education and 0 if otherwise
Post-secondary	Woman has a post-secondary education; dummy = 1 if woman has a post-secondary education and 0 if otherwise
Cost of contraceptive	Amount paid for last contraceptive
Christian	Woman is a Christian; dummy = 1 if woman is a Christian and 0 if otherwise
Muslim	Woman is a Muslim; dummy = 1 if woman is a Muslim and 0 if otherwise
Traditional	Woman is a traditionalist; dummy = 1 if woman is a Traditionalist and 0 if otherwise
Other	Woman is of any other religion; dummy = 1 if woman is of any other

	religion and 0 if otherwise
North-Central	Woman resides in the north central; dummy = 1 and 0 if otherwise
North-East	Woman resides in the north east; dummy = 1 and 0 if otherwise
North-West	Woman resides in the north west; dummy = 1 and 0 if otherwise
South-East	Woman resides in the south east; dummy = 1 and 0 if otherwise
South-South	Woman resides in the south south; dummy = 1 and 0 if otherwise
South-West	Woman resides in the southwest; dummy = 1 and 0 if otherwise
Urban residence	Woman resides in an urban area; dummy = 1 and 0 if otherwise
Rural residence	Woman resides in a rural area; dummy = 1 and 0 if otherwise
Child mortality equation	
Cost of electricity	Amount paid for electricity bill
Prenatal care use	Woman uses prenatal care only; dummy = 1 and 0 if otherwise
Postnatal care use	Woman uses postnatal care only; dummy = 1 and 0 if otherwise
Use of both	Woman uses both prenatal and postnatal care; dummy = 1 and 0 if otherwise
Use of none	Woman uses neither prenatal nor postnatal care; dummy = 1 and 0 if otherwise
Hospital and maternity home delivery	Woman has her child in a hospital or maternity home; dummy = 1 and 0 if otherwise
Home delivery and others	Woman has her child at home or in other places; dummy = 1 and 0 if otherwise
Use of vaccine	Child has ever been vaccinated; dummy = 1 and 0 if otherwise
Non-use of vaccine	Child has never been vaccinated; dummy = 1 and 0 if otherwise
Don’t know	Don’t know if child has ever been vaccinated, unspecified; dummy = 1 and 0 if otherwise
Cost of vaccine	Amount paid to vaccinate a child
Birth weight	Child Weight at birth
Cost of prenatal care	Amount paid for a prenatal care service
Cost of postnatal care	Amount paid for a postnatal care service
Use of mosquito net	Household windows protected by mosquito nets; dummy = 1 and 0 if otherwise
Non use of mosquito net	Household windows not protected by mosquito nets; dummy = 1 and 0 if otherwise
Public tap	Household drinks public tap water; dummy = 1 and 0 if otherwise
Borehole	Household drinks borehole water; dummy = 1 and 0 if otherwise
Rain	Household drinks rain water; dummy = 1 and 0 if otherwise
Bottle/sachet	Household drinks bottle or sachet water; dummy = 1 and 0 if otherwise
Flush toilet	Flush toilet is used in the household; dummy = 1 and 0 if otherwise
Pit latrine	Pit latrine is used in the household; dummy = 1 and 0 if otherwise

No toilet/bush	Household has no toilet or use the bush; dummy = 1 and 0 if otherwise
0-29 mins	Distance to hospital is between 0 - 29 minutes; dummy = 1 and 0 if otherwise
30-59 mins	Distance to hospital is between 30 - 59 minutes; dummy = 1 and 0 if otherwise
60 mins and above	Distance to hospital is 60 mins and above; dummy = 1 and 0 if otherwise
0-29 mins	Distance to clinic is between 0 - 29 minutes; dummy = 1 and 0 if otherwise
30-59 mins	Distance to clinic is between 30 - 59 minutes; dummy = 1 and 0 if if otherwise
60 mins and above	Distance to clinic is 60 mins and above; dummy = 1 and 0 if otherwise
Maternal labour participation equation	
Probability of formal sector employment	Whether a woman works in a public or private enterprise (1 = Yes, 0 = No)
Probability of informal sector employment	Whether a woman is an own account worker/self-employed, engaged in unpaid family work or engaged in farm work (1 = Yes, 0 = No)
Probability of being out of the labour force	Whether a woman is a fulltime housewife so she is not working nor searching for a job (1 = Yes, 0 = No)
Hours of work	Hours of work per day

Source: Author’s compilation

In the child mortality equation, the effect of each community-level variable is captured through dummy variables, they include the use of mosquito net, source of drinking water, use of prenatal and postnatal care, type of toilet facilities, the use of vaccines and distance to the nearest hospital or clinic.

4.3.3 Descriptive Statistics

Table 4.2 is the descriptive statistics of the data used in this study. The mean and standard deviations of the data used in this study are presented at the national level and for urban and rural locations as shown in Table 4.2. The mean age of mothers is 32.6 at the national level. It is higher in urban than rural locations (33.9 and 32.2 respectively). The mean number of children ever born is 3.8 at the national level, 3.6 in urban and 3.82 in rural locations. This shows a higher fertility in rural than urban locations. The mean number of child death is 0.41 with a higher mean of 0.44 in rural locations compared to 0.33 in urban locations. The mean mortality rate is 0.08 at the national level, 0.06 in urban and 0.09 in rural locations. The mean mortality rate shows the ratio of number of child deaths to the total number of children. It is high in rural locations than in urban locations. Therefore, the risk of child death is higher in rural than urban locations. This may be attributed to the relatively poor availability and access to health care in rural than urban locations. Concerning the number of mothers participating in the labour force, 82 percent of mothers are within the labour force while 18 percent are outside the labour force. A large percentage of women work in the informal sector than the formal sector.

Table 4.2 Descriptive Statistics

Variables	Pooled Sample Mean	Pooled Sample Standard Deviation	Urban Sample Mean	Urban Sample Standard Deviation	Rural Sample Mean	Rural Sample Standard Deviation
Fertility Variables						
Number of children ever born	3.8	2.17	3.6	2.05	3.82	2.2
Age	32.64	8.12	33.93	7.90	32.24	8.15
Age squared	1131.23	541.09	1213.37	540.77	1105.91	538.68
Household size	5.81	2.29	5.51	2.24	5.90	2.30
Per capita expenditure	297951.2	0	279652.5	0	303593.4	0
Age at first childbirth	19.58	4.70	21.14	4.87	19.09	4.53
Age at first childbirth squared	405.25	195.17	470.74	210.73	385.05	185.51
No education	0.54	0.5	0.29	0.45	0.61	0.49
Primary	0.24	0.42	0.25	0.43	0.23	0.42
Secondary	0.17	0.38	0.32	0.47	0.12	0.33
Post-secondary	0.06	0.24	0.15	0.35	0.03	0.18
Christian	0.45	0.50	0.52	0.50	0.43	0.49
Muslim	0.54	0.50	0.47	0.50	0.56	0.50
Traditional	0.01	0.10	0.00	0.07	0.01	0.11
Other	0.00	0.05	0.00	0.05	0.00	0.05
Married monogamous	0.94	0.24	0.92	0.27	0.95	0.23

Married polygamous	0.00	0.05	0.00	0.06	0.00	0.04
Divorced/separated/widow	0.04	0.21	0.06	0.24	0.04	0.19
Single	0.01	0.12	0.01	0.12	0.01	0.11
North-Ccentral	0.18	0.38	0.15	0.36	0.19	0.39
North-Eeast	0.18	0.38	0.08	0.27	0.21	0.41
North-West	0.30	0.46	0.20	0.40	0.33	0.47
South-East	0.09	0.29	0.09	0.28	0.09	0.29
South-South	0.12	0.32	0.11	0.31	0.12	0.33
South-West	0.13	0.34	0.37	0.48	0.06	0.24
Urban residence	0.24	0.42	-	-	-	-
Rural residence	0.76	0.43	-	-	-	-
Use of contraceptives	0.15	0.36	0.23	0.42	0.13	0.331
Non-use of contraceptives	0.85	0.36	0.77	0.42	0.87	0.331
Cost of contraceptives	45.59	440.01	81.15	0.46	34.62	431.69
Male child preference	0.24	0.43	0.27	0.44	0.24	0.42
Female child preference	0.2	0.40	0.20	0.40	0.20	0.40
Indifferent	0.56	0.50	0.54	0.50	0.57	0.50
Maternal labour participation						
Working in formal sector	0.08	0.27	0.15	0.35	0.05	0.23
Not working in formal sector	0.92	0.27	0.85	0.35	0.95	0.23
Working in informal sector	0.53	0.5	0.62	0.48	0.50	0.50
Not working informal sector	0.47	0.5	0.38	0.48	0.50	0.50
Within the labour force	0.82	0.38	0.85	0.36	0.81	0.39
Out of the labour force	0.18	0.38	0.15	0.36	0.19	0.39
Hours of work	5.85	4.52	6.43	4.56	5.67	4.49
Child Mortality Variables						
Number of child deaths	0.41	1.09	0.3	0.92	0.44	1.13

Mortality rate	0.08	0.2	0.06	0.18	0.09	0.21
Cost of electricity	183.15	818.01	466.08	1181.96	95.51	641.28
Prenatal care use	0.1	0.21	0.13	0.34	0.10	0.30
Postnatal care use	0.01	0.1	0.01	0.10	0.01	0.09
Use of both	0.07	0.25	0.10	0.30	0.06	0.23
Use of none	0.82	0.38	0.75	0.43	0.84	0.37
Cost of prenatal care	192.94	1120.39	321.28	1664.59	153.18	882.74
Cost of postnatal care	91.91	870.45	143.89	1213.16	75.80	731.75
Hospital and maternity home delivery	0.003	0.053	0.003	0.055	0.003	0.052
Home delivery and others	0.997	0.053	0.997	0.055	0.997	0.052
Use of vaccine	0.004	0.6	0.004	0.064	0.004	0.059
Non-use of vaccine	0.001	0.25	0.000	0.018	0.001	0.027
Don't know	0.996	0.66	0.996	0.066	0.996	0.065
Cost of vaccine	0.15	7.24	0.11	5.60	1.167	7.671
Birth weight	0.01	0.46	0.01	0.27	0.01	0.51
Use of mosquito net	0.2	0.4	0.43	0.50	0.12	0.33
Non-use of mosquito net	0.8	0.4	0.57	0.50	0.88	0.33
Public tap	0.11	0.32	0.24	0.43	0.07	0.26
Borehole	0.4	0.49	0.53	0.50	0.37	0.48
Rain	0.47	0.5	0.20	0.40	0.56	0.50
Bottle/sachet	0.01	0.1	0.03	0.18	0.00	0.06
Flush toilet	0.16	0.37	0.37	0.48	0.09	0.29
Pit latrine	0.54	0.5	0.46	0.50	0.56	0.50
No toilet/bush	0.29	0.46	0.16	0.37	0.34	0.47
0-29 mins to nearest hospital	0.24	0.42	0.45	0.50	0.17	0.37
30-59 mins to nearest hospital	0.38	0.49	0.41	0.49	0.37	0.48
60 mins and above to nearest hospital	0.38	0.49	0.14	0.35	0.46	0.50
0-29 mins to nearest clinic	0.41	0.49	0.58	0.49	0.36	0.48

30-59 mins to nearest clinic	0.38	0.48	0.35	0.48	0.39	0.49
60 mins and above to nearest clinic	0.21	0.41	0.08	0.27	0.25	0.44

***Source*:** Computed from HNLSS, 2010

The mean household size was 5.81, with a higher mean of 5.90 recorded in rural locations while the urban location has a mean household size of 5.51. The average age at which women had their first childbirth was lower in rural areas with a mean of 19.1 while urban women had their first childbirth at an average age of 21.1. This suggests that early childbearing due to early marriage or teenage pregnancy is prevalent in rural than urban locations. There were more number of women with no western education in rural than urban locations (61 percent and 29 per cent respectively). The level of education attained by a larger percentage of rural women (23 per cent) was primary education, followed by a secondary education attained by 12 per cent while only 3 per cent have a post-secondary education. More urban women (32 per cent) had secondary education followed by a primary education obtained by 25 per cent. A larger percentage of urban and rural women delivered their children at home or other places instead of using a hospital or maternity home facility. A significantly large percentage of women don’t know whether their child (ren) had been vaccinated. This shows a poor commitment to the vaccination process.

While 43 per cent of urban women used mosquito net, only 12 per cent of rural women used mosquito nets on the windows and doors of their homes. The source of drinking water for a larger percentage of rural women (56 per cent) was rainwater, followed by 37 per cent that use borehole water. Only 7 per cent of rural women obtained their drinking water from a public tap while none of the rural women could afford bottle or sachet water as their source of drinking water. In the case of urban women, 53 per cent used borehole, 24 per cent used public tap, 20 per cent used rainwater and 3 per cent relied on bottle or sachet water as their source of drinking water.

CHAPTER FIVE

EMPIRICAL ANALYSIS AND RESULTS

5.0 Introduction

This chapter provides an empirical analysis of the data used in the study and presents as well as discusses the results obtained from the analysis. The data included 41,575 women obtained from the Harmonized Living Standard Survey (HNLSS) 2010. The socio-demographic characteristics of the women used in the study are presented below as well as the estimates of the determinants of fertility, child mortality and maternal labour participation.

5.1 Socio-demographic Characteristics of Women

5.1.1 Number of Children Ever Born by Women

As shown in Figure 5.1, 51 per cent of the 41,575 women used in the study obtained from the HNLSS, 2010 had between 1 and 3 children, 38 per cent had between 4 and 6 children, 9 per cent had between 7 and 9 children, 2 per cent had between 10 and 12 children while 0.13 per cent had between 13 and 14 children. Thus a total of 89 per cent of women had between 1 and 6 children.

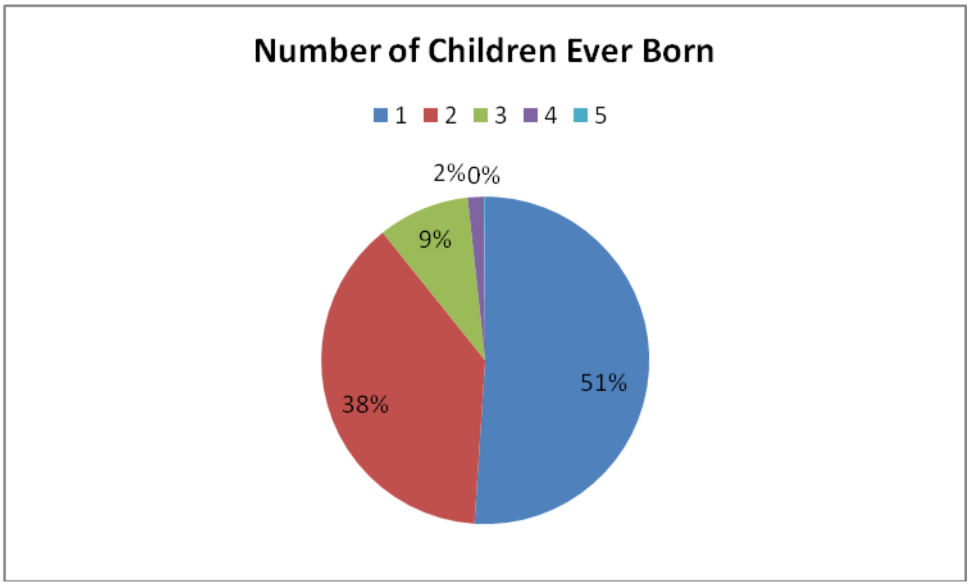

Figure 5.1 Number of Children Ever Born by Women

Source: HNLSS, 2010

5.1.2 Mean Number of Children by Employment Status, Number of Child Deaths and Education

From the HNLSS, 2010 as shown in Table 5.1, the mean number of children was higher among women who are not working in the informal sector and are probably unemployed and lower among women working in the formal sector. The mean number of children was seen to increase as the number of child deaths increased. The mean number of children was higher among women with a primary education and declined among those with a secondary or post secondary education.

The mean age at first childbirth was lowest among women who were out of the labour force but highest among women working in the formal sector. Thus women who were out of the labour force started having children earlier than working women and hence, tend to have more number of children ever born. The mean age at first childbirth was lowest among women with no education (18.51) and increased as they attain higher levels of education. The mean age at first childbirth was lowest (18.18) among women with the highest number of child deaths, that is 10 to 13 showing that women who start child bearing early (probably due to early marriage or teenage pregnancy) had more number of child deaths. This was probably because younger women are not mature physically and emotionally; and are inexperienced in child care.

Table 5.1 Mean Number of Children by Employment Status, Number of Child Deaths and Education

Variables	Mean number of Children	Mean Age at First Childbirth
Employment Status:		
Working in the formal sector	3.58	21.72
Not working in the formal sector	3.78	19.40
Working in the informal sector	3.70	19.61
Not working in the informal sector	3.84	19.54
Out of the labour force	3.64	18.86
In the labour force	3.80	19.73
Education		
None	3.85	18.51
Primary	4.02	19.83
Secondary	3.27	21.26
Post-secondary	3.40	23.35
Number of Child Death		
0-3	3.64	19.61
4-6	7.69	18.32
7-9	9.91	17.83
10-13	12.15	18.18

Source: Author’s compilation from the HNLSS, 2010

5.1.3 Mean Number of Children and Age at First Childbirth by Geopolitical Zone, Education and Residence

The mean number of children a woman has was highest in the North-East followed by the South-East and North-West but lowest in the South-West as shown in Table 5.2. The mean age at first birth was lower in the three northern zones with the lowest mean age of 17 years found in the North-West zone. Thus, women in the North East had more number of children ever born than women in other zones. The highest mean age of first childbirth was 22 years in the South-East and South-West zones. Rural locations had a higher mean number of children than urban locations, while the mean age of first childbirth was lower in rural than urban locations. This shows that early childbearing was more prevalent in the three northern zones and in rural locations, suggesting the possibility of rampant early marriages and teenage pregnancy.

5.1.4 Mean Number of Children and Age at First Childbirth by Age Group

As shown in Table 5.3, the mean number of children a woman had was highest among older women aged 45 years and above. The mean number of children increased as women grew older. Thus the number of children women have will increase as they grow older from one child among women aged 15 to 19 to five children among women aged 45 years and above. The lowest mean age at first childbirth was approximately 16.58. This shows that young mothers aged 15 to 19 years have on average started childbearing as early as 16.58 years. The mean age at first childbirth increased as the age group of women increased.

Table 5.2 Mean Number of Children and Age at First Childbirth by Geopolitical Zone and Residence

Variables	Mean number of Children	Mean Age at First Childbirth
North Central	3.64	19.93
North East	3.95	18.22
North West	3.89	17.83
South East	3.94	22.23
South South	3.81	20.35
South West	3.27	22.35
Rural Residence	3.82	19.09
Urban Residence	3.60	21.14
National	3.8	19.58

Source: Author's compilation from the HNLSS, 2010

Table 5.3 Mean Number of Children and Age at First Childbirth by Age Group

Age Group	Mean number of Children	Mean Age at First Childbirth
15-19	1.78	16.58
20-24	2.20	17.71
25-29	2.90	19.07
30-34	3.72	19.64
35-39	4.40	20.25
40-44	4.95	20.39
45-49	5.18	21.16

Source: Author's compilation from the HNLSS, 2010

5.1.5 Mean Child Death by Geopolitical Zones

The mean child death was 0.09 in rural locations and 0.06 in urban locations as shown in Table 5.4. Thus, while 9 per cent of the total number of children of rural women had died, only 6 per cent was reported among urban women. This shows a higher child death rate in rural than urban locations. This could be explained by the greater availability and access to health care infrastructure in urban areas compared to the fewer and ill-equipped healthcare facilities provided in rural areas. The mean child death was highest in the North-West followed by the North-East. Thus, women in the North-West had a higher child death ratio (number of child deaths to the total number of children) than those in other zones. The lowest mean was found in the South-West.

5.1.6 Mean Child Death by Employment Status and Education

As shown in Table 5.5, the highest mean child death was observed among women who do not work in the informal sector as well as those out of the labour force with as high as 9 per cent of their total children ever born reported dead, followed by women working in the informal sector with a mean child death of 8 per cent. Women working in the formal sector had the lowest mean child death of 6 per cent. Thus, despite the fact that working women had to reduce the time allocated to childcare due to the amount of time allocated to formal sector work, they still had more surviving children probably due to the income effect of their higher wages compared to informal sector employed women who were engaged in unpaid family work and farm work and were likely to earn less. The mean child death was highest among women with no education and it declines as the level of education increases. The mean child death was equal among women with either primary or secondary education however, it declined further among women with post-secondary level of educational attainment. Thus, the more educated a woman was, the fewer her experiences of child death probably due to increased knowledge of hygiene and a greater appreciation and utilisation of healthcare services.

Table 5.4 Mean Child Death by Geopolitical Zones

Variables	Mean Child Death
North Central	0.06
North East	0.09
North West	0.11
South East	0.08
South South	0.08
South West	0.04
Rural Residence	0.09
Urban Residence	0.06
National	0.08

Source: Author’s compilation from the HNLSS, 2010

Table 5.5 Mean Child Death by Employment Status and Education

Variables	Mean Child Death
Employment Status:	
Working in the formal sector	0.06
Not working in the formal sector	0.09
Working in the informal sector	0.08
Not working in the informal sector	0.08
Out of the labour force	0.09
In the labour force	0.08
Education	
None	0.10
Primary	0.07
Secondary	0.07
Post-secondary	0.06

Source: Author’s compilation from the HNLSS, 2010

5.1.7 Mean Child Death by Age Group

The mean child death was higher among the youngest women aged 15 to 19 and among older women within the age group of 40 to 44 with as high as 10 per cent of child death as shown in Table 5.6. The lowest mean child death of 7 per cent was also obtained among young women aged 20 to 24. Thus, the mean child death did not show a consistent pattern across different age groups of women and so may not necessarily be influenced by a woman's age but by her education and employment status as previously shown. The inconsistent pattern is depicted in Figures 5.2 and 5.3.

Table 5.6. Mean Child Death by Age Group

Age Group	Mean Child Death
15-19	0.10
20-24	0.07
25-29	0.08
30-34	0.09
35-39	0.08
40-44	0.10
45-49	0.09

Source: Author's compilation from the HNLSS, 2010

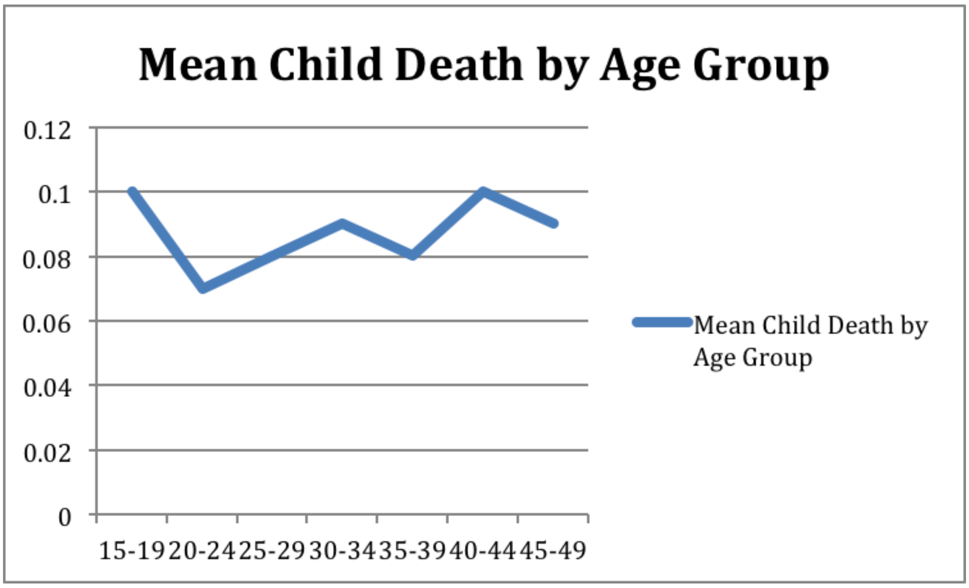

Figure 5.2 Mean Child Death by Age Group

Source: HNLSS, 2010

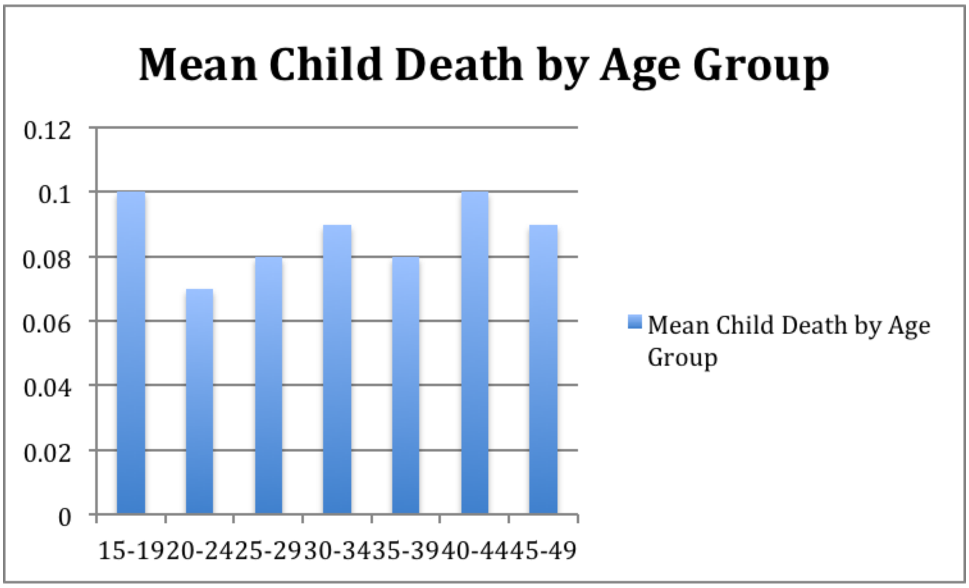

Fig 5.3 Mean Child Death by Age Group

Source: HNLSS, 2010

5.1.8 Maternal Labour Participation by Education, Child Death and Number of Children

Generally, a greater percentage of mothers participated in the informal sector, followed by the percentage of mothers who were out of the labour force. This is as presented in Table 5.7. A fewer percentage of mothers were engaged in formal sector employment. Women with the least number of children (1-3) had the highest participation rate of 8 per cent in the formal sector but it declined to 3 per cent for women with the largest number of children (11-14). As the number of child death increased, the participation rate of women in the formal sector declined from 8 per cent to 6 per cent but increased in the informal sector from 53 per cent to 55 per cent; except for the case of highest number of child death ranging from 10 to 13. The number of women out of the labour force increased from 18 per cent to 23 per cent as the number of child deaths increased.

Women with no education participated more in the informal sector (53 per cent) than in the formal sector (only 3 per cent). More women with primary or secondary education were employed in the informal sector than in the formal sector. The participation rate increased to 57 per cent in the formal sector but declined to 32 per cent in the informal sector when they had as high as post-secondary education. The percentage of women outside the labour force declined steadily as the level of educational attainment increases.

Table 5.7 Maternal Labour Participation by Number of Children, Child Death and Education

Variable	Employment Status		
	Formal sector	Informal sector	Out of labour force
Number of Children			
1-3	0.08	0.54	0.19
4-6	0.08	0.53	0.17
7-10	0.06	0.49	0.17
11-14	0.03	0.4	0.13
Number of Child Deaths			
0-3	0.08	0.53	0.18
4-6	0.04	0.53	0.22
7-9	0.06	0.55	0.22
10-13	0.08	0.45	0.23
Education			
No education	0.03	0.53	0.24
Primary education	0.04	0.51	0.12
Secondary education	0.1	0.61	0.13
Post secondary education	0.57	0.32	0.09

Source: Author’s compilation from the HNLSS, 2010

5.2 Determinants of Fertility

The results from the estimation of the fertility equation, which is equation (a) in equation (14) are presented in this section. The estimation used data for women within the reproductive ages of 15 and 49 with at least a child ever born. Based on the result from some econometric tests first carried out, the method employed is the two-stage estimation method involving the use of the OLS estimator and the probit method to control for endogeneity bias. A robust estimation is also carried out to control for heteroskedasticity bias. The estimation was carried out at the national level, for urban and rural locations, then some interaction variables were introduced into the equation and re-estimated. The estimation was also done for the six geopolitical zones and for seven age groups of mothers.

5.2.1 Econometric Tests

Some tests were carried out to ascertain the econometric properties of the equations, these include test for exogeneity, test for heteroskedasticity and test for instrument relevance and validity.

Test for Exogeneity

The results of the test for exogeneity using the Hausman test are presented in Table 5.8. In the fertility equation, child mortality, measured as the number of child deaths as well as the three measures of maternal labour participation were found to be endogenous explanatory variables. This is because the coefficients of their residuals are significantly different from zero.

Table 5.8 Test for Exogeneity

Variable	Residual coefficient	t-statistic	p-value
Fertility equation			
Number of child deaths	0.769	116.37	0.000
Probability of formal sector employment	-0.235	-2.21	0.027
Probability of informal sector employment	-0.338	-2.01	0.045
Probability of being out of the labour force	0.472	2.17	0.030

Source: Computed by author

Test for Heteroskedasticity

The Breusch-Pagan/Cook- Weisberg heteroskedasticity test was conducted for equation (a) in equation (14), used in estimating the determinants of fertility. The decision rule is to reject the null hypothesis that there is no heteroskedasticity if the Prob>chi2 value shows that the Chi2(1) score is significant. The results as shown in Table 5.9 revealed that there was a significant presence of heteroskedasticity with a significant Chi2(1) score in the fertility equation.

Test for Instrument Relevance and Validity

To test for the relevance of the instruments used, the first stage regression of the reduced form equations of the endogenous variables were estimated and the results are presented in Appendix II. The first stage regression of the reduced form equations for child mortality and the three measures of maternal labour participation shows that the instruments used are highly significant at the 1% level to explain fertility. Thus, the instruments used are relevant. To ensure that the instruments are valid, a test on whether the instruments have a significant effect on the dependent variable was conducted and the results are presented in Table 5.10. The instruments used are valid because they do not have any significant effect on the dependent variables.

Table 5.9 Test for Heteroskedasticity

Dependent Variable	Chi2(1)	Prob>chi2
Number of children ever born	4579.82	0.0000

Source: Computed by author

Table 5.10 Test for Instrument Validity

Instrument	Coefficient	t-statistic	p-value
Fertility equation			
Use of flush toilet	0.042	1.62	0.106
Cost of electricity	-0.000	-0.69	0.487

Source: Computed by author

5.2.2 Determinants of Fertility at the National Level and by Urban and Rural Location

The estimates of the determinants of fertility are presented at the national level and by urban and rural locations in Table 5.11.

From Table 5.11, the overall significance of the models was high at the 1% significance level. The number of child deaths had a significant positive effect on the number of children ever born. An increase in the number of child deaths was associated with an increase in fertility of 2.6 children at the national level with 1% statistical significance. Thus, women tend to have more births as they experience more number of child deaths. This also held in urban and rural areas where an increase in the number of child deaths was associated with 2.8 and 2.2 more children, respectively. This positive effect is consistent with Schultz (1973), which explains that one effect of child mortality on fertility is its effect on the derived demand for births by increasing the number of births required to obtain a survivor. This confirms the replacement effect in which there is the tendency to replace a lost child with an additional birth and the hoarding effect by Olsen (1980) or insurance strategy by Lloyd and Ivanov (1988) in which a woman has excess number of children in anticipation of a child death experience in countries with high child mortality rates such as Nigeria. It was highly significant in urban and rural locations at 1% significance level. The result is also consistent with Benefo and Schultz (1996), Wolpin (1984), Blackburn and Cipriani (1998) and Handa (2000) that found lower child mortality rates significant to induce decreased number of childbirths by a woman and higher rates responsible for increased births. The positive child mortality effect shows that parents are inelastic to the increase in the cost of a surviving child because they focus more on the future social and financial benefits expected from their mature surviving child (Schultz 1973).

Working in the formal sector was associated with higher number of children ever born however; it was not significant at the 5 per cent statistical significance level at the national level and in urban and rural locations. Women working in the informal sector had less number of children than those who do not work in the informal sector, this was significant at the national level and for rural location at the 5 per cent significance level. It was not significant for urban location.

Table 5.11 Determinants of Fertility at the National Level and by Urban and Rural Locations

Variables	National	Urban	Rural
Number of child death	2.588(7.08)*	2.808(4.71)*	2.203(4.59)*
Employment status			
Working in the formal sector	0.379(1.72)	0.491(1.32)	0.067(0.24)
Not working in the formal sector	RC	RC	RC
Working in the informal sector	-0.680(1.97)**	-0.161(-0.32)	-1.049(-2.10)**
Not working in the informal sector	RC	RC	RC
Out of the labour force	-0.488(-0.86)	-0.353(-0.41)	-0.027(-0.03)
Within the labour force	RC	RC	RC
Education			
No education	RC	RC	RC
Primary education	0.371(4.58)*	0.300(2.34)**	0.459(4.08)*
Secondary education	0.131(0.82)	-0.056(-0.23)	0.376(1.69)
Post-secondary education	-1.053(-2.17)**	-0.982(-1.17)	-0.515(-0.87)
Urban residence	0.197(4.19)*	-	-
Rural residence	RC	RC	RC
Religion			
Christianity	0.029(0.13)	-0.337(-0.83)	0.367(1.17)
Muslim	0.310(1.61)	-0.171(-0.50)	0.592(2.20)**
Traditional	RC	RC	RC
Others	0.054(0.15)	-0.434(-0.70)	0.519(1.02)
Age	0.083(2.68)*	0.024(0.49)	0.127(3.00)*
Age squared	-0.000(-0.64)	0.000(0.90)	-0.001(-1.49)
Household size	1.718(44.99)*	1.879(26.38)*	1.674(35.73)*
Age at first childbirth	0.050(3.65)*	0.091(3.76)*	0.027(1.66)
Age at first childbirth squared	-0.002(-8.20)*	-0.003(-5.88)*	-0.002(-5.88)*
Log per capita expenditure	0.002(0.83)	-0.002(-0.32)	0.001(0.24)
Marital status			
Married monogamous	0.005(0.03)	0.370(1.35)	-0.228(-1.17)
Married polygamous	0.137(0.40)	1.061(1.91)	-0.511(-1.13)
Divorced/separated/widowed	-0.174(-1.44)	0.419(1.95)	-0.300(-2.03)**
Single	RC	RC	RC
Geopolitical zone			
North-Central	-0.246(-1.00)	-0.151(-0.43)	-0.502(-1.40)
North-East	-0.181(-0.32)	0.177(0.21)	-0.718(-0.87)

North-West	-0.550(-1.54)	-0.455(-0.87)	-0.805(-1.56)
South-East	-0.633(-2.36)**	-0.244(-0.61)	-0.945(-2.47)**
South-South	-0.676(-3.59)*	-0.500(-1.60)	-0.758(-3.11)*
South-West	RC	RC	RC
Use of contraceptives	0.233(3.30)*	0.194(1.86)	0.209(2.08)**
Non-use of contraceptives	RC	RC	RC
Cost of contraceptives	-0.000(-0.49)	0.000(0.19)	0.000(0.06)
Constant	-2.470(-5.50)*	-1.856(-2.44)**	-2.834(-4.87)*
R-squared	0.4068	0.4706	0.3906
F-statistic(p-value)	999.19(0.0000)	297.92(0.0000)	766.56(0.0000)
Observations	41575	9798	31777

***Note*:** Values within parenthesis represent t-statistics where (*) and (**) represent significance at (1%) and (5%) respectively. RC denotes reference category.

Being out of the labour force did not significantly explain the number of children ever born in urban and rural areas. The results from the three measures of maternal labour participation provide scanty information; hence there is the need to introduce an interaction variable.

Other significant determinants of the number of children ever born include education which had a positive significant effect among women with a primary education in urban and rural locations at 5 per cent significance level. Thus, women with primary education had higher fertility than those with no education. Having secondary education was not significant among urban and rural women. Women with post secondary education had lower fertility than those with no education and this was significant only at the national level at 5 per cent. Thus, as more time is allocated to studies, less time is left for childbearing and childcaring activities. Also, educated women easily understand the growing concern for reduced number of children in order to have increased expenditure per child.

Religion was significant only among Muslim women who tend to have more number of children ever born than those who are traditionalists. This was significant only in rural locations at the 5 per cent level. Household size had a positive effect thus, the larger the household, the more the number of children a woman ever has. This was significant at 1 per cent in urban and rural areas. Women with large household size tend to have more children probably because of the opportunity of having older children, relatives such as mother-in-law, grandparents and friends who could act as surrogate parents and provide child care support.

Age at first childbirth had a negative non-linear significant relationship with fertility in urban and rural locations. Thus, fertility increases with early childbearing but declines as women have their first childbirth at a later stage in life. Consequently, reducing early childbearing whether due to early marriages or teenage pregnancies would reduce fertility. The use of contraceptives had a positive significant effect at the national level and for rural location suggesting that contraceptives were likely used more for child spacing than for permanent prevention of pregnancy. This is contrary to Canning and Schultz (2012) that find the use of contraceptives reducing fertility.

The log of per capita expenditure of household was not significant neither is the cost of contraceptives. Women residing in the South-East and South-South had significantly lower fertility than those in the South-West.

A Fertility Interaction Model at the National Level and by Urban and Rural Locations

Interacting the employment status of a woman with her education, the study further examined the impact a woman's employment status would have on her fertility, depending on her level of educational attainment. The results are presented in Table 5.12. From Table 5.12, employment status was interacted with education and the results showed that formal sector employment and being out of the labour force, which were insignificant in the previous estimation, became significant. Educated women who work in the formal sector had less number of children than those who are uneducated but it was significant among women with at least secondary education in urban and rural locations. This is consistent with Feyisetan (1985) that also found the negative employment – fertility relationship and the incompatibility hypothesis obtainable in the formal sector. Women employed in the informal sector with primary education had less number of children than those without education, this was significant at 1 per cent, women with post secondary education had more number of children, suggesting that they found work and childcare compatible. This was significant at 1 per cent only among urban women. This positive effect in the informal sector is consistent with Wusu (2012) that found that informal sector workers had greater fertility than formal sector workers. It is also consistent with Togunde (1988), Mason and Palan (1981) and Fapohunda (1982) that argue for a positive effect due to less restrictions on the presence of children in the workplace. Being out of the labour force significantly increases the number of children ever born among educated women than those with no education. Thus, women who do not work and are not searching for a job have all their time allocated for childbearing and childcare. This is consistent with the negative fertility – employment relationship of Becker (1965). It was highly significant for women at the primary, secondary and post-secondary educational levels, this was obtained at the national level and in urban and rural locations.

Table 5.12 Fertility Interaction Model at the National Level and by Urban and Rural Locations

Selected Explanatory Variables	National	Urban	Rural
Number of child deaths	1.956(9.49)*	2.215(5.90)*	1.866(7.61)*
Employment status			
No education*formal sector	RC	RC	RC
Primary education * formal sector	-0.029(-0.26)	-0.217(-0.93)	0.157(1.03)
Secondary education *formal sector	-0.369(-3.44)*	-0.411(-2.22)	-0.358(-2.08)**
Post-secondary education *formal sector	-0.799(-4.78)*	-0.636(-2.52)	-0.504(-1.67)
No education * informal sector	RC	RC	RC
Primary education* informal sector	-0.153(-2.31)*	0.041(0.25)	-0.086(-0.91)
Secondary education * informal sector	-0.024(-0.36)	0.187(1.26)	-0.046(-0.44)
Post-secondary education * informal sector	-0.031(0.34)	0.525(2.92)*	-0.052(-0.30)
No education * out of labour force	RC	RC	RC
Primary education * out of labour force	0.260(4.27)*	0.664(4.65)*	0.145(2.13)**
Secondary education * out of labour force	0.295(4.53)*	0.420(3.31)*	0.206(2.56)*
Post-secondary education * out of labour force	0.256(2.78)*	0.420(2.92)*	0.068(0.49)
Household size	1.743(54.30)*	1.901(30.41)*	1.696(45.34)*
Age at first childbirth	0.019(1.94)	0.058(3.16)*	0.009(0.77)
Age at first childbirth squared	-0.002(-7.56)*	-0.002(-5.22)*	-0.002(-6.03)*
Log per capita expenditure	0.001(-0.89)	-0.006(-.08)**	0.000(0.00)
Constant	-2.712(-14.05)*	-2.936(-6.67)*	-2.436(-10.97)*

Number of observations	41575	9798	31777
R^2	0.4074	0.4735	0.3904
F-Statistic(ProbF-stat)	820.59(0.0000)	244.05(0.0000)	624.20(0.0000)

***Note*:** Values within parenthesis represent t-statistics where (*) and (**) represent significance at (1%) and (5%), respectively. RC denotes reference category.

5.2.3 Determinants of Fertility by Geopolitical Zones.

The estimates of the determinants of fertility are presented by geopolitical zones in Table 5.13. The overall significance of the models was high at the 1 per cent significance level. The number of child deaths had a significant positive effect on the number of children ever born in all zones except the North-East where it was negative but insignificant. Thus, an increase in the number of child deaths is associated with an increase in fertility of 3.8, 2.3, 2.1, 2.8 and 3.4 children in the North-Central, North-West, South-South and South-West zones respectively at the 1 per cent significance level.

The greatest effect of 3.840 was obtained in the North-Central. Thus in all zones except the North-East, fertility increases as the number of child deaths increase. Thus, the replacement and anticipatory effect is applicable to women in urban and rural locations and in all zones except the North-East. The result is consistent with Benefo and Schultz (1996), Wolpin (1984), Blackburn and Cipriani (1998) and Handa (2000) that find lower child mortality rates significant to induce decreased number of childbirths by a woman and higher rates responsible for increased births. This is also consistent with Schultz (1973) who explains that child mortality affects the derived demand for births by increasing the number of births required to obtain a survivor. The negative effect in the North-East implying a reduction in fertility by -0.023 is very minimal.

Working in the formal sector was associated with higher number of children ever born in all zones except the North-West and South-South, however, it was not significant at the 5 per cent statistical significance level in any zone. Women working in the informal sector had less number of children than those who do not work in the informal sector; this was significant only in the North-East zone. Being out of the labour force significantly increased the number of children ever born in the North-East but significantly reduced it in the North-West. It was however not significant in other zones.

Table 5.13 Determinants of Fertility by Geopolitical Zones

Variables	North Central	North East	North west	South East	South South	South West
Number of child deaths	3.840 (4.74)*	-0.023(-0.02)	2.286(3.45)*	2.146(1.72)	2.755(2.87)*	3.360(5.38)*
Employment status						
Working in the formal sector	0.842(1.78)	0.626(1.03)	-0.170(-0.38)	1.100(1.51)	-0.972(-1.62)	0.701(1.77)
Not working in the formal sector	RC	RC	RC	RC	RC	RC
Working in the informal sector	-0.712(-0.87)	-5.274(-5.15)*	-0.015(-0.03)	0.547(0.47)	-0.086(-0.09)	-0.680(-1.38)
Not working in the informal sector	RC	RC	RC	RC	RC	RC
Out of the labour force	-1.753(-1.30)	5.912(3.60)*	-1.149(-1.46)*	-0.935(-0.50)	1.022(0.69)	-0.774(0.91)
Within the labour force	RC	RC	RC	RC	RC	RC
Education						
No education	RC	RC	RC	RC	RC	RC
Primary education	0.027(0.14)	1.129(4.82)*	0.727(6.08)*	-0.033(-0.12)	0.442(2.02)**	0.010(0.08)
Secondary education	-0.192(-0.51)	1.475(3.15)*	0.252(1.10)*	-0.677(-1.27)	0.484(1.12)	-0.211(-0.87)

Post-secondary education	-2.237(-2.20)*	-3.154(-2.39)**	0.419(0.40)	-1.989(-1.25)	2.017(1.52)	-1.805(-1.99)**
Urban residence	0.283(2.54)**	0.715(5.05)*	0.291(3.60)*	-0.270(-1.80)	-0.006(0.05)	0.089(1.19)
Rural residence	RC	RC	RC	RC	RC	RC
Religion						
Christianity	-0.477(-0.88)	2.386(3.49)*	0.335(0.94)	-0.536(-0.71)	0.622(1.06)	-0.118(-0.32)
Muslim	-0.029(-0.06)	2.996(5.01)*	0.436(1.68)	-0.757(-0.79)	-0.085(-0.16)	0.299(1.03)
Traditional	RC	RC	RC	RC	RC	RC
Others	-1.070(-0.97)	3.285(3.04)*	0.390(0.50)	-0.998(-0.85)	1.354(1.48)	-0.262(-0.38)
Age	0.023(0.32)	0.393(4.47)*	0.075(1.57)	0.024(0.24)	0.057(0.69)	0.026(0.51)
Age squared	0.000(0.35)	-0.003(-3.99)*	0.000(0.25)	0.000(0.39)	0.000(0.47)	0.000(0.36)
Household size	1.534(16.83)*	2.022(20.33)*	1.578(22.98)*	2.250(17.13)*	2.001(18.70)*	1.419(18.66)*
Age at first childbirth	0.114(3.78)*	-0.010(-0.30)	0.021(0.69)	0.050(1.15)	0.025(0.74)	0.161(6.24)*
Age at first childbirth squared	-0.004(-5.87)*	-0.002(-3.28)*	-0.002(-2.89)*	-0.002(-3.46)*	-0.001(-1.87)	-0.004(-8.24)*
Log per capita expenditure	0.003(0.44)	-0.022(-2.74)*	0.004(0.74)	0.009(0.92)	0.002(-0.19)	0.002(0.46)
Marital status						
Married monogamous	1.194(3.14)*	-1.398(-3.25)*	-0.782(-2.65)*	0.483(0.82)	0.173(0.48)	1.066(3.71)*
Married polygamous	1.378(1.56)	-4.239(-4.65)*	-1.995(-3.09)*	1.781(1.75)	0.016(0.02)	1.827(3.38)*

Divorced/separated/ Widowed	0.559(1.77)	-0.703(1.96)**	-1.206(-5.43)*	0.379(0.78)	0.998(3.79)*	1.674(3.02)*
Single	RC	RC	RC	RC	RC	RC
Use of contraceptives	0.350(2.12)*	-0.781(-3.64)*	0.095(0.85)	0.588(2.47)**	0.045(0.24)	0.309(3.08)*
Non-use of contraceptives	RC	RC	RC	RC	RC	RC
Cost of contraceptives	-0.000(0.42)	0.000(2.35)**	-0.000(-0.60)	-0.000(-0.80)	-0.000(1.01)	0.000(0.20)
Constant	-3.252(-3.75)*	-5.258(-3.24)*	-3.240(-4.55)*	-0.906(-0.73)	-3.864(-3.74)*	-2.671(-3.36)*
R –squared	0.4564	0.4170	0.3533	0.4406	0.4389	0.4873
F-statistic(p-value)	299.50(0.0000)	256.84(0.0000)	287.52(0.0000)	134.79(0.0000)	183.04(0.0000)	247.94(0.0000)
Observations	7516	7364	12473	3708	4954	5560

***Note*:** Values within parenthesis represent t-statistics where (*) and (**) represent significance at (1%) and (5%) respectively. RC denotes reference category.

Other significant determinants of the number of children ever born include education. In the North-East, North-West and South-South zones, women with a primary education had higher fertility than those with no education showing that the effect of primary education on fertility reduction in those Zones is weak. Having a secondary education significantly increased fertility among women in the North-East and North-West signifying that the effect of even a secondary education is weak in these zones. In the North-Central, North-East and South-West, women with post-secondary education however had lower fertility than those with no education; this is significant at 5 per cent.

Religion was positively significant among Christian and Muslim women only in the North-East. Thus, Christian and Muslim women have more number of children ever born than women who practice traditional religion.

The larger the household, the more the number of children a woman ever has. This was significant at the 1 per cent level in all six zones.

In all the six zones except in the South-South, age at first childbirth had a negative non linear relationship with fertility. Thus the lower the age at which a woman starts having childbirths the greater her fertility, probably because she has a longer reproductive period than one who starts childbearing at a later stage in life.

Women in the North-Central, South-East and South-West, who use contraceptives had more children than those who do not, suggesting that its use is likely for child spacing than for permanent prevention of pregnancy. There is however a negative effect in the North-East, this is consistent with Canning and Schultz (2012) that find fertility reduction significantly determined by the use of contraceptives.

The log of per capita expenditure of household was only significant in the North-East with a negative effect. Thus, women who reside in a household with a high per capita expenditure tend to have less number of children ever born. This tends to increase the total health and other expenditures per child. This is consistent with Handa (2000) that finds a negative effect of per capita household expenditure on the number of births. Increasing cost of contraceptives discourage its use thus increasing the number of children ever born. This was significant only the North-East.

5.2.4 Determinants of Fertility by Mothers' Age Group

The estimates of the determinants of fertility by mothers' age group are presented in Table 5.14. The overall significance of the models was high at the 1% significance level. The number of child deaths had a significant positive effect on the number of children ever born. An increase in the number of child deaths was associated with an increase in fertility thus, women tend to have more births as they experience more number of child deaths.

The positive effect of child mortality held for all age groups of mothers except for the age group, 20 to 24 that had a negative effect, however, it was insignificant. The positive effect is highly significant among mothers aged 30 years and above. The strongest effect of 6.735 was seen among women aged 45 to 49 probably because they are closest to menopause. Thus, the replacement and anticipatory effects are applicable to young and older women. This result is also consistent with Benefo and Schultz (1996), Wolpin (1984), Blackburn and Cipriani (1998) and Handa (2000) that found low child mortality rates significant to induce decreased number of childbirths by a woman and increasing rates responsible for increased births.

Formal sector employment did not significantly explain the number of children ever born for all age group of women. Women who work in the informal sector had less number of children than those who do not, this was significant among older women within the age group of 40 to 44. Being out of the labour force did not significantly explain the number of children ever born for all age group of women.

Education had a positive significant effect among women with primary education and it was significant for women aged 40 years and above. Women with secondary education had more number of children than those with no education and this was significant for women within the ages of 40 to 44. However, women with as high as post-secondary education had fewer children than those with no education, this was significant among older women aged 40 to 44. Thus, while primary and secondary education increased fertility, women with post secondary education had lower fertility than those with no education. Thus, higher educational attainment reduced the number of children ever born.

5.14 Determinants of Fertility by Mothers' Age Group

Variables	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Number of child deaths	3.584(1.61)	-0.271(-0.28)	1.534(1.82)	2.455(3.78)*	4.020(5.30)*	2.551(2.18)**	6.735(5.25)*
Employment status							
Working in the formal sector	1.017(0.85)	0.517(0.95)	-0.313(-0.76)	0.468(1.12)	0.594(1.15)	-1.188(1.57)	0.096(0.11)
Not working in the formal sector	RC	RC	RC	RC	RC	RC	RC
Working in the informal sector	3.790(1.41)	-1.888(-1.65)	1.921(1.91)	-0.631(-1.40)	0.451(0.83)	-5.574(-5.23)*	-1.330(-1.39)
Not working in the informal sector	RC	RC	RC	RC	RC	RC	RC
Out of the labour force	-5.809(-1.37)	0.337(0.19)	-2.380(-1.52)	-0.081(-0.10)	-1.421(-1.47)	2.160(1.24)	1.282(0.79)
In the labour force	RC	RC	RC	RC	RC	RC	RC
Education							
No education	RC	RC	RC	RC	RC	RC	RC
Primary education	-0.642(-1.09)	0.446(1.71)	-0.013(-0.06)	0.221(1.85)	0.178(1.24)	1.167(4.65)*	0.685(2.89)*

Secondary education	-1.739(-1.50)	0.258(0.49)	-0.321(-0.74)	0.051(0.22)	-0.238(-0.85)	1.244(2.49)**	0.488(1.08)
Post-secondary education	-1.433(-0.58)	-2.022(-1.85)	1.353(1.68)	-1.149(-1.20)	-0.800(-0.67)	-4.787(-2.82)*	-0.082(-0.04)
Urban residence	-0.053(-0.19)	0.275(1.93)	-0.087(-0.77)	0.189(2.34)**	-0.008(-0.09)	0.742(4.85)*	0.397(2.72)*
Rural residence	RC	RC	RC	RC	RC	RC	RC
Religion							
Christianity	-1.946(-1.16)	0.400(0.55)	-0.506(-0.82)	-0.009(-0.03)	-0.194(-0.48)	1.247(1.76)	0.225(0.34)
Muslim	-1.976(-1.35)	1.124(1.74)	-0.694(-1.27)	0.245(0.90)	-0.296(-0.99)	2.730(4.64)*	0.167(0.34)
Traditional	RC	RC	RC	RC	RC	RC	RC
Others	-3.737(-1.45)	0.498(0.42)	-1.213(-1.26)	0.070(0.12)	0.101(0.14)	2.263(2.08)**	1.173(1.14)
Age	-4.593(4.62)*	-0.281(-0.59)	0.621(1.26)	-0.229(-0.31)	1.720(1.72)	2.719(1.74)	-0.234(-0.12)
Age squared	0.123(4.47)*	0.010(0.91)	-0.009(-1.04)	0.004(0.40)	-0.024(-1.73)	-0.032(-1.73)	0.003(0.15)
Household size	0.651(3.58)*	0.860(8.92)*	1.281(16.04)*	1.975(24.07)*	2.304(25.27)*	1.990(17.20)*	2.266(17.21)*
Age at first childbirth	0.000(0.01)	-0.063(-1.70)	-0.008(-0.29)	0.085(3.06)*	0.094(2.88)*	-0.080(-1.89)	0.111(2.27)**
Age at first childbirth squared	0.003(1.95)	0.000(0.02)	-0.001(1.98)**	-0.003(-4.63)*	-0.002(3.85)*	-0.004(4.67)*	-0.002(2.56)**
Log per capita expenditure	0.023(1.24)	0.003(0.36)	0.008(1.08)	-0.003(-0.66)	0.003(0.48)	0.004(0.37)	-0.009(-1.00)

Marital status							
Married monogamous	0.476(0.61)	- 0.738(2.17)**	0.812(2.19)**	0.956(1.99)**	0.792(2.06)*	1.412(2.07)**	1.212(1.84)
Married polygamous	1.334(0.73)	1.056(0.68)	1.408(1.72)	1.068(1.51)	0.738(0.91)	1.013(0.92)	0.932(0.88)
Divorced/separated /widowed	-0.085(-0.15)	-1.673(6.34)*	0.774(2.63)*	0.688(1.53)	0.726(2.38)**	0.731(1.24)	1.784(3.37)*
Single	RC	RC	RC	RC	RC	RC	RC
Geopolitical zone							
North-Central	2.926(1.50)	-0.805(-0.99)	1.361(1.90)	-0.397(-1.28)	0.297(0.79)	-3.006(4.06)*	-1.163(-1.78)
North- East	6.790(1.51)	-1.038(-0.55)	3.199(1.93)	-0.558(-0.78)	0.939(1.08)	-5.358(3.15)*	-3.083 (-2.07)**
North-West	4.181(1.50)	-0.641(-0.55)	2.246(2.19)**	-0.966(2.03)**	-0.064(-0.11)	-4.475(4.12)*	-3.176(3.15)*
South-East	3.241(1.60)	-1.101(-1.26)	1.611(2.15)**	-0.513(-1.37)	0.072(0.16)	-4.632(5.56)*	- 2.015(2.55)**
South-South	1.276(1.19)	- 1.013(2.07)**	0.886(2.27)**	-0.581(-1.68)	-0.440(-1.03)	-3.410(5.33)*	-1.408(-1.94)
South-West	RC	RC	RC	RC	RC	RC	RC
Use of contraceptives	0.907(1.66)	-0.292(-1.32)	0.528(2.69)*	0.119(1.21)	0.466(3.98)*	-0.233(-1.09)	0.330(1.63)
Non-use of contraceptives	RC	RC	RC	RC	RC	RC	RC
Cost of contraceptives	-0.000(-0.92)	0.000(0.64)	-0.000(-1.81)	0.000(0.71)	-0.000(-1..01)	0.000(0.63)	0.000(0.83)
Constant	37.268(4.45)*	5.331(1.02)	- 13.737(2.10)**	1.679(0.14)	-35.103(1.90)	-52.408(1.61)	1.659(0.04)
R squared	0.1590	0.2500	0.2924	0.2819	0.2678	0.2254	0.1943

F-statistics(p-value)	20.56(0.0000)	55.08(0.0000)	126.62(0.0000)	112.91(0.0000)	92.92(0.0000)	58.83(0.0000)	42.65(0.0000)
Observations	1478	4902	8812	7924	7885	5978	4596

***Note*:** Values within parenthesis represent t-statistics where (*) and (**) represent significance at (1%) and (5%) respectively. RC denotes reference category.

Muslim women and women of other religions had more children than those who are traditionalists. This was significant only among women of 40 to 44 years.

Age had a positive non-linear effect such that fertility declined early in life but increased as they grew older, this was significant only among young women aged 15 to19 at 5 per cent significance level.

For all age group of women, household size was positively significant. Thus, fertility increased as household size grew large. The childcare support provided by more household members could encourage more births.

Age at first childbirth had a negative non linear significant relationship with fertility among young and older women of all age groups except for women within the ages of 15 to 19 as well as 20 to 24.

The use of contraceptives was significant only among women aged 25 to 29 and 35 to 39; the effect was positive.

Being married increased the number of children a woman had as married mothers were observed to have significantly more number of children than single mothers, this was significant for all age groups of women except those aged 15 to19 and 20 to 24 in the case of women in a monogamous marriage; and for women who are divorced, separated or widowed, it was significant only for age groups of 20 to 24, 25 to 29, 35 to 39 and 45 to 49. It was not significant for women in a polygamous marriage.

The log of per capita expenditure of household was not significant for all age groups of women.

5.2.5 The Replacement Rate

The results from calculating the replacement rate of births to a child death are presented in Tables 5.15 and 5.16.

Table 5.15 Estimates of Replacement Response at the National level and by Location

Estimation Method	Coefficient Estimate			Implied Replacement Rate		
	National	Urban	Rural	National	Urban	Rural
Ordinary Least Squares(OLS)	0.901(103.84)*	0.914(44.65)*	0.896(93.14)*	0.57	0.59	0.56
Instrumental Variables (IV)	0.521(48.16)*	0.503(19.49)*	0.521(43.48)*	0.52	0.50	0.52

Note: * represents t-statistic entered in parenthesis, significant at 1%

The corrected OLS method and the instrumental variables (IV) estimation method were employed since the number of births and the mortality rate were correlated. The instrumental variable estimate cannot be corrected because the implied average within parity variance in mortality rates was very small or negative, and the variance of the number of child deaths was different from its predicted value (Olsen 1980). Since the instrumental variables replacement rate estimates cannot be corrected, we can only rely on the OLS estimator results for the replacement rate. As shown in Table 5.15, the national implied replacement rate was 0.57. Thus, an additional child death experienced by a woman would produce 57 per cent more births. The implied replacement rate of 0.59 in the urban area was slightly higher than 0.56 in the rural location. Thus urban women tend to replace a child death by having additional births than rural women. This could be explained by the fact that most parts of urban cities are largely rural in characteristic (agrarian with little or no industralisation, and most women are barely educated) and hence, are mere extensions of rural areas though in an urban location. Thus the manual services of a large number of children would be useful. Also, the relatively higher child labour income contribution to household income in urban locations could explain the higher replacement rate in urban than rural locations. The rural and urban replacement rates calculated for Nigeria in this study are lower than 0.70 and 0.66 for rural and urban respectively reported by Handa (2000) for Jamaica but higher than the range of 0.20 to 0.25 reported by Benefo and Schultz (1996) for both urban and rural locations of Ghana and Cote d'Ivoire.

Table 5.16 shows that the implied replacement rate of 0.61 in the South-West was the highest amongst the six geopolitical zones, followed by 0.60 in the north central and 0.54 in the North-East, North-West and South-South. Thus, a unit increase in the total number of child deaths in the South-West would produce 61 per cent more births. Women in the South-East had the least number of births as replacement for a dead child than women in other zones.

The relatively high replacement rate discussed above shows that reducing the number of child deaths experienced by women should be a major target of policy if fertility rates are to fall significantly. It also shows that women tend to have more births or number of children in the event of the death of a child just in the bid to replace a dead child. The number of more births the death of a child would produce is shown by the replacement rate.

Table 5.16 Estimates of Replacement Response by Geopolitical Zone

Estimation Method	Coefficient Estimate						Implied Replacement Rate					
	North Central	North East	North West	South east	South south	South west	North central	North east	North west	South east	South south	South west
Ordinary Least Squares(OLS)	0.967 (38.17)*	0.893 (43.70)*	0.879 (64.69)*	0.878 (26.65)*	0.889 (33.64)*	0.887 (27.87)*	0.60	0.54	0.54	0.49	0.54	0.61
Instrumental Variables(IV)	0.531 (17.12)*	0.510 (20.15)*	0.552 (32.98)*	0.364 (8.48)*	0.428 (12.44)*	0.432 (10.51)*	0.53	0.51	0.55	0.36	0.43	0.43

Note: * represents t-statistic entered in parenthesis, significant at 1%

5.3 Determinants of Child Mortality

The results from the estimation of the child mortality equation, which is equation (b) in equation (14) are presented in this section. The estimation was carried out for women within the reproductive ages of 15 and 49 with at least a child. Based on the result from some econometric tests first carried out, the method employed is the two-stage estimation method involving the use of the OLS estimator and the probit method to control for endogeneity bias. A robust estimation is also carried out to control for heteroskedasticity bias. The estimation of child mortality using the number of child deaths was carried out at the national level, for urban and rural locations and then some interaction variables were introduced into the equation and re-estimated. The estimation was also carried out for the six geopolitical zones. The child mortality equation was also estimated using the mortality rate as a measure to control for the possible exposure time to death because the HNLSS questionnaire does not explicitly specify an age limit for child deaths; hence there is the possibility that the death of older children may be included in the mortality data (Handa, 2000).

5.3.1 Econometric Tests

Some test carried out to ascertain the econometric properties of the equations include test for exogeneity, test for heteroskedasticity and test for instrument relevance and validity.

Test for Exogeneity

The results of the test for exogeneity using the Hausman test are presented in Table 5.17. In the child mortality equation, fertility, measured as the number of children ever born as well as the three measures of maternal labour participation were found to be endogenous, except the probability of formal sector employment, which was exogenous since its residual coefficient was insignificant.

Table 5.17 Test for Exogeneity

Variable	Residual coefficient	t-statistic	p-value
Child mortality equation			
Number of children ever born	-0.306	-2.11	0.035
Probability of formal sector employment	-0.037	-1.19	0.233
Probability of informal sector employment	-0.044	-1.82	0.069
Probability of being out of the labour force	-0.025	-1.82	0.069

Source: Computed by author

Test for Heteroskedasticity

The Breusch-Pagan/Cook- Weisberg heteroskedasticity test was conducted for equation (b) in equation (14), used in estimating the determinants of child mortality. The decision rule is to reject the null hypothesis that there is no heteroskedasticity if the Prob>chi2 value shows that the Chi2(1) score is significant. The results as shown in Table 5.18 reveal that there was a significant presence of heteroskedasticity with a significant Chi2(1) score in the child mortality equation (b).

Test for Instrument Relevance and Validity

To test for the relevance of the instruments used, the first stage regressions of the reduced form equations for the endogenous variables are estimated and the results are presented in Appendix II. The first stage regression of the reduced form equations for fertility and for two measures of maternal labour participation (probability of formal sector employment and the probability of being out of the labour force) showed that the instruments used were highly significant at the 1% level to explain fertility. Thus, the instruments used are relevant. In order to ensure that the instruments are valid, a test on whether the instruments have a significant effect on the dependent variable was conducted and the results are presented in Table 5.19. The instruments used are valid because they do not have any significant effect on the dependent variables.

Table 5.18 Test for Heteroskedasticity

Dependent Variable	Chi2(1)	Prob>chi2
Number of children ever born	4579.82	0.0000
Number of child death	51845.87	0.0000
Probability of formal sector employment	19661.43	0.0000
Probability of informal sector employment	48.9	0.0000
Probability of being out of the labour force	6256.38	0.0000

Source: Computed by author

Table 5.19 Test for Instrument Validity

Instrument	Coefficient	t-statistic	p-value
Child mortality equation			
Cost of contraceptives	-0.000	-1.16	0.248
Hours of work per day	0.062	1.48	0.138
Cost of electricity	0.000	0.72	0.474

Source: Computed by author

5.3.2 Determinants of Child Mortality Using the Number of Child Death – Estimated at the National Level and by Urban and Rural Locations

The estimates for the determinants of child mortality are presented at the national level and by urban and rural locations in Table 5.20. The overall significance of the model was high at the 1% significance level. The number of children ever born was found to have a positive effect on the number of child deaths at the national level and in rural locations but has a negative effect in urban location, however, it was insignificant. This positive effect is consistent with Herzer *et al.* (2012), Benefo and Schultz (1996), Maglad (1994), Handa (2000) and Blackburn and Cipriani (1998).

Women in the formal sector had less number of child deaths than those who do not work in the formal sector, this was significant at the national level at the 5% level. This is consistent with Rosenzweig and Schultz (1983) and Tulasidhar (1993) that found a negative effect of employment on child mortality. However, it was not significant in urban and rural locations.

Women working in the informal sector had less number of child deaths than those not employed in the informal sector. This obtained at the national level and in urban and rural locations but it was significant only in urban locations at 5%. Since in this sector, it is possible to combine work and childcare to an extent, because there is less restriction on children in the workplace, this result is expected.

Women who are out of the labour force have less number of child deaths than those within the labour force, this was obtained at the national level and in urban and rural locations although it was significant only in urban locations at the 5% level. This negative effect was not surprising because women who are outside the labour force have more time for childcare and do not have to allocate time for work.

Educated women had less number of child deaths than women with no education, this was found at the national level as well as in urban and rural locations. However it was only significant in urban locations at the 1% level. This could be as a result of the higher health and hygiene awareness that education offers; educated women were more likely to utilize modern health services and display higher hygienic practices (Kembo and Van Ginneken, 2009; Cutler *et al.*, 2006 and Tulasidhar, 1993).

Table 5.20 Determinants of Child Mortality Using the Number of Child Death – Estimated at the National Level and by Urban and Rural Locations

Variables	National	Urban	Rural
Number of children ever born	0.097(0.67)	-0.200(-0.74)	0.143(0.83)
Employment status			
Working in the formal sector	-0.050(-2.37)**	-0.042(-1.69)	-0.054(-1.72)
Not working in the formal sector	RC	RC	RC
Working in the informal sector	-0.295(-0.64)	-3.524(-2.35)**	0.260(0.53)
Not working in the informal sector	RC	RC	RC
Out of the labour force	-0.116(-0.58)	-1.552(-2.41)**	0.088(0.42)
In the labour force	RC	RC	RC
Education			
No education	RC	RC	RC
Primary education	-0.146(-0.96)	-1.123(-2.46)**	-0.141(-0.86)
Secondary education	-0.097(-1.13)	-0.814(-2.57)*	-0.070(-0.79)
Post-secondary education	-0.425(-0.82)	-4.377(-2.42)**	-0.347(-0.64)
Urban residence	0.068(0.51)	-	-
Rural residence	RC	RC	RC
Age	0.013(0.40)	0.075(1.16)	0.004(0.12)
Age squared	-0.000(-0.40)	-0.001(-1.58)	-0.000(-0.05)
Household size	-0.257(-1.00)	0.113(0.26)	-0.343(-1.12)
Per capita expenditure	0.001(0.52)	0.004(1.34)	0.001(0.76)
Marital status			
Married monogamous	0.060(1.28)	1.177(2.24)	0.054(0.22)
Married polygamous	0.105(0.37)	1.872(2.84)*	-0.121(-0.38)
Divorced/separated/widowed	-0.158(-1.63)	-0.732(-2.33)**	-0.154(-1.45)
Single	RC	RC	RC
Cost of electricity	0.000(0.56)	0.000(2.35)**	0.000(0.26)
Prenatal care use	0.015(0.27)	0.048(0.53)	-0.007(-0.10)

Postnatal care use	0.015(0.23)	0.244(1.61)	0.011(0.14)
Use of both	0.025(0.86)	0.044(0.93)	0.016(0.42)
Use of none	RC	RC	RC
Cost of prenatal care	-0.000(-1.05)	-0.000(-2.55)**	-0.000(-0.26)
Cost of postnatal care	0.000(0.96)	-0.000(-1.48)	0.000(0.77)
Use of vaccine	0.057(0.62)	- 0.165(-1.00)	0.065(0.60)
Non- use of vaccine	-0.086(-0.44)	1.483((1.14)	-0.266(-3.14)*
Don't know	RC	RC	RC
Cost of vaccine	0.002(1.30)	0.005(2.15)**	0.002(1.26)
Birth weight	-0.006(-1.16)	0.011(0.66)	-0.006(-0.93)
Use of mosquito net	0.031(0.27)	0.700(2.22)**	-0.021(-0.16)
Non-use of mosquito net	RC	RC	RC
Public tap	0.030(0.51)	0.338(1.94)	0.051(0.77)
Borehole	0.046(0.60)	0.461(2.06)**	0.055(0.66)
Rain	RC	RC	RC
Bottle/sachet	0.143(1.11)	0.781(2.38)**	0.068(0.44)
Flush toilet	-0.024(-1.29)	-0.025(-0.90)	-0.026(-1.01)
Pit latrine	0.002(0.13)	-0.012(-0.46)	-0.003(-0.18)
No toilet/bush	RC	RC	RC
0-29 mins to hospital	0.003(0.04)	0.404(2.16)**	-0.007(-0.10)
30-59 mins to hospital	-0.020(-0.63)	0.080(1.12)	-0.013(-0.36)
60 mins and above to hospital	RC	RC	RC
0-29 mins to clinic	0.120(1.40)	0.639(2.32)**	0.121(1.34)
30-59 mins to clinic	0.086(1.51)	0.437(2.39)**	0.081(1.33)
60 mins and above to clinic	RC	RC	RC
Hospital and maternity home delivery	-0.026(-0.25)	-0.426(-2.20)**	-0.019(-0.15)
Home delivery and others	RC	RC	RC
North-Central	0.114(7.56)*	0.083(3.43)*	0.165(8.54)*
North-East	0.295(14.62)*	0.343(6.79)*	0.337(14.54)*

North-West	0.412(19.91)*	0.327(8.35)*	0.470(19.07)*
South-East	0.152(7.93)*	0.113(3.87)*	0.196(7.86)*
South-South	0.202(10.73)*	0.084(3.05)*	0.274(11.24)*
South-West	RC	RC	RC
Constant	0.266(0.48)	-2.497(-1.68)	-0.135(-0.22)
R –squared	0.0358	0.0399	0.0340
F-statistic(p-value)	33.32(0.0000)	7.42(0.0000)	25.21(0.0000)
Observations	40382	9550	30832

***Note*:** Values within parenthesis represent t-statistics where (*) and (**) represent significance at (1%) and (5%) respectively. RC denotes reference category.

High cost of electricity significantly increased the number of child deaths at the national level as well as in urban and rural locations, but it was significant in urban locations only. Increasing cost of basic social amenities and infrastructures such as electricity deprive households of the use of such amenities that provide pro-health environmental conditions.

Short distances to the nearest hospital and clinic still increased the number of child deaths significantly in urban areas than a distance of 60 minutes and above. This could be explained by the poor road access due to the bad state of roads and the congestion of the few good ones.

The use of boreholes and bottle or sachet water still increase child mortality than the use of rainwater for drinking, this was significant only in urban locations. This goes to show that poor quality water could be available even from boreholes and private production. Thus, great care must be taken to ensure adequate treatment and quality standards are adhered to in the supply of water for drinking.

Women whose place of delivery is the hospital or maternity home had less number of child deaths than those who deliver their children at home or in other places this was significant only in urban locations. Women who reside in any of the other five zones tended to have more number of child deaths than those in the South-West.

The cost of vaccine had a positive significant effect on the number of child deaths in urban locations only. Thus, higher cost of vaccine would discourage its use by women who cannot afford it.

The negative significant effect of the cost of prenatal care shows that the higher the cost of prenatal care, the lower the number of child deaths. This could imply that prenatal care services may be seen as luxury goods, such that women who can afford them increase their demand even with higher prices.

The type of toilet used was not significant to explain the number of child deaths neither was the use of prenatal or postnatal care. The birth weight was also insignificant.

A Child Mortality Interaction Model at the National Level and by Urban and Rural Locations

The child mortality interaction model is estimated at the national level and by location. The number of children ever born and the employment status were interacted with education. The results are presented in Table 5.21.

The number of children ever born which was insignificant in the previous estimation, became highly significant when interacted with education. The number of child deaths was lower among educated women with more children than among women with no education. This was significant among women with primary and secondary education at the national level and urban location. However, it was significant among women with post-secondary education at the national level and in urban and rural locations. This negative effect is consistent with Eswaran (2002) and Rosenzweig and Schultz (1983) and the influence of education is consistent with Cutler *et al.* (2006) as well as Kembo and Van Ginneken (2009).

Women employed in the formal sector that had post secondary education experienced less number of child deaths than those with no education. This was significant at the national level and in rural locations. Thus, despite the reduced time allocated for childcare as a result of time allocation for work, the level of child deaths was still lower among formal sector employed women with post secondary education probably because of the higher income they are likely to earn due to their higher educational achievement and the influence that such education have on healthy practices. Thus, the importance of education cannot be overemphasised because it increases the health and hygiene awareness as well as the utilisation of modern healthcare facilities (Tulasidhar, 1993).

Women employed in the informal sector with primary education had more number of child deaths than those with no education, this was significant at the national level as well as in urban and rural locations. Having secondary education was not significant, however, women working in the informal sector with post secondary education also had more number of child deaths than uneducated women but it was significant only in urban areas. The high number of deaths recorded among

Table 5.21 Estimates of the Determinants of Child Mortality Interaction Model at the National Level and by Location

Selected Explanatory Variables	National	Urban	Rural
No education*Number of children ever born	RC	RC	RC
Primary education* Number of children ever born	-0.039(-3.63)*	-0.110(-4.67)*	-0.015(-1.25)
Secondary education* Number of children ever born	-0.033(-2.62)*	-0.064(-2.94)*	-0.017(-1.04)
Post-secondary education* Number of children ever born	-0.046(-2.79)*	-0.068(-2.77)*	-0.049(-1.86)
Employment status			
No education*formal sector	RC	RC	RC
Primary education* formal sector	-0.036(-0.67)	-0.003(-0.03)	-0.044(-0.64)
Secondary education*formal sector	-0.014(-0.35)	-0.027(-0.71)	0.006(0.08)
Post-secondary education*formal sector	-0.088(-2.60)*	-0.037(-1.02)	-0.156(-2.45)**
No education*informal sector	RC	RC	RC
Primary education* informal sector	0.096(1.94)**	0.273(2.23)**	0.126(1.67)
Secondary education*informal sector	-0.012(-0.24)	0.112(0.90)	-0.025(-0.28)
Post-secondary education*informal sector	-0.015(-0.20)	0.289(2.22)**	-0.165(-1.22)
No education*out of labour force	RC	RC	RC
Primary education* out of labour force	-0.015(-0.48)	0.047(0.76)	-0.002(-0.04)
Secondary education*out of labour force	0.010(0.32)	0.049(0.86)	0.021(0.43)
Post-secondary education*out of labour force	0.039(0.96)	0.100(1.50)	0.042(0.63)
Age	0.033(5.87)*	0.025(2.04)**	0.034(5.22)*
Age squared	-0.000(-2.08)**	-0.000(-0.47)	-0.000(-1.79)
Household size	-0.039(-2.21)**	0.083(2.19)**	-0.070(-3.42)*
Per capita expenditure	0.000(0.12)	-0.002(-1.12)	0.001(0.52)

Constant	-0.498(-5.24)*	-0.393(-1.85)	-0.508(-4.57)*
R –squared	0.0366	0.0440	0.0345
F-statistic(p-value)	29.00(0.000)	6.45(0.0000)	21.51(0.0000)
Observations	40382	9550	30832

Note: Values within parenthesis represent t-statistics where (*) and (**) represent significance at (1%) and (5%) respectively. RC denotes reference category.

educated informal sector employed women despite the high level of compatibility of work and childcare could be attributed to the low income generally earned by some informal sector workers involved in small-scale self-employed businesses, farm work and unpaid family work compared to most formal sector employment.

Being out of the labour force had no significant effect on child mortality even among educated women.

An increasing household size reduced the number of child deaths in rural areas significantly but increased it in urban locations. Age has a non linear negative relationship with the number of child deaths showing that child mortality increases among young mothers but declines as such mothers grow older. This was significant only at the national level. Thus, early marriages and childbearing increases the risk of child loss.

The number of child deaths declined as the size of the household increased at the national level and among rural women but among urban women, the reverse was the case. Increasing household size was not necessarily as a result of more number of children but could be as a result of an increasing number of adult household members who are relatives or friends. Such adult members could contribute to household income and/or provide childcare support, thus reducing the number of child deaths among rural women. However, in a situation where they provide childcare support but their presence reduces per capita household income, a positive effect is possible as observed among urban women.

5.3.3 Determinants of Child Mortality Using the Number of Child Deaths – Estimated by Geopolitical Zone

The estimates for the determinants of child mortality are presented by geopolitical zones in Table 5.22.

The overall significance of the models was high at the 1% significance level. The number of children ever born was not significant in any of the zones.

Formal sector employed women had less number of child deaths than those who do not work in the formal sector. It was significant only in the North-Central and South-East zones. This could be attributed to the positive income effect of higher earnings in this sector compared to the informal sector. This is consistent with

Rosenzweig and Schultz (1983) and Tulasidhar (1993) though not consistent with Basu and Basu (1991) that found employment increasing child mortality.

Informal sector employment and a woman's decision to be out of the labour force were not significant to explain the number of child death a woman experiences.

The number of child deaths significantly reduced with high cost of electricity. This negative significant effect in the North-East probably implies that electricity is a necessary good so that demand still increases as its price rises.

Table 5.22 Determinants of Child Mortality Using the Number of Child Deaths – Estimated by Geopolitical Zone

Variables	North-Central	North-East	North-West	South-East	South-South	South-West
Number of children ever born	-0.358(-0.78)	-0.533(-1.19)	0.367(0.76)	-0.333(-1.15)	-0.046(-0.29)	0.781(1.70)
Employment status						
Working in the formal sector	-0.142(-4.46)*	-0.021(-0.35)	-0.101(-1.91)	-0.132(-.79)*	0.048(0.73)	0.016(0.54)
Not working in the formal sector	RC	RC	RC	RC	RC	RC
Working in the informal sector	0.102(0.10)	0.819(1.03)	0.025(0.02)	-1.701(-0.53)	-0.978(-1.03)	0.708(0.51)
Not working in the informal sector	RC	RC	RC	RC	RC	RC
Out of the labour force	0.008(0.02)	0.455(1.33)	-0.020(-0.04)	-0.749(-0.54)	-0.415(-1.05)	0.276(0.46)
In the labour force	RC	RC	RC	RC	RC	RC
Education						
No education	RC	RC	RC	RC	RC	RC
Primary education	0.021(0.06)	0.274(0.89)	-0.073(-0.17)	-0.415(-0.41)	-0.302(-0.99)	-0.078(-0.20)
Secondary education	-0.149(-1.04)	-0.055(-0.53)	0.025(0.11)	-0.338(-0.53)	-0.251(-1.32)	0.247(0.70)
Post-secondary education	-0.162(-0.16)	0.494(0.64)	0.026(0.02)	-2.095(-0.56)	-1.218(-1.10)	1.065(0.59)
Urban residence	-0.035(-0.12)	-0.175(-0.68)	-0.059(-0.16)	0.334(0.37)	0.219(0.81)	-0.107(-0.30)
Rural residence	RC	RC	RC	RC	RC	RC

Age	0.094(0.95)	0.161(1.64)	-0.055(-0.52)	0.092(1.30)	0.002(0.06)	-0.184(-1.66)
Age squared	-0.001(-0.85)	-0.001(-1.59)	0.001(0.82)	-0.001(-1.02)	0.000(0.34)	0.002(1.57)
Household size	0.585(0.71)	0.869(1.09)	-0.802(-0.94)	0.462(0.92)	0.077(0.27)	-1.330(-1.84)
Per capita expenditure	-0.001(-0.38)	0.001(0.21)	0.000(0.15)	0.001(1.13)	0.002(0.71)	-0.000(-0.13)
Marital status						
Married monogamous	-0.279(-0.48)	-0.908(-1.62)	0.157(0.25)	0.318(0.27)	0.254(0.67)	0.265(0.77)
Married polygamous	-0.553(-0.78)	-.451(2.08)**	-0.174(-0.23)	-0.007(-0.01)	0.323(0.61)	0.696(1.60)
Divorced/separated/widowed	0.047(0.29)	-0.309(-1.59)	-0.338(-1.36)	-0.529(-0.80)	-0.083(-0.41)	0.331(0.94)
Single	RC	RC	RC	RC	RC	RC
Cost of electricity	0.000(0.18)	-0.000(-3.31)*	0.000(0.04)	0.000(0.97)	0.000(0.25)	-0.000(-0.63)
Prenatal care use	0.237(1.35)	0.233(1.33)	-0.121(-0.68)	0.129(1.03)	0.047(0.61)	-0.213(-1.53)
Postnatal care use	0.103(1.81)	0.034(0.30)	-0.107(-0.66)	0.125(0.53)	0.214(1.06)	-0.238(-1.24)
Use of both	0.086(1.07)	0.118(1.30)	0.064(0.67)	0.002(0.03)	0.067(1.04)	-0.100(-1.43)
Use of none	RC	RC	RC	RC	RC	RC
Cost of prenatal care	0.000(0.49)	-0.000(-0.33)	0.000(0.01)	-0.000(-0.49)	-0.000(-1.47)	0.000(0.46)
Cost of postnatal care	-0.000(-0.16)	-0.000(-0.10)	-0.000(-0.39)	-0.000(-0.83)	0.000(0.71)	0.000(1.17)
Hospital and maternity home delivery	-0.188(-0.60)	0.505(1.47)	-0.035(-0.13)	0.186(0.32)	-0.478(3.43)*	- 0.118(2.13)**
Home delivery and others	RC	RC	RC	RC	RC	RC

Use of vaccine	-0.256(-1.73)	0.601(2.50)**	-0.021(-0.10)	-0.016(-0.04)	0.121(0.55)	-0.120(-1.24)
Non-use of vaccine	1.745(1.48)	-0.432(4.03)*	-0.266(2.17)**	Omitted	-0.232(2.90)*	Omitted
Don’t know	RC	RC	RC	RC	RC	RC
Cost of vaccine	0.002(1.17)	-0.002(-1.43)	0.001(0.24)	0.006(1.23)	-0.001(-0.47)	-0.003(-1.17)
Birth weight	0.071(0.84)	-0.015(-0.24)	-0.002(-0.10)	-0.039(-0.28)	0.054(0.90)	-0.021(-1.60)
Use of mosquito net	-0.137(-0.45)	-0.468(-1.70)	0.042(0.13)	0.190(0.27)	0.202(0.91)	-0.009(-0.04)
Non-use of mosquito net	RC	RC	RC	RC	RC	RC
Public tap	-0.048(-0.36)	0.076(0.65)	-0.019(-0.12)	0.285(0.75)	0.051(0.43)	0.026(0.17)
Borehole	-0.088(-0.47)	-0.166(-1.43)	0.016(0.08)	0.307(0.62)	0.111(0.73)	0.039(0.21)
Rain	RC	RC	RC	RC	RC	RC
Bottle/sachet	-0.215(-0.64)	-0.159(-0.47)	0.145(0.22)	0.298(0.40)	0.258(0.99)	0.1250.52)
Flush toilet	-.073(2.19)**	0.034(0.55)	0.022(0.45)	0.120(1.89)	-0.264(5.12)*	-0.015(-0.62)
Pit latrine	-0.014(-0.60)	0.069(2.26)**	0.015(0.41)	0.066(1.57)	-0.214(4.90)*	0.020(0.83)
No toilet/bush	RC	RC	RC	RC	RC	RC
0-29 mins to hospital	-0.123(-0.77)	-0.229(-1.57)	0.011(0.06)	0.149(0.36)	0.091(0.67)	0.030(0.20)
30-59 mins to hospital	-0.123(-1.46)	-0.137(-1.68)	0.029(0.32)	0.016(0.11)	-0.042(-0.70)	0.047(1.00)
60 mins and above to hospital	RC	RC	RC	RC	RC	RC
0-29 mins to clinic	0.087(0.49)	0.097(-0.64)	0.067(0.29)	0.372(0.63)	0.102(0.57)	-0.080(-0.31)

30-59 mins to clinic	0.082(0.68)	-0.103(-0.97)	0.038(0.25)	0.289(0.75)	0.104(0.84)	-0.007(-0.04)
60 mins and above to clinic	RC	RC	RC	RC	RC	RC
Constant	-1.406(-1.04)	-1.520(-1.19)	1.437(0.82)	-2.549(-0.91)	-0.324(-0.36)	3.556(1.33)
R –squared	0.0345	0.0361	0.0293	0.0211	0.0373	0.0161
F-statistic(p-value)	7.71(0.0000)	9.74(0.0000)	9.44(0.0000)	2.82(0.0000)	5.27(0.0000)	2.67(0.0000)
Observations	7378	7086	12063	3601	4789	5465

Note: Values within parenthesis represent t-statistics where (*) and (**) represent significance at (1%) and (5%) respectively. RC denotes reference category.

Women who use the hospital or maternity home for delivery had less number of child deaths than those who deliver their children at home or in other places. It was significant in the South-South and South-West zone. Women who reside in any of the other five zones had more number of child deaths than those in the South-West.

The use of a flush toilet significantly reduced the number of child deaths in the North-Central, and South-South zones, but increased child death in the South-East than the use of a bush or having no toilet at all. Sastry (1996) also found the availability of adequate toilet facilities reduces the number of child deaths. While the number of child deaths was higher among women in the North-East who used pit latrine than among those who used bush or had no toilet, it was lower in the case of women in the South-South. Thus, in addition to the availability, how a toilet facility is used is also of importance to ensure good health for children.

Education was also insignificant in all six zones. Whether a woman resides in an urban or rural location, mothers' age, household size and household per capita expenditure were also insignificant. The cost of vaccine and a child's birth weight were insignificant.

The source of drinking water, including public taps, boreholes and bottle or sachet water was not significant in any of the zones. The distance to the nearest hospital was also insignificant.

5.3.4 Determinants of Child Mortality Using the Mortality Rate –Estimated at the National level and by Urban and Rural Locations

Using the child mortality rate, the child mortality equation was estimated at the national level and by location. The results are presented in Table 5.23.

The results obtained using the mortality rate is generally similar to those obtained when the number of child deaths was used as a measure of child mortality. There is no major difference in the estimates obtained using both measures, therefore it can be concluded that the estimates obtained using the number of child deaths are reliable.

Table 5.23 Estimates of the Determinants of Child Mortality Using the Mortality Rate at the National level and by Location

Variables	National	Urban	Rural
Number of children ever born	-0.001(-0.02)	-0.039(-0.80)	-0.004(-0.16)
Employment status			
Working in the formal sector	-0.011(-2.72)*	-0.010(-1.71)	-0.012(-2.16)**
Not working in the formal sector	RC	RC	RC
Working in the informal sector	0.059(0.58)	-0.594(-2.27)**	-0.048(-0.45)
Not working in the informal sector	RC	RC	RC
Out of the labour force	0.018(0.41)	-0.256(-2.27)**	0.011(0.23)
In the labour force	RC	RC	RC
Education			
No education	RC	RC	R`C
Primary education	0.028(0.84)	-0.191(-2.40)**)	-0.025(-0.71)
Secondary education	-0.021(-1.07)	-0.141(-2.52)**	-0.014(-0.70)
Post-secondary education	0.084(0.71)	-0.729(-2.32)**	-0.065(-0.53)
Urban residence	0.012(0.41)	-	-
Rural residence	RC	RC	RC
Age	0.005(0.95)	0.014(1.18)	0.004(0.70)
Age squared	-0.000(-1.30)	-0.000(-1.72)	-0.000(-1.01)
Household size	-0.039(-0.92)	0.007(0.09)	-0.049(-1.01)
Per capita expenditure	0.000(0.74)	-0.001(-1.24)	0.000(1.00)
Marital status			
Married monogamous	-0.002(-0.04)	-0.197(-2.16)**	-0.010(-0.21)
Married polygamous	0.011(0.19)	0.354(3.00)*	-0.053(0.89)
Divorced/separated/widowed	-0.038(1.72)	-0.118(-2.13)**	-0.042(-1.77)
Single	RC	RC	RC

Cost of electricity	0.000(0.22)	0.000(2.04)**	0.000(0.21)
Prenatal care use	0.010(1.08)	0.014(0.84)	0.006(1.59)
Postnatal care use	-0.003(-0.22)	0.028(1.02)	0.007(0.45)
Use of both	0.007(1.22)	0.001(0.14)	0.010(1.43)
Use of none	RC	RC	RC
Cost of prenatal care	-0.000(-0.82)	-0.000(-2.58)	0.000(0.16)
Cost of postnatal care	0.000(0.97)	-0.000(-0.92)	0.000(0.44)
Hospital and maternity home delivery	-0.020(-1.05)	-0.101(-3.08)	-0.016(-0.72)
Home delivery and others	RC	RC	RC
Use of vaccine	0.005(0.28)	-0.031(-0.95)	0.008(0.37)
Non-use of vaccine	0.042(0.74)	0.143(0.97)	0.032(0.53)
Don’t know	RC	RC	RC
Cost of vaccine	0.000(1.13)	0.001(1.93)	0.000(1.10)
Birth weight	-0.001(-1.34)	0.006(0.78)	-0.002(-1.55)
Use of mosquito net	-0.004(-0.16)	0.114(2.09)**	0.002(0.08)
Non-use of mosquito net	RC	RC	RC
Public tap	0.008(0.65)	0.065(2.13)**	0.008(0.58)
Borehole	0.011(0.64)	0.082(2.12)**	0.010(0.60)
Rain	RC	RC	RC
Bottle/sachet	0.035(1.30)	0.147(2.57)*	0.018(0.56)
Flush toilet	-0.003(-0.84)	-0.004(-0.65)	-0.003(-0.67)
Pit latrine	-0.001(-0.42)	-0.003(-0.60)	-0.002(-0.63)
No toilet/bush	RC	RC	RC
0-29 mins to hospital	-0.002(-0.18)	0.068(2.08)**	-0.007(-0.44)
30-59 mins to hospital	-0.004(-0.64)	0.015(1.21)	-0.003(-0.52)
60 mins and above to hospital	RC	RC	RC
0-29 mins to clinic	0.023(1.22)	0.119(2.45)**	0.022(1.10)
30-59 mins to clinic	0.017(1.32)	0.087(2.69)*	0.013(1.02)
60 mins and above to clinic	RC	RC	RC

North-Central	0.020(6.35)*	0.014(2.65)*	0.030(7.15)*
North-East	0.048(12.35)*	0.046(5.39)*	0.058(12.11)*
North-West	0.067(17.40)*	0.051(7.22)*	0.079(16.27)*
South-East	0.036(8.94)*	0.035(4.87)*	0.042(8.38)*
South-South	0.039(9.85)*	0.025(3.54)*	0.050(10.06)*
South-West	RC	RC	RC
Constant	-0.010(-0.09)	-0.379(-1.41)	0.012(0.10)
R –squared	0.0224	0.0235	0.0210
F-statistic(p-value)	22.56(0.0000)	5.53(0.0000)	16.77(0.0000)
Observations	40382	9550	30832

***Note*:** Values within parenthesis represent t-statistics where (*) and (**) represent significance at (1%) and (5%) respectively. RC denotes reference category.

The number of children ever born still had an insignificant effect on the mortality rate just as was obtained previously when the number of child deaths was used as a measure of child mortality before it was interacted with education.

Women working in the formal sector had lower mortality rates than women not working in the formal sector and this is highly significant just as obtained under the estimation using the number of child deaths. Working in the informal sector and being out of the labour force significantly reduced the number of child deaths but only in urban locations just as was obtained when the number of child deaths was used as a child mortality measure.

Educated women still had less number of child deaths than uneducated women with significance seen in only urban locations at the 5% level. The cost of electricity wa still positively significant in urban locations only. The use and cost of postnatal care were still not significant as previously obtained. Short distances to the nearest hospital and clinics still had an increasing effect on child mortality than a distance of 60 minutes and above just as previously obtained.

5.4 Determinants of Maternal Labour Participation

The results obtained from the estimation of the maternal labour participation equation (c) in equation (14) are presented in this section. The maternal labour participation equation was estimated using three measures to capture women employed in the formal sector, women employed in the informal sector and women who are out of the labour force. The estimation was carried out for women within the reproductive ages of 15 and 49, having at least a child ever born. Based on the result from some econometric tests first carried out, the method employed is the two-stage estimation method involving the use of the probit method and the OLS estimator in order to control for endogeneity bias. The marginal effects of the equations are presented overleaf. A robust estimation was also carried out to control for heteroskedasticity bias. The estimation was carried out at the national level, for urban and rural locations, and for the six geopolitical zones.

5.4.1 Econometric Tests

Some tests carried out to ascertain the econometric properties of the equations include a test for exogeneity, a test for heteroskedasticity and a test for instrument relevance and validity.

Test for Exogeneity

The results of the test for exogeneity using the Hausman test are presented in Table 5.24. In the maternal labour participation equation, the number of child deaths was insignificant and therefore found to be exogenous when all the three measures are used. The number of children ever born was found to be exogenous only when the probability of being out of the labour force was used as a measure of maternal labour participation.

Table 5.24 Test for Exogeneity

Variable	Residual coefficient	t-statistic	p-value
Formal sector employment equation			
number of children ever born	0.291	2.53	0.011
number of child deaths	-0.950	-0.64	0.523
Informal sector employment equation			
number of children ever born	11.144	32.55	0.000
number of child deaths	0.870	1.41	0.160
Probability of being out of the labour force			
number of children ever born	0.067	0.76	0.446
number of child deaths	-0.301	-0.94	0.345

Source: Computed by author

Test for Heteroskedasticity

The Breusch-Pagan/Cook- Weisberg heteroskedasticity test was conducted for equation (c) used in estimating the determinants of maternal labour participation. The decision rule is to reject the null hypothesis that there is no heteroskedasticity if the Prob>chi2 value shows that the Chi2(1) score is significant. The results as shown in Table 5.25 reveal there was a significant presence of heteroskedasticity with a significant Chi2(1) score in the maternal labour participation equation.

Test for Instrument Relevance and Validity

To test for the relevance of the instruments used, the first stage regression of the reduced form equations of the endogenous variables are estimated and the results are presented in Appendix II. The first stage regressions of the reduced form equations for the number of children ever born and the number of child deaths showed that the instruments used are highly significant at the 1% level. In order to ensure that the instruments are valid, a test on whether the instruments have a significant effect on the dependent variable was conducted and the results are presented in Table 5.26. The instruments used are valid because they do not have any significant effect on the dependent variables.

Table 5.25 Test for Heteroskedasticity

Dependent Variable	Chi2(1)	Prob>chi2
number of children ever born	4579.82	0.0000
number of child deaths	51845.87	0.0000
Probability of formal sector employment	19661.43	0.0000
Probability of informal sector employment	48.9	0.0000
Probability of being out of the labour force	6256.38	0.0000

Source: Computed by author

Table 5.26 Test for Instrument Validity

Instrument	Coefficient	t-statistic	p-value
Formal sector employment equation			
Monogamous marriage	-0.136	-0.94	0.345
Polygamous marriage	-0.192	-0.73	0.466
Informal sector employment equation			
Monogamous marriage	0.015	0.12	0.908

Source: Computed by author

5.4.2 Probability of Labour Participation in the Formal Sector at the National Level and by Urban and Rural Location

The marginal effects estimates of the probability of labour participation in the formal sector are presented at the national level and by location in Table 5.27.

The overall significance of the models was high at the 1% significance level. An increase in the number of children ever born increased the probability of a woman working in the formal sector by 2.8%, 9.2% and 0.9% at the national level and in urban and rural locations, respectively. It was however significant at 5 per cent at the national level and in urban locations only. This positive effect is contrary to the negative incompatibility hypothesis buttressed by studies such as Longwe *et al.* (2013), Ackah *et al.* (2009) and Eckstein and Liftshitz (2009) that found a negative effect of fertility on employment but could be explained by the child care support provided by her older children who act as surrogate parents (Siah and Lee, 2014; Desta, 2013; Togunde, 1988; Fapohunda, 1982; and Mason and Palan, 1981) and the need for increased household income to meet the needs of the increasing number of children.

An increase in the number of child deaths is associated with a 0.3%, 0.7% and 0.2% reduction in the probability of working in the formal sector at the national level, urban and rural, locations respectively. However, it was significant at 5 per cent only at the national level. The rate of reduction however is highest among urban women. Thus, a higher number of child deaths reduced the probability that a woman participate in a formal sector labour market as she would have to pay more attention to childcare by reducing the time allocated to work. This is consistent with Frijters *et al*. (2009), which found that mothers of poorly developing children would rather stay at home to care for their children than work.

An increase in the number of working hours per day significantly increased the probability that a woman will work in the formal sector by 0.4%, 0.7% and 0.3% at the national level as well as in urban and rural locations at the 1% significance level. This is because the more the number of hours, the greater the total income earned.

Table 5.27 Marginal Effects Estimates of the Probability of Labour Participation in the Formal Sector at the National Level and by Location

Variables	National	Urban	Rural
Number of children ever born	0.028(2.40)**	0.092(2.65)*	0.009(0.79)
Number of child deaths	-0.003(-2.29)**	-0.007(-1.67)	-0.002(-1.74)
Hours of work per day	0.004(15.57)*	0.007(8.95)*	0.003(12.54)*
Education			
No education	RC	RC	RC
Primary education	0.001(0.20)	-0.010(-0.60)	-0.005(0.92)
Secondary education	0.073(16.94)*	0.096(7.96)*	0.069(14.93)*
Post secondary education	0.572(37.16)*	0.625(21.63)*	0.563(29.14)*
Urban residence	0.028(9.56)*	-	-
Rural residence	RC	RC	RC
Age	-0.004(-1.97)**	-0.012(-1.87)	-0.001(-0.60)
Age squared	0.000(1.47)	0.000(0.94)	0.000(0.68)
Household size	-0.052(-2.74)*	-0.162(-2.89)*	-0.020(-1.02)
Per capita expenditure	-0.000(-0.76)	-0.000(-0.21)	-0.000(-0.80)
North-Central	0.007(1.42)	0.033(2.23)**	0.001(0.15)
North-East	0.007(0.66)	-0.005(-0.15)	0.012(1.13)
North-West	0.027(2.67)*	-0.019(-0.69)	0.036(3.19)*
South-East	0.004(0.70)	0.009(0.58)	0.002(0.24)
South-South	0.016(2.23)**	0.006(0.33)	0.017(2.12)**
South west	RC	RC	RC
Pseudo R –squared	0.2488	0.2529	0.2061
	5073.50(0.0000)	1818.95(0.0000)	2580.27(0.0000)
Wald Chi2(prob-chi2)			
Observations	41575	9798	31777

***Note*:** Values within parenthesis represent z-statistics where (*) and (**) represent significance at (1%) and (5%) respectively. RC denotes reference category.

Having a secondary education significantly increased the probability of labour participation in the formal sector by 7.3%, 9.6% and 6.9% at then ational level and in urban and rural locations at the 1% significance level than having no education. Women with post secondary education had a higher probability of 57.2% at the national level, 62.5% in urban locations and 56.3% in rural locations than women with no education. This was significant at the 1% significance level. Thus, higher qualifications increase the chances of a woman's employment. This is consistent with Lisaniler and Bhatti (2005), Iwayemi and Olusoji (2013), Ackah *et al.* (2009) and Aromolaran (2004).

The probability that a woman participates in a formal sector employment declines by 5.2% and 16.2% at the national level and in urban locations, respectively as a woman's household size gets larger. This could be as a result of the higher total household income from the presence of other adult household members who work. This reduces the pressure on her to seek to earn income to meet household needs.

The probability of a formal sector employment is 2.8% higher among urban than rural women. This could be associated with the fact that most formal sector jobs are situated in urban areas due to the higher level of infrastructural development. This was highly significant at the 1 per cent significance level.

5.4.3 Probability of Labour Participation in the Formal Sector by Geopolitical Zone

The marginal effects estimates of the probability of labour participation in the formal sector are presented by geopolitical zone in Table 5.28. The overall significance of the model was high at the 1% significance level. An increase in the number of children ever born increased the probability of a woman working in the formal sector in all zones except the South-East and the South-West. This was significant at the 5 per cent level.

An increase in the number of child deaths reduced the probability of participation in a formal sector employment. This was significant only in the North-Central zone at the 5 per cent level.

Increasing number of working hours per day significantly increased the probability that a woman will work in the formal sector. This is because increased working hours could be synonymous with higher earnings. This was significant in all zones except the South-West.

Women with primary education had a greater probability of participating in the formal sector than women having no education. This was significant in the North-West and South-East. However, having a primary education significantly reduced formal sector labour participation in the South-South. Women with secondary and post secondary education had a higher probability of participating in the formal sector than women with no education. This was significant at the 1% significance level in all six zones. This is because higher qualifications increase the chances of employment. This is consistent with Lisaniler and Bhatti (2005), Iwayemi and Olusoji (2013), Ackah *et al.* (2009) and Aromolaran (2004).

Higher per capita expenditure increased the likelihood of a formal sector labour participation in the North-Central and North-East, but reduced the likelihood in other zones, it was significant at the 5 per cent level only in the North-East.

The probability of a formal sector employment was higher among urban than rural women. This could be associated with the fact that most formal sector jobs are situated in urban areas due to the higher level of infrastructural development. This was highly significant in all the six zones except the North-West.

Table 5.28 Marginal Effects Estimates of the Probability of Labour Participation in the Formal Sector by Geopolitical Zone

Variables	North central	North east	North west	South east	South south	South west
Number of children ever born	0.060(2.59)*	0.042(2.01)**	-0.067(-.02)**	-0.029(-0.68)	0.071(2.16)**	0.048(1.19)
Number of child deaths	-0.013(-3.74)*	-0.000(-0.30)	-0.002(-1.84)	-0.009(-1.85)	0.002(0.62)	0.003(0.57)
Hours of work per day	0.003(5.63)*	0.002(5.09)*	0.005(11.07)*	0.007(6.48)*	0.007(7.66)*	0.000(0.47)
Education						
No education	RC	RC	RC	RC	RC	RC
Primary education	-0.002(-0.22)	-0.010(-1.13)	0.043(2.46)**	0.051(2.10)**	-0.055(-3.16)*	0.006(0.27)
Secondary education	0.078(9.00)*	0.086(9.25)*	0.051(6.05)*	0.123(5.25)*	0.044(2.95)*	0.083(5.39)*
Post-secondary education	0.761(17.46)*	0.618(14.83)*	0.270(7.89)*	0.559(9.97)*	0.517(13.87)*	0.620(14.66)*
Urban residence	0.037(6.46)*	0.028(4.13)*	0.002(0.46)	0.048(4.45)*	0.052(4.72)*	0.027(3.05)*
Rural residence	RC	RC	RC	RC	RC	RC
Age	-0.006(-1.43)	-0.009(-2.70)*	0.010(1.87)	0.000(0.00)	-0.003(-0.55)	-0.006(-0.82)
Age squared	0.000(0.02)	0.000(2.46)*	-0.000(-0.73)	0.000(0.90)	-0.000(-0.83)	0.000(0.50)
Household size	-0.108(-2.86)*	-0.068(-1.94)	0.110(2.00)**	0.057(0.80)	-0.132(-.46)**	-0.088(-1.35)
Per capita expenditure	0.001(1.69)	0.001(2.02)**	-0.001(-1.47)	-0.001(-1.68)	-0.000(-0.21)	-0.001(-1.79)
Pseudo R –squared	0.4075	0.2310	0.1150	0.2490	0.2014	0.2830

Wald Chi2(prob-chi2)	1167.78(0.0000)	573.09(0.0000)	608.19(0.0000)	554.21(0.0000)	681.92(0.0000)	1056.52(0.0000)
Observations	7516	7364	12473	3708	4954	5560

***Note*:** Values within parenthesis represent z-statistics where (*) and (**) represent significance at (1%) and (5%) respectively. RC denotes reference category.

5.4.4 Probability of Labour Participation in the Informal Sector at the National level and by Urban and Rural Locations

The marginal effects estimates of the probability of labour participation in the informal sector are presented at the national level and by location in Table 5.29.

The overall significance of the models was high at the 1% significance level. The marginal effect of the number of children ever born was highly negatively significant at the 1 per cent significance level at the national level and in both locations. Thus, an increase in the number of children ever born reduced the probability that a woman works in an informal sector by 32% at the national level, 23% in urban locations, and 36% in rural locations. Thus higher fertility reduces the probability of participation in the informal sector. This negative effect is also reported in Ackah et al (2009) but it is not consistent with the positive effect recorded in Siah and Lee (2014) and Desta (2013) especially in rural locations usually characterized by the proximity of the workplace such as farms or shops to the house, the flexibility of working hours and the need for large manual labour on the farm.

An increase in the number of child deaths significantly increased the probability that a woman works in an informal sector by 0.6% at the national level and 0.8% in rural locations. It was significant at the national level and in rural locations at the 5% and 1% significance levels respectively. This result could be due to the greater compatibility of work and childcare as well as the less restriction of children in the workplace, which would afford a woman the opportunity to combine childcare and work.

An increase in the number of working hours per day increased the probability of labour participation in the informal sector by 2.3% at the national level and by 3.2% and 2% in urban and rural areas respectively. This was significant at the national level and in urban and rural locations. More hours of work would amount to greater total earnings or wages and McCabe and Rosenzweig (1976) found higher wages increasing labour participation.

Table 5.29 Marginal Effects Estimates of the Probability of Labour Participation in the Informal Sector at the National Level and by Locations

Variables	National	Urban	Rural
Number of children ever born	-0.319(-9.93)*	-0.233(-4.18)*	-0.356(-9.00)*
Number of child deaths	0.006(2.33)**	-0.005(-0.91)	0.008(2.95)*
Hours of work per day	0.023(33.66)*	0.032(22.17)*	0.020(25.55)*
Education			
No education	RC	RC	RC
Primary education	0.089(6.71)*	0.117(4.88)*	0.091(5.68)*
Secondary education	0.043(5.16)*	0.044(2.86)*	0.046(4.61)*
Post-secondary education	-0.377(-23.86)*	-0.449(-15.66)*	-0.307(-14.43)*
Urban residence	0.103(14.92)*	-	-
Rural residence	RC	RC	RC
Age	0.058(10.81)*	0.053(5.34)*	0.063(9.62)*
Age squared	-0.000(-8.28)*	-0.000(-4.59)*	-0.000(-7.45)*
Household size	0.517(9.75)*	0.395(4.33)*	0.578(8.82)*
Per capita expenditure	0.000(0.23)	0.000(0.33)	0.000(0.20)
North-Central	-0.039(-2.88)*	-0.026(-0.54)	0.037(2.10)**
North-East	0.097(3.73)*	0.026(0.60)	0.188(5.86)*
North-West	0.196(7.88)*	-0.234(-8.78)*	0.293(9.52)*
South-East	-0.237(-16.34)*	-0.107(-3.33)*	-0.184(-9.81)*
South-South	-0.129(-7.18)*	-0.261(-3.02)*	-0.069(-3.04)*
South-West	RC	RC	RC
Pseudo R –squared	0.0660	0.1488	0.0430
Wald Chi2(prob-chi2)	3426.35(0.0000)	1528.37(0.0000)	1725.68(0.0000)
Observations	41575	9798	31777

Note: Values within parenthesis represent z-statistics where (*) and (**) represent significance at (1%) and (5%) respectively. RC denotes reference category.

Education was highly significant such that unlike women with no education, having primary education increased the probability of an informal sector employment by 8.9% at the national level, 11.7% in urban locations and 9.1% in rural locations. Having secondary education increased the probability of an informal sector employment by 4.3% at the national level, 4.4% in urban locations and 4.6% in rural locations. A post-secondary education significantly reduced the probability of a woman working in an informal sector by 37.7% at the national level, 44.9% in urban locations and 30.7% in rural locations. Thus, post-secondary education reduces the probability that a woman would be self-employed or be engaged in an unpaid family work or farm work. This could be as a result of the little or no earnings associated with such work and the lack of a requirement for professional and academically acquired skills. Education was also found to increase employment in Ackah *et al.* (2009), Iwayemi and Olusoji (2013) and Lisaniler and Bhatti (2005).

Residing in an urban rather than a rural location significantly increased the probability of an informal sector employment by 10.3 per cent.

The probability of being employed in an informal sector increased as a woman grows older into adulthood and advances but declines later in life probably as a result of old age. This was significant at the national level and in urban and rural locations. Lisaniler and Bhatti (2005) also found age significantly increasing labour participation.

An increase in household size increased the probability of an informal sector employment by 51.7% at the national level, 39.5% in urban locations and 57.8% in rural locations. This was highly significant among urban and rural women.

Urban women who reside in the North-West, South-East, and South-South were less likely to decide to work in the informal sector than those who reside in the South-West. Rural women who reside in the north central, North-East and North-West and South-East had a higher probability of participating in an informal sector employment than those in the south west. However, rural women in the South-East and South-South were less likely to participate in an informal sector employment than those in the South-West.

5.4.5 Probability of Labour Participation in the Informal Sector by Geopolitical Zone

The marginal effects estimates of the probability of labour participation in the informal sector are presented by Geopolitical zone in Table 5.30.

The overall significance of the models was high at the 1% significance level. The marginal effects of the number of children ever born was highly negatively significant at 1 per cent significance level. Thus, an increase in the number of children ever born reduces the probability that a woman works in an informal sector, this is significant in all zones except the South-South and South-West zones. Thus higher fertility reduces the probability of participation in the informal sector. This negative effect is also reported in Ackah *et al* (2009) but it is not consistent with the positive effect recorded in Siah and Lee (2014).

The number of child deaths was not significant in any zone except the North-Central where an increase in the number of child deaths causes a 2% increase in the probability that a woman works in an informal sector.

The number of hours of work per day was highly positively significant in the six zones. More hours of work would amount to greater total earnings or wages and McCabe and Rosenzweig (1976) found that higher wages increase the labour participation of women.

Having primary education significantly increased the probability of an informal sector employment. This was significant in all zones. Although secondary education significantly increased the probability of labour participation in the informal sector in the South-East, South-South and South-West zones, it significantly reduced the probability of an informal sector employment in the North-Central, North-East and North-West zones. Women with post secondary education were less likely to participate in an informal sector employment than women with no education. This was also highly significant at 1 per cent in all zones. Residing in an urban rather than a rural location significantly increased the probability of an informal sector employment by 10.3 per cent. This was highly significant at the 1 percent level in all zones except the North-West where a reduction in probability is observed. It was not significant in the North-East zone.

Table 5.30 Marginal Effects Estimates of the Probability of Labour Participation in the Informal Sector by Geopolitical Zone

Variables	North-Central	North-East	North-West	South-East	South-South	South-West
Number of children ever born	-0.397(-4.48)*	-0.583(-5.33)*	-0.762(-9.03)*	-0.223(-2.77)*	-0.086(-1.39)	0.014(0.21)
Number of child deaths	0.020(2.85)*	0.008(1.49)	0.003(0.85)	-0.008(-0.93)	0.001(0.20)	-0.011(-1.17)
Hours of work per day	0.018(10.81)*	0.017(10.92)*	0.029(21.64)*	0.029(13.41)*	0.017(10.13)*	0.032(15.71)*
Education						
No education	RC	RC	RC	RC	RC	RC
Primary education	0.118(3.57)*	0.115(2.67)*	0.206(6.27)*	0.188(5.06)*	0.120(3.95)*	0.128(4.64)*
Secondary education	-0.009(-0.49)	-0.109(-4.76)*	-0.051(-2.52)*	0.236(8.14)*	0.188(7.91)*	0.157(9.12)*
Post-secondary education	-0.449(-1.92)*	-0.368(-7.65)*	-0.447(-11.54)*	-0.114(-.45)**	-0.128(-3.30)*	-0.290(-7.43)*
Urban residence	0.113(6.99)*	0.005(0.23)	-0.065(-4.77)*	0.179(8.61)*	0.226(12.33)*	0.206(13.82)*
Rural residence	RC	RC	RC	RC	RC	RC
Age	0.074(4.90)*	0.088(5.06)*	0.126(9.13)*	0.029(1.90)	0.024(2.10)**	0.006(0.46)
Age squared	-0.000(-3.95)*	-0.000(-3.07)*	-0.001(-6.47)*	-0.000(-0.60)	-0.000(-2.27)*	-0.000(-1.08)
Household size	0.616(4.21)*	1.005(5.51)*	1.241(8.85)*	0.369(2.81)*	0.098(0.98)	0.016(0.15)
Per capita expenditure	-0.001(-1.17)	0.001(1.21)	-0.000(-0.31)	-0.001(-0.40)	0.002(1.49)	0.000(0.09)
Pseudo R –squared	0.0342	0.0181	0.0370	0.0987	0.0633	0.1709

Wald Chi2(prob-chi2)	316.97(0.0000)	171.07(0.0000)	546.02(0.0000)	406.70(0.0000)	385.00(0.0000)	873.11(0.0000)
Observations	7516	7364	12473	3708	4954	5560

Note: Values within parenthesis represent z-statistics where (*) and (**) represent significance at (1%) and (5%) respectively. RC denotes reference category.

The non linear negative significant effect of age revealed that the probability that a woman participates in the informal sector labour market increased with her age but declined later in her lifetime, probably due to retirement and old age. This was significant in all zones except the South-East and South-West zones. Lisaniler and Bhatti (2005) also found age significantly increasing labour participation.

As the household size increases, women were more likely to participate in an informal sector. This was highly significant in both locations and in all zones except the South-South and South-West zones. Household per capita expenditure was not significant.

5.4.6 Probability of Being Out of the Labour Force at the National Level and by Urban and Rural Locations

The marginal effects estimates of the probability of being out of the labour force are presented at the national level and by location in Table 5.31.

The overall significance of the model was high at the 1% level. Having more number of children lowered the probability that a woman would be out of the labour force. This was significant at the national level and in rural locations. This is probably because of the need to earn more income to meet the additional household needs. This negative effect of fertility on the decision to work is consistent with Perticara (2006) that find fertility increasing the risk of leaving employment.The marginal effects of the number of children ever born were very little such that an increase in fertility reduced the probability of a woman being out of the labour force by 0.4% and 0.5% at the national level and in rural locations, respectively.

The number of child deaths a woman experiences was not significant in both urban and rural locations.

The more the number of hours a woman spent working per day, the lower the probability that she would decide to be out of the labour force. This is because working for more hours is generally synonymous with more earnings, especially for hourly paid jobs (McCabe and Rosenzweig, 1976).

Table 5.31 Marginal Effects Estimates of the Probability of Being Out of the Labour Force at the National Level and by Location

Variables	National	Urban	Rural
Number of children ever born	-0.004(-3.43)*	0.001(0.61)	-0.005(-4.05)*
Number of child deaths	0.001(0.30)	-0.000(-0.07)	0.001(0.43)
Hours of work per day	-0.022(-40.18)*	-0.022(21.50)*	-0.022(34.05)*
Education			
No education	RC	RC	RC
Primary education	-0.016(-3.24)*	0.006(0.63)	-0.024(4.17)*
Secondary education	-0.006(-1.09)	-0.004(-0.44)	-0.005(-0.61)
Post-secondary education	-0.037(-4.21)*	-0.020(-1.88)	-0.043(-3.04)*
Urban residence	0.012(2.60)**	-	-
Rural residence	RC	RC	RC
Age	0.004(2.52)**	0.001(0.25)	0.005(2.30)**
Age squared	-0.000(-2.49)	-0.000(-0.81)	-0.000(1.99)**
Household size	-0.026(-5.43)*	-0.035(3.78)*	-0.023(-4.06)*
Per capita expenditure	0.001(2.27)*	0.001(1.01)	0.001(1.99)**
Marital status			
Married monogamous	0.054(3.34)*	0.068(2.78)*	0.046(2.35)**
Married polygamous	0.152(2.77)*	0.229(2.26)**	0.130(2.01)**
Divorced/separated/widowed	-0.008(-0.35)	0.048(1.18)	-0.026(-1.03)
Single	RC	RC	RC
North-Central	0.042(5.29)*	0.019(1.74)	0.071(5.63)*
North-East	0.173(18.49)*	0.121(7.43)*	0.212(15.06)*
North-West	0.056(7.13)*	0.031(2.73)*	0.086(7.05)*
South-East	-0.007(-0.70)	-0.065(-5.55)*	0.038(2.62)*
South-South	-0.038(-4.48)*	-0.049(4.15)*	-0.015(1.12)
South-West	RC	RC	RC
Pseudo R –squared	0.1379	0.1819	0.1270
Wald Chi2(prob-chi2)	3671.03(0.0000)	1070.59(0.0000)	2649.78(0.0000)
Observations	41575	9798	31777

Note: Values within parenthesis represent z-statistics where (*) and (**) represent significance at (1%) and (5%) respectively. RC denotes reference category.

Women with primary education were less likely to be out of the labour force than uneducated women. Secondary education was not significant but post-secondary education significantly reduced the probability that a woman would choose to be out of the labour force since she has more opportunities of employment and high earnings. This was significant at the national level and in rural locations. This is consistent with Shapiro (2012), Lisaniler and Bhatti (2005), Aromolaran (2004), Ackah *et al* (2009) and Iwayemi and Olusoji (2013) that found education having an increasing effect on labour participation.

Residing in an urban location significantly increased the probability of being out of the labour force than residing in a rural location. This could be as a result of the high level of unemployment due to few jobs and more supply of labour in urban areas. It was significant at the 1 per cent significance level.

Household size had a negative significant effect such that the larger the number of people in a household, the lower the probability that a woman would be out of the labour force probably because of the need for additional household income to meet the growing needs. This was highly significant at the 1 per cent significant level at the national level and in urban and rural locations. An increasing household size reduced the probability of being out of the labour force by 2.6% at the national level, 3.5% in urban and 2.3% in rural locations.

Married mothers in a monogamous or polygamous relationship had a greater probability of being out of the labour force than single mothers. Being in a monogamous marriage significantly increased the probability of being out of the labour force by 5.4% at the national level, 6.8% in urban locations and 4.6% in rural locations than being single. Being in a polygamous marriage significantly increased the probability of being out of the labour force by 15.2% at the national level, 22.9% in urban locations and 13.0% in rural locations than being single.

Household per capita expenditure had an increasing marginal effect, thus as a households' per capita expenditure increases, the probability of being out of the labour force increased significantly by 0.1% at the national level, and in rural locations.

5.4.7 Probability of Being Out of the Labour Force by Geopolitical Zone

The marginal effects estimates of the probability of being out of the labour force are presented by geopolitical zone in Table 5.32.

The overall significance of the models was high at the 1% level. The more number of children a woman had, the lower the probability that she would be out of the labour force probably because of the need to earn more income to meet the additional household needs. It is significant in the North-East, North-West. Thus, an increase in fertility reduced the probability of a woman being out of the labour force.

The number of child death did not significantly explain the probability that a woman would decide to be out of the labour force in any of the six zones.

The more the number of hours a woman spends working per day, the lower the probability that she would decide to be out of the labour force.

Women with at least primary education were less likely to be out of the labour force than women with no education, this was highly significant in the South-East zone. In the North-West, women with primary or post-secondary education were less likely to be out of the labour force than women with no education. However, women with primary or secondary education who reside in the North-East were more likely to be out of the labour force than those with no education. Thus, while education enhanced the earning potential of women in the South-East and North-West and positively influenced their decision to work, it increased the probability to be out of the labour force among the North-East women.

Women were more likely to be out of the labour force when they reside in an urban rather than rural location. It was significant at the 1 per cent significance level. It was also positively significant in the North-West and South-West but negatively significant in the South-East.

Table 5.32 Marginal Effects Estimates of the Probability of Being Out of the Labour Force by Geopolitical Zone

Variables	North-Central	North-East	North-West	South-East	South-South	South-West
Number of children ever born	0.004(1.60)	-0.007(-2.04)**	-0.009(-3.78)*	-0.005(-1.74)	-0.003(-1.41)	0.005(1.83)
Number of child death	-0.003(-0.49)	0.000(0.08)	0.002(0.59)	0.006(1.49)	0.000(0.14)	-0.004(-0.64)
Hours of work per day	-0.025(-18.83)*	-0.026(17.36)*	-0.036(-25.21)*	-0.008(-7.67)*	-0.005(-7.02)*	-0.016(-15.62)*
Education						
No education	RC	RC	RC	RC	RC	RC
Primary education	-0.017(-1.83)	0.069(3.93)*	-0.053(-4.48)*	-0.044(-4.43)*	-0.012(-1.28)	-0.002(-0.21)
Secondary education	-0.011(-1.04)	0.062(2.74)*	-0.013(-0.83)	-0.044(-4.25)*	-0.003(-0.31)	-0.010(-1.04)
Pos-secondary education	0.020(1.04)	-0.071(-1.77)	-0.091(-3.39)*	-0.051(-4.47)*	-0.012(-1.02)	-0.014(-1.26)
Urban residence	-0.000(-0.01)	0.018(1.00)	0.037(3.36)*	-0.028(-3.45)*	0.006(0.87)	0.026(3.60)*
Rural residence	RC	RC	RC	RC	RC	RC
Age	0.008(1.98)**	0.016(2.99)*	0.005(1.23)	0.001(0.37)	-0.010(3.73)*	-0.010(-2.57)**
Age squared	-0.000(-2.33)**	-0.000(-2.74)*	-0.000(-0.91)	-0.000(-0.91)	0.001(3.20)*	0.000(2.39)**
Household size	-0.027(-2.41)**	0.015(0.97)	-0.062(-6.01)*	-0.023(2.18)**	0.008(0.89)	-0.031(-3.41)*
Per capita expenditure	0.001(1.40)	0.001(0.80)	0.000(0.47)	0.001(0.90)	0.001(1.39)	0.000(0.83)*

Marital status						
Married monogamous	0.031(0.68)	0.178(3.35)*	0.088(2.58)**	0.019(0.72)	0.015(0.98)	0.050(1.64)
Married polygamous	0.001(0.01)	0.139(0.68)	0.167(1.10)	0.413(1.81)	-0.009(-0.22)	0.308(2.72)*
Divorced/separated/widowed	-0.004(-0.08)	0.035(0.41)	-0.135(-2.77)*	-0.006(-0.20)	-0.004(-0.21)	0.098(1.51)
Single	RC	RC	RC	RC	RC	RC
Pseudo R –squared	0.1160	0.0498	0.0934	0.0926	0.0700	0.1381
Wald Chi2(prob-chi2)	386.74(0.0000)	365.32(0.0000)	833.91(0.0000)	172.92(0.0000)	118.20(0.0000)	315.01(0.0000)
Observations	7516	7364	12473	3708	4954	5560

***Note*:** Values within parenthesis represent z-statistics where (*) and (**) represent significance at (1%) and (5%) respectively. RC denotes reference category.

The larger the number of people in a household, the lower the probability that a woman would be out of the labour force probably because of larger consumption needs. This was highly significant in all zones except the North-East and South-South.

Married mothers had a greater probability of being out of the labour force than single mothers and this was significant in the North-East and North West for women in a monogamous marriage. It was however significant in the South-West for women in a polygamous marriage.

Per capita expenditure was positively significant only in the South-West, nevertheless, its marginal effect is zero.

CHAPTER SIX

SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSION

6.0 Introduction

This chapter presents the summary of the findings from the estimations carried out. Further contents of this chapter include recommendations made towards policy effectiveness and the conclusion of the study.

6.1 Summary of Findings

This study examined the interrelationship between fertility, child mortality and maternal labour participation in Nigeria. It also calculated the replacement rate of births to a child death in Nigeria. A total of 41,575 women within the reproductive ages of 15 and 49 with at least one child characterize the data used. A test of endogeneity conducted showed that the number of child deaths, the probability of employment in the formal sector, the probability of employment in the informal sector and the probability of being out of the labour force were endogenous in the fertility equation. In the child mortality equation, the number of children ever born, the probability of employment in the informal sector and the probability of being out of the labour force were endogenous while the probability of employment in the formal sector was exogenous. The number of children ever born was endogenous in the three maternal labour participation equations except in the probability of being out of the labour force equation where it was exogenous. The number of child deaths is exogenous in all the three maternal labour participation equations. The two-stage estimation technique was employed such that in each of the fertility, child mortality and maternal labour participation equations, the predicted values of the endogenous variables obtained from the estimation of their reduced form equations are substituted for their actual values in the original equation. The two-stage estimation involved the use of the probit method and the ordinary least squares

(OLS) estimator. To control for heteroskedasticity bias, a robust estimation was carried out.

Determinants of Fertility

The results at the national level as well as by urban and rural locations showed that an increase in the number of child deaths was associated with 2.6 more children at the national level. This positive effect was significant at the 1% level. It was also associated with 2.8 more children in urban locations and 2.2 more children in rural locations. Child mortality had a positive significant effect on fertility at the national level, and in urban and rural locations.

Working in the formal sector was not significant to explain the number of children ever born in urban and rural locations. Women working in the informal sector had less number of children than those who do not work in the informal sector; though it was significant only at the national level and in rural locations. Being out of the labour force was insignificant in urban and rural locations. Interacting employment status with a woman's education, the results showed that women working in the formal sector with at least secondary education had fewer children than uneducated women in urban and rural areas. Women working in the informal sector with a primary education had fewer children, those with as high as post secondary education had more number of children showing a level of compatibility of work and childcare and this was significant in urban locations. Educated women outside the labour force significantly had more number of children than those in the labour force, this obtains in both locations and for all educational attainment levels.

Among the six geopolitical zones, child mortality increased the number of children ever born as shown by its positive significant effect in all geopolitical zones except in the North-East. Working in the formal sector as well as being out of the labour force were insignificant to explain fertility. Working in the informal sector significantly reduced the number of children ever born only in the North-East but was insignificant in other zones.

Among the seven age groups of mothers, the number of children ever born increased with increasing number of child death experiences and this was highly significant among young and older mothers aged 30 years and above. The strongest effect of 6.735 is seen among women aged 45 to 49 probably because they are closest to menopause. Working in the formal sector significantly increased the number of children ever born only among women aged 35 to 39. It was insignificant for other age groups. Working in the informal sector significantly reduced fertility among older women aged 40 to 44; but increased it among young women aged 25 to 29. Being out of the labour force was still insignificant.

The summary of the results above reveals that child mortality has a replacement and anticipatory effect on fertility in the country. The positive effect shows that women are inelastic to the increasing cost of a surviving child but may be more concerned about the expected future benefits from their mature surviving child. Thus child mortality increases fertility among women.

Also, although the negative incompatibility effect of employment on fertility was highly significant in the formal sector, it is not consistent in the informal sector. A positive effect was observed as a result of the greater level of compatibility of work and child care in this sector consisting of women engaged in self-employment, unpaid family work and farm work. This is further buttressed by the increased fertility observed among women who are out of the labour force and face no restrictions with respect to child bearing and childcare as a result of employment. Other significant determinants of high fertility include early childbearing, and large household size which increase fertility. Mothers' age and religion were also significant.

Replacement Rate

The replacement rate of births to a child death was 0.57 in Nigeria. Therefore, with an additional child death experience, a woman would have 0.57 more births. The replacement rate was higher in urban locations, which had a replacement rate of 0.59 than rural locations, which had a replacement rate of 0.56. It was also highest in the South-West having a replacement rate of 0.61, closely followed by the North-Central having 0.60 and lowest in the South-East which had a replacement rate of 0.49.

Determinants of Child Mortality

The number of children ever born only became significant to explain child mortality at the national level and in urban locations when interacted with education. Women with more number of children had less number of child deaths when they had primary, secondary or post-secondary education. In rural locations, it was only significant among women with post-secondary education.

Working in the formal sector was not significant in both locations but became significant when interacted with education. It reduced the number of child deaths especially among women with higher educational attainments in rural locations. Working in the informal sector reduced the number of child deaths, however, when interacted with education, educated urban women were found to have more number of child deaths than uneducated women. This could probably be due to the low income generally earned by some informal sector workers involved in small-scale self-employed businesses, farm work and unpaid family work compared to most formal sector workers in urban locations. Although being out of the labour force reduced the number of child deaths only in urban locations, it did not significantly affect child mortality when interacted with education.

By geopolitical zones, the number of children ever born had a positive effect, such that women with more number of children experience more child deaths, though it was significant only in the South-West zone. Women working in the formal sector have less number of child deaths than those who do not work in the formal sector. This was significant only in the north central zone. In the South-East zone, there was a significant positive effect such that women working in the formal sector experience more number of child deaths than those outside the sector. Working in the informal sector or being outside the labour force had no significant effect in any zone.

Other factors that significantly determine child mortality were education, the use of a flush toilet, safe source of drinking water such as public tap, borehole and bottled or sachet water, hospital delivery, higher cost of electricity if synonymous with greater power supply, short distances to the nearest hospital or clinic, and higher household per capita expenditure.

The summary of the results above shows that higher educational attainment, especially at the post-secondary level is paramount especially in rural locations usually characterised by poor infrastructural development including healthcare services to reduce the number of child deaths. The higher number of child deaths among informal sector workers and the low experiences of child death among formal sector workers suggest that despite the work and childcare compatibility, the higher income usually associated with formal than informal sector employment is important for reduced child mortality. It is also possible that the greater compatibility of work and childcare in the informal sector concomitant with lesser restrictions on the presence of children in the workplace could increase the risk of a child's exposure to unhygienic conditions in the workplace, which have adverse health effects.

Determinants of Maternal Labour Participation

The results obtained at the national level and in urban and rural locations showed that having more number of children significantly increased the probability of a woman's participation in the formal sector if she resides in an urban location, but this significantly reduced the probability of participation in the informal sector in urban and rural locations. Having more number of children reduced the probability of being out of the labour force among rural women but it was insignificant in the case of urban women.

A high number of child deaths significantly reduced the probability of a woman's participation in the formal sector labour market though it was significant only at the national level. High child mortality however, increased the probability of an informal sector employment, this is significant at the national level and in rural locations at the 5% and 1% levels, respectively. It did not significantly explain a woman's decision to be outside the labour force.

Other significant determinants of maternal labour participation include more hours of work per day which significantly increased participation in the formal and informal sectors but reduced the probability of being out of the labour force; education which significantly increased labour participation in formal and informal sectors but reduced the probability of being out of the labour force; and large household size, which increased probability of an informal sector labour participation but reduced the probability of being out of the labour force.

Among the six geopolitical zones, an increase in the number of children significantly increased the probability of a woman's participation in the formal sector in all zones except the South-East and South-West; however, it significantly reduced the probability that a woman works in an informal sector in all zones except the South-South and South-West zones. Having more number of children reduced the probability of being out of the labour force in the North-East, North-West and South-East zones.

While an increasing number of child death experience significantly reduced the probability of a woman's participation in the formal sector labour market only in the North-Central zone; it increased the probability of labour participation in the informal sector significantly but only in the north central zone. However, it did not significantly explain the probability of being out of the labour force.

Thus, high fertility increased maternal labour participation but only in the urban formal sector. Thus the incompatibility hypothesis is contradicted in the formal sector when the effect of fertility is examined on maternal labour participation. High child mortality reduced maternal labour participation in the formal sector but increased participation in the informal sector.

Relationship among Fertility, Child Mortality and Maternal Labour Participation

The relationship among fertility, child mortality and maternal labour participation was such that while high child mortality increased fertility, high fertility reduced child mortality risk only among educated women. While high fertility reduced the probability of non-participation in the labour force, it increased labour participation in favour of the formal sector and not the informal sector. However, labour participation in the formal sector reduced fertility but participation in the informal sector and non-participaton in the labour force increased fertility. High child mortality reduced formal sector labour participation but increased informal sector labour participation while labour participation reduced child mortality for women in the formal sector but increased child mortality for those in the informal sector. Thus variations in any one of the three variables is determined by variations in the pair of the other variables.

6.2 Conclusion

Child mortality has a significant positive effect on fertility in Nigeria, hence, reducing the high child mortality rate in the country would contribute significantly towards reducing the fertility level. High fertility does not increase the number of child deaths only if a woman is educated. Higher child mortality explains the greater participation of women in the informal sector than the formal sector. Meanwhile, the informal sector which has less restrictions on children's presence in the workplace increase the adverse health risks a child faces when exposed to some uncomfortable and unhygienic conditions in the workplace. High fertility increased maternal labour participation but only in the urban formal sector. The negative employment effect on fertility only applies in the formal sector, showing a trade-off relationship only for women in the formal sector. A positive employment effect on fertility is obtained in the informal sector where there is more likely to exist a greater compatibility of work and childcare activities.

Higher educational attainment of women would increase labour force participation in the formal sector, which would help maintain low child mortality. Thus policies aimed at increasing maternal labour participation would not conflict with those designed to reduce child deaths. Maternal education in a high fertility society would also reduce child mortality risks. Also, policies towards reducing child mortality would eventually reduce fertility and further increase labour force participation in the formal sector.

6.3 Recommendations and Policy Implications of the Study

In line with the findings above, recommendations for policy makers and the general public are not farfetched. They include:

- Empowering women through higher educational attainments by enabling them have free or affordable access to primary and secondary education is necessary to increase maternal labour participation especially in the formal sector as well as reduce child mortality.

- Efforts to reduce child mortality should be of high priority, to significantly reduce fertility levels and further increase maternal labour participation.

- Increased maternal labour participation especially in the formal sector should be encouraged to reduce fertility and child mortality. This could be enhanced by increasing the quota for recruitment of female job applicants.

- Policy incentives to reduce early childbearing such as free or subsidised education of girls in rural and urban locations are necessary to reduce the high fertility level.

- Efforts should be directed towards increasing the availability of safe portable drinking water and free or affordable hospital delivery to reduce the number of child deaths.

- Shortening the distance to clinics and hospitals by increasing the number of such healthcare facilities in rural and urban locations is necessary in order to reduce child mortality.

6.4 Limitations of the Study

The study was limited to a one-year period as a result of the data used, which covered only the period 2010. However, the data was chosen because it has a wide set of variables including demographic, economic and social variables. The data used captured cumulative fertility and the stock of child mortality. The data could not be used to capture other measures of fertility such as current and desired fertility.

6.5 Suggestions for Further Research

The study suggests further research, where possible, making use of data covering a wider period provided it does not compromise the inclusion of a wide set of relevant variables. This study examined formal and informal sector differentials with respect to maternal labour participation, however; further research using data capturing public and private sector differentials would provide further information as well as a research using data on current and desired fertility.

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APPENDIX I

JUSTIFICATION FOR THE USE OF THE FOURTH RECOMMENDATION IN CALCULATING THE REPLACEMENT RATE

The fourth recommendation is the appropriate method if the implied average within-parity variance in mortality rates is very small or negative, indicating that there is no within-parity variation in mortality rates; and if Var(d) is different from its predicted value in (3) in Trussel and Olsen (1983), page 397, that is $np(1-p) + p^2$ Var (n). in such a situation, other recommendations cannot be used but the fourth recommendation can because it becomes the better choice of calculating the replacement rate under the OLS.

The formula for implied within-parity variance of d = $\sigma_{p/n} = \dfrac{\text{Var}(d_i/_n) - np(1-p)}{n^2 - n}$

Where Var($\underline{d_i/_n}$) is the sample variance of the number of dead children per woman of the parity n (which from the data is 0.041) and *p* is the mean mortality rate (which from the data is 0.083). Since the number of children (n) reported by respondents ranged from 1 – 14, substituting values of n from 1 to 14 we get various values, all of which range from -0.056 to -0.006 indicating that the implied within-parity variance in mortality rates is very small or negative.

Comparing the sample variance of d obtained from the data which is 1.191 to its predicted value obtained by solving for $np(1-p) + p^2$ Var (n) to get 0.32, we see that they are different, thus the fourth recommendation is appropriate while other recommendations may not be suitable.

Calculating the Replacement Rate

A. Calculating the replacement rate using the OLS estimator, the better choice of calculating the replacement rate as presented in the fourth recommendation was used where the replacement rate (r) is given as:

$r = r_{OLS} - p\text{Var}(n)/\text{Var}(d)$

where, r_{OLS} is the coefficient of number of child deaths using the OLS, Var(n) and Var(d) are the variance of children ever born and number of child deaths respectively, and p is the average mortality rate (total deaths/total births) in the sample.

Thus, substituting the values give:

At the national level,

r = 0.901 – 0.083(4.691)/1.191

= 0.901 - 0.3894/1.191

= 0.901 – 0.327

= 0.574

= 0.57

For urban Nigeria,

r = 0.914 – 0.065(4.213)/0.854

= 0.914 – 0.274/0.854

= 0.914 – 0.321

= 0.593

= 0.59

For rural Nigeria,

r = 0.896 – 0.089(4.827)/1.290

= 0.896 – 0.430/1.290

= 0.896 – 0.333

= 0.563

= 0.56

B. The fourth recommendation states that instrumental variables estimator may also be used but it would not be possible to correct the problems that arise when fertility and the mortality rate are correlated as is the case here. Using the IV estimator to regress the number of child deaths on births, the replacement rate is the coefficient of the number of child death, using the mortality rate as an instrument. As shown in Table 5.13, at the national level, the coefficient is 0.521. For urban Nigeria, the coefficient is 0.503 and for rural Nigeria, the coefficient is 0.521.

APPENDIX II

FIRST STAGE REGRESSION RESULTS

Determinants of Fertility

Table 1. Estimates of the First Stage Regressions

Variables	Child mortality	Formal sector participation	Informal sector participation	Out of labour force
Flush toilet	-0.034(-2.24)**			
Cost of electricity		0.000(2.03)**	0.000(3.56)*	
Distance to nearest hospital (0-29min)				0.095(5.15)*
Education				
No education	RC	RC	RC	RC
Primary education	-0.032(-2.23)**	0.105(3.32)*	0.043(2.40)**	-0.107(-4.91)*
Secondary education	-0.039(-2.41)**	0.512(15.66)*	0.249(11.62)*	-0.054(-2.09)**
Post secondary education	-0.120(-5.68)*	1.896(51.35)*	0.627(19.00)*	-0.233(-5.68)*
Urban residence	-0.027(-1.98)**	0.199(7.75)*	0.228(13.08)*	0.088(4.25)*
Rural residence	RC	RC	RC	RC
Religion				
Christianity	0.012((0.23)	0.456(2.91)*	0.243(3.82)*	-0.155(-1.99)**
Muslim	0.031(0.56)	0.301(1.92)	0.555(8.68)*	0.061(0.79)
Traditional	RC	RC	RC	RC
Others	-0.206(-2.63)*	0.647(2.88)*	0.368(2.66)*	-0.330(-1.73)
Age	0.041(7.33)*	0.002(0.21)	0.032(5.05)*	0.001(0.13)
Age squared	-0.000(-3.55)*	0.000(0.63)	-0.000(-4.83)*	-0.000(-0.98)
Household size	0.101(-6.65)*	-0.034(-1.28)	-0.058(-3.58)*	-0.132(-6.83)*
Age at first childbirth	-0.014(-3.07)*	-0.021(-2.92)*	0.007(1.62)	0.001(0.10)
Age at first childbirth squared	-0.000(-0.52)	0.001(4.13)*	-0.000(-0.96)	0.000(0.84)
Log per capita expenditure	0.000(0.36)	-0.002(-0.93)	0.000(0.33)	0.004(2.75)*
Marital status				
Married monogamous	-0.120(-2.59)*	-0.034(-0.38)	0.174(3.03)*	0.186(2.45)**
Married polygamous	-0.123(-1.04)	-0.090(-0.38)	0.166(1.15)	0.444(2.51)**
Divorced/separated/widowed	-0.157(-2.93)*	0.112(1.10)	-0.089(-1.36)	-0.190(-

				2.06)**
Single	RC		RC	RC
Geopolitical zone				
North-Central	0.099(6.76)*	0.133(3.48)*	-0.376(-14.90)*	0.295(9.19)*
North-East	0.256(13.57)*	0.228(5.20)*	-0.584(-21.17)*	0.871(26.37)*
North-West	0.360(19.01)*	0.371(9.11)*	-0.432(-16.25)*	0.594(18.61)*
South-East	0.176(9.30)*	0.067(1.55)	-0.728(-24.67)*	0.095(2.31)**
South-South	0.194(10.44)*	0.239(6.00)*	-0.545(-19.85)*	-0.032(-0.80)
South-West	RC	RC	RC	RC
Use of contraceptives	-0.026(-1.98)**	0.096(3.43)*	-0.025(-1.29)	0.110(4.52)*
Non-use of contraceptives	RC	RC	RC	RC
Cost of contraceptives	0.000(0.38)	0.000(0.98)	-0.000(-0.30)	-0.000(-2.23)**
Male child preference	-0.059(-4.84)*	0.007(0.29)	-0.078(-5.01)*	-0.076(-4.05)*
Female child preference	-0.092(-7.02)*	0.023(0.84)	0.002(0.14)	-0.034(-1.71)
Indifferent	RC	RC	RC	
Constant	-0.160(-1.39)	-2.480(-9.92)*	0.651(4.92)*	-1.267(-7.79)*
R-squared	0.04			
F-statistic(p-value)	54.81(0.000)			
Pseudo R –squared		0.24	0.053	0.08
Wald Chi2(prob-chi2)		4982.14(0.000)	2774.31(0.000)	2805.80(0.000)
Observations	41575	41575	41575	41575

Note: Values within parenthesis represent t-statistics (for the second column) and z-statistics (for other columns) where (*) and (**) represent significance at (1%) and (5%) respectively. RC denotes reference category.

Table 2. Estimates of the First Stage Regressions

Variables	Fertility	Informal sector participation	Out of labour force
Cost of contraceptives	0.000(3.60)*	-	-
Hours of work per day	-	0.058(33.63)*	-0.098(-38.74)*
Cost of electricity	-	0.000(3.01)*	-0.000(-0.12)
Education			
No education	RC	RC	RC
Primary education	0.322(13.10)*	-0.087(-4.85)*	-0.081(-3.57)*
Secondary education	-0.029(-1.09)	0.035(1.61)	-0.043(-1.54)
Post secondary education	-0.344(-9.09)*	-0.953(-26.97)*	-0.171(-3.82)*
Urban residence	0.012(0.48)	0.161(8.50)*	0.040(1.75)
Rural residence	RC	RC	RC
Age	0.163(18.71)*	0.026(3.99)*	0.017(2.21)**
Age squared	-0.001(-4.92)*	-0.000(-4.31)*	-0.000(-2.47)**
Household size	1.667(65.75)*	-0.058(-3.52)*	-0.155(-7.72)*
Per capita expenditure	-0.001(-0.66)	0.000(0.20)	0.003(2.20)**
Marital status			
married monogamous	-0.485(-5.32)*	0.120(2.05)**	0.234(2.87)*
married polygamous	-0.501(-2.19)**	0.103(0.68)	0.505(2.65)*
divorced/separated/widowed	-0.174(-1.70)	-0.201(-2.99)*	-0.108(-1.10)
Single	RC	RC	RC
Cost of electricity	-0.000(-0.30)		
Prenatal care use	0.358(12.07)*	0.001(0.04)	-0.040(-1.47)
Postnatal care use	0.245(2.92)*	0.089(1.30)	0.018(0.21)
Use of both	0.180(5.24)*	0.052(1.82)	-0.058(-1.59)
Use of none	RC	RC	RC
Cost of prenatal care	-0.000(-2.86)*	-0.000(-0.61)	0.000(0.89)
Cost of postnatal care	0.000(2.00)**	0.000(0.18)	-0.000(-0.96)
Use of vaccine	0.690(1.87)	0.051(0.18)	-0.669(-2.16)**
Non-use of vaccine	RC	RC	RC
Don’t know	0.546(1.63)	-0.020(-0.08)	-0.449(-1.61)
Cost of vaccine	0.001(0.80)	0.002(1.59)	0.000(0.14)
Birth weight	-0.028(-3.64)*	-0.000(-0.01)	0.001(0.12)

Use of mosquito net	-0.167(-7.11)*	0.199(10.51)*	0.023(1.00)
Non-use of mosquito net	RC	RC	RC
Public tap	-0.081(-2.57)*	0.053(2.28)**	-0.001(-0.04)
Borehole	-0.085(-4.26)*	0.134(9.09)*	-0.004(-0.22)
Rain	RC	RC	RC
Bottle/sachet	-0.152(-2.36)**	0.144(2.11)**	0.068(0.79)
Flush toilet	0.016(0.51)	0.205(8.65)*	-0.006(-0.19)
Pit latrine	-0.077(-3.67)*	0.220(13.43)*	0.073(3.53)*
No toilet/bush	RC	RC	RC
0-29 mins to hospital	-0.095(-3.15)*	0.074(3.28)*	0.001(0.04)
30-59 mins to hospital	-0.091(-3.85)*	0.036(2.03)**	-0.063(-2.88)*
60 mins and above to hospital	RC	RC	RC
0-29 mins to clinic	0.005(0.15)	0.070(3.15)*	0.149(5.34)*
30-59 mins to clinic	-0.012(-0.43)	0.055(2.67)*	0.110(4.25)*
60 mins and above to clinic	RC	RC	RC
Hospital/maternity home delivery	0.123(0.91)	-0.144(-1.10)	-0.014(-0.10)
Home delivery and others	RC	RC	RC
North-Central	0.257(9.24)	-0.307(-11.95)*	0.164(4.92)*
North-East	0.728(21.59)*	-0.367(-12.81)*	0.607(16.97)*
North-West	0.711(21.96)*	-0.130(-4.72)*	0.205(5.82)*
South-East	0.245(6.99)*	-0.861(-28.64)*	-0.012(-0.27)
South-South	0.414(12.73)*	-0.694(-24.78)*	-0.192(-4.59)*
South-West	RC	RC	RC
Constant	-4.077(-11.10)*	-0.611(-2.14)	-0.509(-1.64)
R-squared	0.3781	-	-
F-statistic(p-value)	636.24(0.0000)	-	-
Pseudo R –squared	-	0.0775	0.1395
Wald Chi2(prob-chi2)	-	3794.24(0.0000)	3649.22(0.0000)
Observations	40382	40382	40382

Note: Values within parenthesis represent t-statistics (for the second column) and z-statistics (for other columns) where (*) and (**) represent significance at (1%) and (5%) respectively. RC denotes reference category.

Determinants of Maternal Labour Participation- Probability of Labour Participation in the Formal Sector

Table 3. Estimates of the First Stage Regressions

Variables	Fertility
Married monogamous	-0.351(-8.50)*
Married polygamous	-0.371(-1.78)
Hours of work per day	0.005(2.30)**
Education	
No education	RC
Primary education	0.340(13.72)*
Secondary education	-0.041(-1.63)
Post-secondary education	-0.380(-10.78)*
Urban residence	-0.055(-2.50)**
Rural residence	RC
Age	0.157(18.39)*
Age squared	-0.001(-4.60)*
Household size	1.671(68.07)*
Per capita expenditure	-0.001(-0.42)
North-Central	0.289(10.48)*
North-East	0.748(23.04)
North-West	0.725(23.25)*
South-East	0.293(8.78)*
South-South	0.436(13.93)*
South-West	RC
Constant	-3.685(-27.32)*
R-squared	0.3731
F-statistic(p-value)	1520.98(0.0000)
Observations	41575

Note: Values within parenthesis represent t-statistics (for the second column) and z-statistics (for other columns) where (*) and (**) represent significance at (1%) and (5%) respectively. RC denotes reference category.

Determinants of Maternal Labour Participation- Probability of Labour Participation in the Informal Sector

Table 4. Estimates of the First Stage Regressions

Variables	Fertility
Married monogamous	-0.337(-8.29)*
Hours of work per day	0.005(2.32)**
Education	
No education	RC
Primary education	0.341(13.75)*
Secondary education	-0.041(-1.62)
Post secondary education	-0.379(-10.77)*
Urban residence	-0.054(-2.48)**
Rural residence	RC
Age	0.157(18.35)*
Age squared	-0.001(-4.56)*
Household size	1.670(68.03)*
Per capita expenditure	-0.001(-0.41)
North-Central	0.290(10.54)*
North-East	0.750(23.11)*
North-West	0.727(23.32)*
South-East	0.296(8.86)*
South-South	0.438(13.99)*
South-West	RC
Constant	-3.694(-27.42)*
R-squared	0.3731
F-statistic(p-value)	1621.71(0.0000)
Observations	41575

Note: Values within parenthesis represent t-statistics (for the second column) and z-statistics (for other columns) where (*) and (**) represent significance at (1%) and (5%) respectively. RC denotes reference category.

APPENDIX III

STATA REGRESSION RESULTS

SECOND STAGE REGRESSION RESULTS

*Determinants of fertility

```
. regress nchildren nchildeathhatF pformal1hatF pinformal1hatF polaforce2hatF m
> arital1 marital2 marital3 residence1 religion1 religion2 religion4 geozone1 g
> eozone2 geozone3 geozone4 geozone5 age age2 lnhhs firstdevage firstdevage2 co
> ntrause1 costcontra educatn2 educatn3 educatn4  lnpcexpd, robust
```

```
Linear regression                               Number of obs =   41575
                                                F( 27, 41547) =  999.19
                                                Prob > F      =  0.0000
                                                R-squared     =  0.4068
                                                Root MSE      =  1.6686

------------------------------------------------------------------------------
             |               Robust
   nchildren |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
```

nchildeath~F	2.587729	.3655294	7.08	0.000	1.871284	3.304175
pformal1hatF	.3789212	.220003	1.72	0.085	-.0522894	.8101317
pinformal~tF	-.6803785	.345265	-1.97	0.049	-1.357105	-.0036518
polaforce~tF	-.4877635	.564841	-0.86	0.388	-1.594864	.6193369
marital1	.0046203	.1567737	0.03	0.976	-.3026593	.3119
marital2	.1369579	.3463287	0.40	0.693	-.5418537	.8157695
marital3	-.1740148	.1210949	-1.44	0.151	-.4113634	.0633338
residence1	.1967415	.0469034	4.19	0.000	.1048097	.2886732
religion1	.0289827	.2299111	0.13	0.900	-.4216479	.4796132
religion2	.3099962	.1926052	1.61	0.108	-.0675141	.6875066
religion4	.0544322	.3738316	0.15	0.884	-.6782857	.7871501
geozone1	-.2455243	.2444644	-1.00	0.315	-.7246797	.2336311
geozone2	-.1807989	.5640581	-0.32	0.749	-1.286365	.9247669
geozone3	-.5501668	.3566904	-1.54	0.123	-1.249288	.148954
geozone4	-.6327217	.2676937	-2.36	0.018	-1.157407	-.1080365
geozone5	-.6762184	.1881273	-3.59	0.000	-1.044952	-.3074849
age	.0828152	.0308992	2.68	0.007	.0222521	.1433783

```
        age2 |  -.0001932   .0003008    -0.64   0.521    -.0007828    .0003963

       lnhhs |   1.717907   .0381863    44.99   0.000     1.643061    1.792753

 firstdevage |   .0497159   .0136102     3.65   0.000     .0230397    .0763921

firstdevage2 |  -.0022174   .0002704    -8.20   0.000    -.0027474   -.0016874

  contrause1 |   .2334957   .0706887     3.30   0.001     .0949443    .3720471

  costcontra |  -.0000251    .000051    -0.49   0.622    -.0001251    .0000749

    educatn2 |   .3705298   .0809886     4.58   0.000     .2117904    .5292691

    educatn3 |   .1311229   .1599542     0.82   0.412    -.1823907    .4446365

    educatn4 |  -1.052868   .4844415    -2.17   0.030    -2.002383   -.1033522

    lnpcexpd |    .002425   .0029159     0.83   0.406    -.0032903    .0081402

       _cons |  -2.470069   .4490169    -5.50   0.000    -3.350152   -1.589987

------------------------------------------------------------------------------
.
end of do-file

. bysort sector: regress nchildren nchildeathhatF pformal1hatF pinformal1hatF p

> olaforce2hatF marital1 marital2 marital3 religion1 religion2 religion4 geozon

> e1 geozone2 geozone3 geozone4 geozone5 age age2 lnhhs firstdevage firstdevage
```

```
> 2 contrause1 costcontra educatn2 educatn3 educatn4  lnpcexpd, robust

-------------------------------------------------------------------------------

-> sector = URBAN

Linear regression                              Number of obs =    9798

                                          F( 26,  9771) =  297.92

                                          Prob > F      =  0.0000

                                          R-squared     =  0.4706

                                          Root MSE      =  1.4953
-------------------------------------------------------------------------------
             |               Robust
  nchildren |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]

-------------+----------------------------------------------------------------

nchildeath~F |   2.808353   .5967335     4.71   0.000     1.638632    3.978074

pformal1hatF |   .4912561   .3722478     1.32   0.187    -.2384265    1.220939

pinformal~tF |  -.1611086   .5069959    -0.32   0.751    -1.154925    .8327083

polaforce~tF |  -.3532408    .855655    -0.41   0.680    -2.030501     1.32402

    marital1 |   .3695589   .2742901     1.35   0.178    -.1681064    .9072242
```

marital2	1.060731	.5544869	1.91	0.056	-.0261776	2.14764
marital3	.4185642	.2151869	1.95	0.052	-.0032466	.8403751
religion1	-.3369249	.4063838	-0.83	0.407	-1.133521	.4596714
religion2	-.1714714	.3425479	-0.50	0.617	-.8429362	.4999934
religion4	-.4340447	.6187939	-0.70	0.483	-1.647009	.7789193
geozone1	-.15088	.3530774	-0.43	0.669	-.8429848	.5412247
geozone2	.1768706	.8246969	0.21	0.830	-1.439706	1.793447
geozone3	-.4547102	.5223488	-0.87	0.384	-1.478622	.5692014
geozone4	-.2438574	.4021657	-0.61	0.544	-1.032185	.5444705
geozone5	-.4996882	.3116519	-1.60	0.109	-1.11059	.1112138
age	.0244315	.0500192	0.49	0.625	-.0736164	.1224794
age2	.0004507	.0004988	0.90	0.366	-.000527	.0014284
lnhhs	1.878527	.071205	26.38	0.000	1.738951	2.018104
firstdevage	.0910034	.0242003	3.76	0.000	.0435658	.138441
firstdevage2	-.0028237	.0004798	-5.88	0.000	-.0037643	-.0018831
contrause1	.1941363	.1042201	1.86	0.063	-.0101566	.3984293

costcontra | .0000152   .0000822   0.19   0.853   -.0001459   .0001763

educatn2 | .3004748   .1284115   2.34   0.019   .0487617   .5521878

educatn3 | -.0562277   .2464607   -0.23   0.820   -.5393417   .4268863

educatn4 | -.9823045   .8372517   -1.17   0.241   -2.623491   .6588819

lnpcexpd | -.0015285   .0047047   -0.32   0.745   -.0107507   .0076937

_cons | -1.855895   .7606434   -2.44   0.015   -3.346913   -.3648762

-> sector = RURAL

Linear regression   Number of obs =   31777

F(26, 31750) = 766.56

Prob > F   = 0.0000

R-squared   = 0.3906

Root MSE   = 1.7158

| Robust

nchildren | Coef.   Std. Err.   t   P>|t| [95% Conf. Interval]

-------------+--

nchildeath~F	2.203395	.4802213	4.59	0.000	1.262142	3.144647
pformal1hatF	.0665495	.2750589	0.24	0.809	-.4725766	.6056756
pinformal~tF	-1.048786	.5006053	-2.10	0.036	-2.029992	-.0675805
polaforce~tF	-.0269614	.7988595	-0.03	0.973	-1.592757	1.538834
marital1	-.2279842	.1948554	-1.17	0.242	-.6099083	.1539398
marital2	-.5109942	.4508547	-1.13	0.257	-1.394687	.3726985
marital3	-.2996608	.1479611	-2.03	0.043	-.5896703	-.0096513
religion1	.3674704	.3138036	1.17	0.242	-.2475969	.9825376
religion2	.5922206	.2696096	2.20	0.028	.0637753	1.120666
religion4	.519164	.5083351	1.02	0.307	-.4771925	1.515521
geozone1	-.5015629	.3582783	-1.40	0.162	-1.203802	.2006765
geozone2	-.7179203	.8223738	-0.87	0.383	-2.329805	.8939642
geozone3	-.8052058	.5174942	-1.56	0.120	-1.819515	.2091029
geozone4	-.9451973	.3820921	-2.47	0.013	-1.694113	-.1962821
geozone5	-.7579613	.2433626	-3.11	0.002	-1.234961	-.2809612

```
         age |   .1268931   .0423635     3.00   0.003      .043859    .2099273
        age2 |  -.0006129   .0004119    -1.49   0.137    -.0014203    .0001945
       lnhhs |   1.673581   .0468343    35.73   0.000     1.581784    1.765378
 firstdevage |   .0274071   .0165142     1.66   0.097    -.0049613    .0597756
firstdevage2 |  -.0019361   .0003291    -5.88   0.000    -.0025811    -.001291
  contrause1 |    .209325    .100813     2.08   0.038     .0117276    .4069224
  costcontra |   4.21e-06   .0000695     0.06   0.952     -.000132    .0001404
    educatn2 |    .459407   .1125827     4.08   0.000     .2387405    .6800735
    educatn3 |   .3764385   .2232755     1.69   0.092    -.0611902    .8140671
    educatn4 |  -.5145882   .5927454    -0.87   0.385    -1.676392    .6472157
    lnpcexpd |   .0009548    .003908     0.24   0.807     -.006705    .0086146
       _cons |  -2.834004   .5817312    -4.87   0.000     -3.97422   -1.693789
------------------------------------------------------------------------------
.
end of do-file

. do "C:\DOCUME~1\Ovi\LOCALS~1\Temp\STD0k000000.tmp"
. *Fertility Interaction Model
. regress nchildren nchildeathhatF educpformal2 educpformal3 educpformal4 educp
> informal2 educpinformal3 educpinformal4  educpolaforce2 educpolaforce3 educpo
> laforce4 marital1 marital2 marital3 residence1 religion1 religion2 religion4
```

> geozone1 geozone2 geozone3 geozone4 geozone5 age age2 lnhhs firstdevage first

> devage2 contrause1 costcontra educatn2 educatn3 educatn4 lnpcexpd, robust

Linear regression   Number of obs =   41575

F(33, 41541) = 820.59

Prob > F   = 0.0000

R-squared   = 0.4074

Root MSE   =   1.668

	Robust				
nchildren	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]
nchildeath~F	1.956265	.20611	9.49	0.000	1.552285 2.360245
educpformal2	-.0285974	.1119084	-0.26	0.798	-.2479404 .1907455
educpformal3	-.3686674	.1071699	-3.44	0.001	-.5787227 -.1586122
educpformal4	-.7989451	.1670456	-4.78	0.000	-1.126358 -.4715323
educpinfor~2	-.1528298	.0661486	-2.31	0.021	-.2824824 -.0231772
educpinfor~3	-.0238214	.0657316	-0.36	0.717	-.1526568 .105014
educpinfor~4	-.0308769	.0901691	-0.34	0.732	-.2076103 .1458564

educpolafo~2 |	.2601487	.0609929	4.27	0.000	.1406013	.379696
educpolafo~3 |	.2952035	.065119	4.53	0.000	.1675689	.422838
educpolafo~4 |	.2555251	.0918955	2.78	0.005	.075408	.4356423
marital1 |	-.3402927	.0950792	-3.58	0.000	-.52665	-.1539354
marital2 |	-.4103202	.2163267	-1.90	0.058	-.8343251	.0136848
marital3 |	-.030533	.1058865	-0.29	0.773	-.2380728	.1770068
residence1 |	.0694228	.0268826	2.58	0.010	.0167323	.1221132
religion1 |	.1900099	.083254	2.28	0.022	.0268303	.3531895
religion2 |	.072491	.0827394	0.88	0.381	-.0896799	.234662
religion4 |	.2534662	.1788801	1.42	0.157	-.0971425	.6040749
geozone1 |	-.0893032	.0427783	-2.09	0.037	-.1731494	-.0054569
geozone2 |	-.0535802	.0727354	-0.74	0.461	-.1961431	.0889827
geozone3 |	-.2599977	.0870925	-2.99	0.003	-.4307008	-.0892946
geozone4 |	-.0820013	.0635286	-1.29	0.197	-.2065187	.0425161
geozone5 |	-.0251938	.0619489	-0.41	0.684	-.1466149	.0962274
age |	.1139511	.0122441	9.31	0.000	.0899524	.1379498

```
        age2 |  -.0003766   .0001452    -2.59   0.009    -.0006611   -.0000921

       lnhhs |    1.74269   .0320937    54.30   0.000     1.679786    1.805594

 firstdevage |   .0190747   .0098402     1.94   0.053    -.0002123    .0383617

firstdevage2 |  -.0017932   .0002371    -7.56   0.000     -.002258   -.0013284

  contrause1 |    .213442   .0243452     8.77   0.000     .1657248    .2611591

  costcontra |   .0000443   .0000191     2.32   0.020     6.93e-06    .0000817

    educatn2 |   .6308185   .2233337     2.82   0.005     .1930797    1.068557

    educatn3 |  -.0547451   .1705377    -0.32   0.748    -.3890027    .2795124

    educatn4 |   .5064034   .1325196     3.82   0.000     .2466622    .7661445

    lnpcexpd |   -.001389   .0015577    -0.89   0.373     -.004442    .0016641

       _cons |  -2.712213   .1930208   -14.05   0.000    -3.090538   -2.333888

------------------------------------------------------------------------------
end of do-file
. do "C:\DOCUME~1\Ovi\LOCALS~1\Temp\STD0k000000.tmp"

. bysort sector: regress nchildren nchildeathhatF educpformal2 educpformal3 edu

> cpformal4 educpinformal2 educpinformal3 educpinformal4  educpolaforce2 educpo

> laforce3 educpolaforce4 marital1 marital2 marital3 religion1 religion2 religi
```

```
> on4 geozone1 geozone2 geozone3 geozone4 geozone5 age age2 lnhhs firstdevage f

> irstdevage2 contrause1 costcontra educatn2 educatn3 educatn4  lnpcexpd, robus

> t
------------------------------------------------------------------------------
-> sector = URBAN
Linear regression                              Number of obs =    9798

                                       F( 32,  9765) =  244.05

                                       Prob > F      =  0.0000

                                       R-squared     =  0.4735

                                       Root MSE      =  1.4918
------------------------------------------------------------------------------
             |               Robust

   nchildren |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]

-------------+----------------------------------------------------------------

nchildeath~F |   2.215433   .3755033     5.90   0.000     1.479369    2.951498

educpformal2 |  -.2166616    .233146    -0.93   0.353     -.673676    .2403528

educpformal3 |  -.4110128   .1850834    -2.22   0.026    -.7738145    -.048211

educpformal4 |  -.6361164   .2524588    -2.52   0.012    -1.130988    -.141245

educpinfor~2 |    .041162   .1663555     0.25   0.805    -.2849292    .3672533
```

educpinfor~3	.187472	.1490152	1.26	0.208	-.1046287	.4795727
educpinfor~4	.5245107	.1793343	2.92	0.003	.1729784	.8760431
educpolafo~2	.6636274	.1425995	4.65	0.000	.384103	.9431519
educpolafo~3	.4198608	.1267831	3.31	0.001	.1713397	.6683819
educpolafo~4	.419568	.1437012	2.92	0.004	.137884	.7012521
marital1	.0776617	.1802671	0.43	0.667	-.275699	.4310224
marital2	.540534	.3457797	1.56	0.118	-.1372658	1.218334
marital3	.6092281	.1932833	3.15	0.002	.2303528	.9881035
religion1	.110166	.243792	0.45	0.651	-.3677168	.5880488
religion2	-.0831447	.2459896	-0.34	0.735	-.5653352	.3990458
religion4	.2164252	.375655	0.58	0.565	-.5199363	.9527868
geozone1	-.0926841	.0838104	-1.11	0.269	-.2569698	.0716017
geozone2	.1466355	.1567985	0.94	0.350	-.1607221	.4539931
geozone3	-.2473135	.1645842	-1.50	0.133	-.5699326	.0753056
geozone4	.136408	.1362063	1.00	0.317	-.1305846	.4034006
geozone5	.0575724	.1283625	0.45	0.654	-.1940447	.3091895

age	.0695157	.0252666	2.75	0.006	.0199878	.1190435
age2	.000097	.0002998	0.32	0.746	-.0004906	.0006846
lnhhs	1.90122	.062519	30.41	0.000	1.778669	2.02377
firstdevage	.0583672	.0184483	3.16	0.002	.0222047	.0945296
firstdevage2	-.0022939	.0004399	-5.22	0.000	-.0031561	-.0014317
contrause1	.1791257	.040471	4.43	0.000	.0997941	.2584572
costcontra	.000105	.0000388	2.71	0.007	.0000291	.000181
educatn2	.6816439	.4020737	1.70	0.090	-.1065038	1.469791
educatn3	-.118847	.277214	-0.43	0.668	-.6622438	.4245498
educatn4	.7817785	.1983427	3.94	0.000	.3929857	1.170571
lnpcexpd	-.0058461	.00281	-2.08	0.038	-.0113543	-.0003378
_cons	-2.936196	.4402345	-6.67	0.000	-3.799146	-2.073245

-> sector = RURAL

Linear regression   Number of obs =   31777

F(32, 31744) = 624.20

Prob > F   = 0.0000

R-squared = 0.3904

Root MSE = 1.7163

nchildren	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
nchildeath~F	1.865501	.2450704	7.61	0.000	1.385154	2.345849
educpformal2	.1566543	.152273	1.03	0.304	-.1418065	.4551152
educpformal3	-.3577384	.1724036	-2.08	0.038	-.6956562	-.0198207
educpformal4	-.5036668	.3017324	-1.67	0.095	-1.095074	.0877404
educpinfor~2	-.0859717	.0943665	-0.91	0.362	-.2709336	.0989903
educpinfor~3	-.0464936	.106224	-0.44	0.662	-.2546967	.1617095
educpinfor~4	-.0521907	.173245	-0.30	0.763	-.3917575	.2873761
educpolafo~2	.1448243	.0680276	2.13	0.033	.0114875	.2781611
educpolafo~3	.2058544	.0803248	2.56	0.010	.0484146	.3632942
educpolafo~4	.0681109	.1397322	0.49	0.626	-.2057697	.3419915
marital1	-.5038655	.1115639	-4.52	0.000	-.7225351	-.2851959

marital2	-.8183915	.2691539	-3.04	0.002	-1.345944	-.2908395
marital3	-.2531376	.1263344	-2.00	0.045	-.5007579	-.0055174
religion1	.1748651	.0896291	1.95	0.051	-.0008115	.3505416
religion2	.0506405	.0893744	0.57	0.571	-.1245367	.2258178
religion4	.1658156	.2039154	0.81	0.416	-.2338666	.5654977
geozone1	-.1166336	.0519865	-2.24	0.025	-.2185291	-.0147381
geozone2	-.0909118	.0854198	-1.06	0.287	-.258338	.0765143
geozone3	-.2822763	.1036533	-2.72	0.006	-.4854409	-.0791118
geozone4	-.1460282	.0784557	-1.86	0.063	-.2998044	.0077481
geozone5	-.0871905	.0749373	-1.16	0.245	-.2340705	.0596894
age	.1231399	.0142341	8.65	0.000	.0952405	.1510393
age2	-.0004613	.0001694	-2.72	0.006	-.0007933	-.0001293
lnhhs	1.695656	.0373986	45.34	0.000	1.622353	1.768959
firstdevage	.0088861	.0115093	0.77	0.440	-.0136725	.0314447
firstdevage2	-.0016961	.0002814	-6.03	0.000	-.0022476	-.0011446
contrause1	.2239211	.0301021	7.44	0.000	.1649197	.2829224

costcontra	.0000223	.0000174	1.28	0.202	-.0000119	.0000564
educatn2	.8384075	.3031462	2.77	0.006	.2442292	1.432586
educatn3	-.1455539	.2626413	-0.55	0.579	-.660341	.3692331
educatn4	.269502	.2014396	1.34	0.181	-.1253273	.6643313
lnpcexpd	3.14e-07	.0018594	0.00	1.000	-.0036442	.0036448
_cons	-2.435568	.2219666	-10.97	0.000	-2.870631	-2.000505

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end of do-file

. do "C:\DOCUME~1\Ovi\LOCALS~1\Temp\STD0k000000.tmp"

. bysort Zone: regress nchildren nchildeathhatF pformal1hatF pinformal1hatF pol

> aforce2hatF marital1 marital2 marital3 residence1 religion1 religion2 religio

> n4 age age2 lnhhs firstdevage firstdevage2 contrause1 costcontra educatn2 edu

> catn3 educatn4 lnpcexpd, robust

-> Zone = North Cent

Linear regression Number of obs = 7516

F(22, 7493) = 299.50

Prob > F = 0.0000

R-squared = 0.4564

Root MSE = 1.5133

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nchildren	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
nchildeath~F	3.840384	.8106348	4.74	0.000	2.251313	5.429456
pformal1hatF	.842163	.4724353	1.78	0.075	-.0839428	1.768269
pinformal~tF	-.7117694	.8222574	-0.87	0.387	-2.323625	.9000859
polaforce~tF	-1.752776	1.352781	-1.30	0.195	-4.404607	.8990546
marital1	1.19425	.3802336	3.14	0.002	.4488853	1.939614
marital2	1.377537	.8826205	1.56	0.119	-.3526467	3.107721
marital3	.5585061	.3156807	1.77	0.077	-.0603167	1.177329
residence1	.2826039	.1112201	2.54	0.011	.0645813	.5006264
religion1	-.4770504	.5393189	-0.88	0.376	-1.534267	.580166
religion2	-.0287699	.4508623	-0.06	0.949	-.9125866	.8550468
religion4	-1.070071	1.1003	-0.97	0.331	-3.226968	1.086826
age	.0232345	.072154	0.32	0.747	-.1182075	.1646766
age2	.00025	.000711	0.35	0.725	-.0011438	.0016438
lnhhs	1.533876	.0911296	16.83	0.000	1.355237	1.712516

firstdevage	.114337	.030247	3.78	0.000	.0550445	.1736296
firstdevage2	-.0035048	.000597	-5.87	0.000	-.0046751	-.0023344
contrause1	.3498451	.1651907	2.12	0.034	.0260249	.6736653
costcontra	-.0000586	.0001396	-0.42	0.675	-.0003323	.0002151
educatn2	.0266336	.1898287	0.14	0.888	-.3454838	.3987511
educatn3	-.191505	.3737413	-0.51	0.608	-.9241428	.5411327
educatn4	-2.237161	1.016993	-2.20	0.028	-4.230752	-.2435693
lnpcexpd	.0029381	.0066225	0.44	0.657	-.0100439	.0159201
_cons	-3.251567	.8665878	-3.75	0.000	-4.950323	-1.552812

-> Zone = North East

Linear regression Number of obs = 7364

F(22, 7341) = 256.84

Prob > F = 0.0000

R-squared = 0.4170

Root MSE = 1.719

nchildren	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
nchildeath~F	-.0232079	1.026633	-0.02	0.982	-2.035703	1.989288
pformal1hatF	.6261694	.6106521	1.03	0.305	-.5708842	1.823223
pinformal~tF	-5.273597	1.023603	-5.15	0.000	-7.280153	-3.267042
polaforce~tF	5.912328	1.640594	3.60	0.000	2.696292	9.128363
marital1	-1.397543	.429701	-3.25	0.001	-2.239881	-.5552059
marital2	-4.238924	.912474	-4.65	0.000	-6.027635	-2.450213
marital3	-.7027967	.3580774	-1.96	0.050	-1.404731	-.0008622
residence1	.7146049	.1415803	5.05	0.000	.4370668	.992143
religion1	2.385777	.6838026	3.49	0.000	1.045327	3.726226
religion2	2.99613	.5982537	5.01	0.000	1.823381	4.168879
religion4	3.284797	1.081317	3.04	0.002	1.165105	5.40449
age	.3927291	.0877838	4.47	0.000	.2206477	.5648104
age2	-.0033592	.0008428	-3.99	0.000	-.0050113	-.0017072
lnhhs	2.022379	.0994955	20.33	0.000	1.82734	2.217419

firstdevage	-.0104418	.0348493	-0.30	0.764	-.0787564	.0578728
firstdevage2	-.0021873	.0006677	-3.28	0.001	-.0034962	-.0008784
contrause1	-.7814683	.2148193	-3.64	0.000	-1.202576	-.3603608
costcontra	.0003657	.0001557	2.35	0.019	.0000605	.0006708
educatn2	1.129459	.2341343	4.82	0.000	.6704891	1.58843
educatn3	1.474535	.4678644	3.15	0.002	.5573861	2.391683
educatn4	-3.154289	1.321144	-2.39	0.017	-5.74411	-.5644681
lnpcexpd	-.0224938	.0082129	-2.74	0.006	-.0385935	-.0063941
_cons	-5.258339	1.622644	-3.24	0.001	-8.439187	-2.077492

-> Zone = North West

Linear regression Number of obs = 12473

F(22, 12450) = 287.52

Prob > F = 0.0000

R-squared = 0.3533

Root MSE = 1.8779

nchildren	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
nchildeath~F	2.28635	.661795	3.45	0.001	.9891296	3.583571
pformal1hatF	-.1701671	.4522549	-0.38	0.707	-1.056657	.7163224
pinformal~tF	-.0150252	.4414724	-0.03	0.973	-.8803793	.8503288
polaforce~tF	-1.14901	.7873324	-1.46	0.144	-2.692303	.3942833
marital1	-.7823676	.2951562	-2.65	0.008	-1.360919	-.2038159
marital2	-1.994948	.646413	-3.09	0.002	-3.262018	-.7278788
marital3	-1.20561	.2219751	-5.43	0.000	-1.640715	-.7705041
residence1	.2906113	.0807867	3.60	0.000	.1322569	.4489657
religion1	.3351693	.3553135	0.94	0.346	-.3613001	1.031639
religion2	.4355811	.2594205	1.68	0.093	-.0729231	.9440853
religion4	.3902336	.7764898	0.50	0.615	-1.131806	1.912274
age	.0746964	.047718	1.57	0.118	-.0188381	.168231

age2	.0001185	.0004729	0.25	0.802	-.0008084	.0010453
lnhhs	1.578264	.0686876	22.98	0.000	1.443626	1.712903
firstdevage	.0205793	.0297631	0.69	0.489	-.037761	.0789196
firstdevage2	-.0018895	.0006538	-2.89	0.004	-.0031712	-.0006079
contrause1	.0948414	.111063	0.85	0.393	-.1228593	.3125422
costcontra	-.0000459	.0000768	-0.60	0.550	-.0001965	.0001047
educatn2	.7267241	.1195971	6.08	0.000	.4922953	.9611528
educatn3	.2518068	.2296431	1.10	0.273	-.1983292	.7019428
educatn4	.4193007	1.06044	0.40	0.693	-1.659325	2.497926
lnpcexpd	.0036941	.0049803	0.74	0.458	-.0060681	.0134564
_cons	-3.240109	.7114302	-4.55	0.000	-4.634622	-1.845596

-> Zone = South East

Linear regression Number of obs = 3708

F(22, 3685) = 134.79

Prob > F = 0.0000

R-squared = 0.4406

Root MSE = 1.5605

nchildren	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
nchildeath~F	2.146328	1.248884	1.72	0.086	-.3022446	4.594901
pformal1hatF	1.100265	.7296579	1.51	0.132	-.3303076	2.530838
pinformal~tF	.5474089	1.172154	0.47	0.641	-1.750726	2.845544
polaforce~tF	-.9349968	1.885726	-0.50	0.620	-4.632167	2.762174
marital1	.4826063	.5890026	0.82	0.413	-.6721969	1.63741
marital2	1.780888	1.017602	1.75	0.080	-.2142312	3.776008
marital3	.3786694	.4881165	0.78	0.438	-.5783357	1.335675
residence1	-.2701455	.1501116	-1.80	0.072	-.5644555	.0241645
religion1	-.5355315	.752447	-0.71	0.477	-2.010785	.9397221
religion2	-.7571846	.9575136	-0.79	0.429	-2.634493	1.120124
religion4	-.9981542	1.173977	-0.85	0.395	-3.299862	1.303554
age	.0244014	.1035057	0.24	0.814	-.1785326	.2273355
age2	.0003913	.0009999	0.39	0.696	-.0015692	.0023517

lnhhs	2.249891	.1313288	17.13	0.000	1.992407	2.507375
firstdevage	.0501477	.0435246	1.15	0.249	-.035187	.1354824
firstdevage2	-.0024788	.0007155	-3.46	0.001	-.0038815	-.001076
contrause1	.5877363	.2379559	2.47	0.014	.121198	1.054275
costcontra	-.00013	.0001635	-0.80	0.427	-.0004507	.0001906
educatn2	-.0331615	.2705144	-0.12	0.902	-.5635342	.4972113
educatn3	-.6773359	.5331581	-1.27	0.204	-1.72265	.3679782
educatn4	-1.988926	1.592041	-1.25	0.212	-5.110294	1.132443
lnpcexpd	.0087066	.009492	0.92	0.359	-.0099034	.0273166
_cons	-.9061572	1.236722	-0.73	0.464	-3.330885	1.518571

-> Zone = South South

Linear regression   Number of obs =   4954

F(22, 4931) = 183.04

Prob > F   = 0.0000

R-squared   = 0.4389

Root MSE   = 1.6736

nchildren	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
nchildeath~F	2.754661	.9599986	2.87	0.004	.8726358	4.636685
pformal1hatF	-.9719986	.6005066	-1.62	0.106	-2.149259	.2052617
pinformal~tF	-.0855347	.9252018	-0.09	0.926	-1.899342	1.728273
polaforce~tF	1.022228	1.482203	0.69	0.490	-1.883549	3.928005
marital1	.1728447	.363688	0.48	0.635	-.5401457	.8858351
marital2	.0162616	.8391294	0.02	0.985	-1.628806	1.661329
marital3	.99793	.2633297	3.79	0.000	.4816866	1.514173
residence1	-.0062246	.1270037	-0.05	0.961	-.2552085	.2427593
religion1	.6216569	.5881468	1.06	0.291	-.5313728	1.774687
religion2	-.0854838	.5431749	-0.16	0.875	-1.150349	.9793809
religion4	1.354064	.9157084	1.48	0.139	-.4411321	3.14926
age	.0568103	.0820012	0.69	0.488	-.1039485	.2175691
age2	.0003776	.0008078	0.47	0.640	-.0012061	.0019614
lnhhs	2.001235	.1069984	18.70	0.000	1.79147	2.210999

firstdevage | .0251206 .033739 0.74 0.457 -.0410229 .0912641

firstdevage2 | -.0012086 .0006446 -1.87 0.061 -.0024724 .0000551

contrause1 | .044931 .1878298 0.24 0.811 -.3232991 .413161

costcontra | .0001295 .0001282 1.01 0.313 -.0001219 .0003809

educatn2 | .4417039 .2191603 2.02 0.044 .0120521 .8713556

educatn3 | .4843404 .4306904 1.12 0.261 -.3600045 1.328685

educatn4 | 2.016996 1.323663 1.52 0.128 -.5779735 4.611966

lnpcexpd | -.0015282 .0078792 -0.19 0.846 -.016975 .0139186

_cons | -3.864226 1.033736 -3.74 0.000 -5.890808 -1.837643

-> Zone = South West

Linear regression Number of obs = 5560

F(22, 5537) = 247.94

Prob > F = 0.0000

R-squared = 0.4873

Root MSE = 1.2028

| Robust

nchildren | Coef. Std. Err. t P>|t| [95% Conf. Interval]

-------------+--

nchildeath~F |	3.359974	.6249228	5.38	0.000	2.13488	4.585068
pformal1hatF |	.7005015	.3962479	1.77	0.077	-.0762999	1.477303
pinformal~tF |	-.6796378	.4934161	-1.38	0.168	-1.646927	.2876515
polaforce~tF |	-.7744361	.8488773	-0.91	0.362	-2.438569	.8896966
marital1 |	1.065532	.2871497	3.71	0.000	.5026062	1.628459
marital2 |	1.826635	.5402083	3.38	0.001	.7676143	2.885655
marital3 |	.6735241	.2231011	3.02	0.003	.2361583	1.11089
residence1 |	.0889678	.0745486	1.19	0.233	-.0571768	.2351123
religion1 |	-.1175079	.3650644	-0.32	0.748	-.8331773	.5981615
religion2 |	.29899	.2907471	1.03	0.304	-.2709885	.8689685
religion4 |	-.262135	.692894	-0.38	0.705	-1.620479	1.096209
age |	.0263723	.0514987	0.51	0.609	-.0745855	.12733
age2 |	.0001828	.0005147	0.36	0.722	-.0008262	.0011919
lnhhs |	1.418843	.0760262	18.66	0.000	1.269802	1.567884
firstdevage |	.1613608	.0258721	6.24	0.000	.1106413	.2120804
firstdevage2 |	-.0041089	.0004986	-8.24	0.000	-.0050863	-.0031316

```
  contrause1 |   .3089303   .1002124     3.08   0.002     .1124747    .5053859

  costcontra |   .0000174   .0000871     0.20   0.842    -.0001533    .0001881

    educatn2 |   .0103862   .1267051     0.08   0.935    -.2380054    .2587779

    educatn3 |  -.2113355    .243292    -0.87   0.385    -.6882833    .2656124

    educatn4 |   -1.80479   .9049937    -1.99   0.046    -3.578933   -.0306475

    lnpcexpd |   .0022667   .0048834     0.46   0.643    -.0073066    .0118401

       _cons |  -2.671168   .7947083    -3.36   0.001    -4.229108   -1.113228

------------------------------------------------------------------------------
end of do-file
. bysort Agegroup: regress nchildren nchildeathhatF pformal1hatF pinformal1hatF

>  polaforce2hatF marital1 marital2 marital3 residence1 religion1 religion2 rel

> igion4 geozone1 geozone2 geozone3 geozone4 geozone5 age age2 lnhhs firstdevag

> e firstdevage2 contrause1 costcontra educatn2 educatn3 educatn4  lnpcexpd, ro

> bust
-------------------------------------------------------------------------------
-> Agegroup = 15 - 19
Linear regression                              Number of obs =    1478

                                               F( 27,  1450) =   20.56
```

Prob > F = 0.0000

R-squared = 0.1590

Root MSE = 1.3236

nchildren	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
nchildeath~F	3.584074	2.225246	1.61	0.107	-.7809726	7.949121
pformal1hatF	1.017254	1.198578	0.85	0.396	-1.333879	3.368387
pinformal~tF	3.790121	2.680449	1.41	0.158	-1.467852	9.048093
polaforce~tF	-5.809307	4.254544	-1.37	0.172	-14.15503	2.536412
marital1	.4763579	.7756928	0.61	0.539	-1.045242	1.997958
marital2	1.334151	1.824983	0.73	0.465	-2.245739	4.914041
marital3	-.0854013	.5572632	-0.15	0.878	-1.17853	1.007727
residence1	-.0533124	.2828451	-0.19	0.851	-.6081418	.501517
religion1	-1.945935	1.674564	-1.16	0.245	-5.230762	1.338892
religion2	-1.975997	1.459308	-1.35	0.176	-4.838578	.8865847
religion4	-3.736865	2.5787	-1.45	0.148	-8.795247	1.321517

geozone1	2.926377	1.950023	1.50	0.134	-.8987905	6.751545
geozone2	6.789713	4.491133	1.51	0.131	-2.0201	15.59953
geozone3	4.181316	2.779042	1.50	0.133	-1.270056	9.632688
geozone4	3.241259	2.019679	1.60	0.109	-.7205466	7.203064
geozone5	1.275758	1.070763	1.19	0.234	-.824652	3.376168
age	-4.592815	.9942581	-4.62	0.000	-6.543153	-2.642477
age2	.1231658	.0275248	4.47	0.000	.0691731	.1771585
lnhhs	.651104	.1817699	3.58	0.000	.2945439	1.007664
firstdevage	.0003798	.0659981	0.01	0.995	-.1290822	.1298419
firstdevage2	.0025304	.0012998	1.95	0.052	-.0000192	.0050801
contrause1	.9072926	.5458922	1.66	0.097	-.1635304	1.978116
costcontra	-.0003771	.0004079	-0.92	0.355	-.0011773	.0004231
educatn2	-.6421883	.5867425	-1.09	0.274	-1.793143	.5087666
educatn3	-1.739275	1.161351	-1.50	0.134	-4.017383	.5388341
educatn4	-1.432575	2.469834	-0.58	0.562	-6.277404	3.412254
lnpcexpd	.0232382	.0187623	1.24	0.216	-.013566	.0600423

_cons | 37.26751   8.377271   4.45   0.000   20.83464   53.70038

-> Agegroup = 20 - 24

Linear regression   Number of obs =   4902

F(27, 4874) =   55.08

Prob > F   = 0.0000

R-squared   = 0.2500

Root MSE   = 1.2589

| Robust

nchildren | Coef.   Std. Err.   t   P>|t| [95% Conf. Interval]

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nchildeath~F | -.2706479   .9654599   -0.28   0.779   -2.163385   1.622089

pformal1hatF | .5174853   .5446525   0.95   0.342   -.5502791   1.58525

pinformal~tF | -1.888287   1.147685   -1.65   0.100   -4.138268   .3616934

polaforce~tF | .337429   1.786348   0.19   0.850   -3.164619   3.839477

marital1 | -.7379822   .3393467   -2.17   0.030   -1.403255   -.0727098

marital2 | 1.056294   1.554828   0.68   0.497   -1.991869   4.104457

marital3	-1.672942	.2639818	-6.34	0.000	-2.190466	-1.155419
residence1	.274597	.1419936	1.93	0.053	-.0037745	.5529685
religion1	.3999731	.7284062	0.55	0.583	-1.028032	1.827978
religion2	1.123847	.6443671	1.74	0.081	-.1394029	2.387097
religion4	.4982655	1.194448	0.42	0.677	-1.843391	2.839922
geozone1	-.8046964	.8155104	-0.99	0.324	-2.403464	.7940716
geozone2	-1.038468	1.881306	-0.55	0.581	-4.726676	2.64974
geozone3	-.6408525	1.170892	-0.55	0.584	-2.936328	1.654623
geozone4	-1.101089	.8752188	-1.26	0.208	-2.816913	.6147344
geozone5	-1.012619	.4900626	-2.07	0.039	-1.973363	-.0518754
age	-.2808482	.4778693	-0.59	0.557	-1.217688	.6559911
age2	.009861	.0108647	0.91	0.364	-.0114387	.0311607
lnhhs	.8599864	.0963707	8.92	0.000	.6710563	1.048916
firstdevage	-.0626163	.036762	-1.70	0.089	-.1346863	.0094537
firstdevage2	.0000131	.0007231	0.02	0.986	-.0014045	.0014307
contrause1	-.2920736	.2216001	-1.32	0.188	-.7265097	.1423625

costcontra | .0001174 .0001822 0.64 0.519 -.0002397 .0004745

educatn2 | .445539 .260411 1.71 0.087 -.0649838 .9560619

educatn3 | .2580896 .5262087 0.49 0.624 -.7735166 1.289696

educatn4 | -2.021731 1.093642 -1.85 0.065 -4.165762 .1222996

lnpcexpd | .0029986 .0083995 0.36 0.721 -.0134682 .0194655

_cons | 5.331029 5.242153 1.02 0.309 -4.945954 15.60801

-> Agegroup = 25 - 29

Linear regression Number of obs = 8812

F(27, 8784) = 126.62

Prob > F = 0.0000

R-squared = 0.2924

Root MSE = 1.3004

| Robust

nchildren | Coef. Std. Err. t P>|t| [95% Conf. Interval]

nchildeath~F	1.534014	.8424272	1.82	0.069	-.1173408	3.185368
pformal1hatF	-.3127595	.4121031	-0.76	0.448	-1.120578	.495059
pinformal~tF	1.920838	1.003687	1.91	0.056	-.0466241	3.8883
polaforce~tF	-2.379591	1.569429	-1.52	0.130	-5.456039	.6968564
marital1	.8122966	.3707072	2.19	0.028	.0856238	1.538969
marital2	1.40769	.8179882	1.72	0.085	-.1957588	3.011138
marital3	.7744111	.294901	2.63	0.009	.1963361	1.352486
residence1	-.0874688	.1137479	-0.77	0.442	-.3104413	.1355038
religion1	-.5055902	.6144999	-0.82	0.411	-1.710154	.6989733
religion2	-.6935125	.5452938	-1.27	0.203	-1.762416	.375391
religion4	-1.213456	.961207	-1.26	0.207	-3.097646	.6707349
geozone1	1.360936	.7175972	1.90	0.058	-.0457222	2.767595
geozone2	3.199407	1.660347	1.93	0.054	-.0552616	6.454075
geozone3	2.245942	1.025173	2.19	0.028	.2363632	4.25552
geozone4	1.610719	.7488242	2.15	0.032	.1428487	3.07859

geozone5	.8859582	.3895104	2.27	0.023	.1224267	1.64949
age	.620628	.4928054	1.26	0.208	-.345386	1.586642
age2	-.0094906	.0091181	-1.04	0.298	-.0273644	.0083831
lnhhs	1.28076	.0798646	16.04	0.000	1.124207	1.437314
firstdevage	-.0081834	.0284655	-0.29	0.774	-.0639824	.0476155
firstdevage2	-.0013259	.0006696	-1.98	0.048	-.0026384	-.0000135
contrause1	.5280044	.1961996	2.69	0.007	.1434072	.9126016
costcontra	-.0002586	.0001428	-1.81	0.070	-.0005386	.0000214
educatn2	-.0134776	.2195485	-0.06	0.951	-.443844	.4168888
educatn3	-.3210829	.4341584	-0.74	0.460	-1.172135	.5299692
educatn4	1.353091	.803916	1.68	0.092	-.2227725	2.928955
lnpcexpd	.0076552	.0070925	1.08	0.280	-.0062478	.0215582
_cons	-13.73699	6.529995	-2.10	0.035	-26.53731	-.9366693

-> Agegroup = 30 - 34

Linear regression Number of obs = 7924

F(27, 7896) = 112.91

Prob > F = 0.0000

R-squared = 0.2819

Root MSE = 1.5126

	Robust					
nchildren	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
nchildeath~F	2.455481	.6500337	3.78	0.000	1.181243	3.729719
pformal1hatF	.4679374	.4184778	1.12	0.264	-.3523898	1.288265
pinformal~tF	-.6313443	.4519669	-1.40	0.162	-1.517319	.2546302
polaforce~tF	-.0807243	.8005243	-0.10	0.920	-1.649964	1.488515
marital1	.9555782	.4801359	1.99	0.047	.0143848	1.896772
marital2	1.067687	.7059153	1.51	0.130	-.3160934	2.451468
marital3	.6875158	.4494412	1.53	0.126	-.1935079	1.568539

residence1	.1892513	.0808883	2.34	0.019	.0306887	.3478138
religion1	-.0094475	.3480687	-0.03	0.978	-.6917543	.6728593
religion2	.2452441	.2731111	0.90	0.369	-.2901259	.7806141
religion4	.0703544	.5819031	0.12	0.904	-1.07033	1.211038
geozone1	-.3973359	.3104254	-1.28	0.201	-1.005852	.21118
geozone2	-.5581466	.7178784	-0.78	0.437	-1.965378	.8490849
geozone3	-.9659903	.4766156	-2.03	0.043	-1.900283	-.0316976
geozone4	-.512574	.3746417	-1.37	0.171	-1.246971	.2218228
geozone5	-.581314	.3457199	-1.68	0.093	-1.259016	.0963884
age	-.2288608	.7416006	-0.31	0.758	-1.682594	1.224872
age2	.0047113	.0116855	0.40	0.687	-.0181955	.027618
lnhhs	1.975009	.082066	24.07	0.000	1.814138	2.13588
firstdevage	.0851408	.0278461	3.06	0.002	.0305552	.1397265
firstdevage2	-.0030408	.0006568	-4.63	0.000	-.0043283	-.0017534
contrause1	.1193734	.0988803	1.21	0.227	-.0744582	.3132049
costcontra	.0000527	.0000747	0.71	0.481	-.0000938	.0001992

```
    educatn2 |   .2205857   .1191547     1.85   0.064    -.0129889    .4541604

    educatn3 |   .0510248   .2327269     0.22   0.826    -.4051816    .5072311

    educatn4 |  -1.148728   .9605303    -1.20   0.232    -3.031622     .734165

    lnpcexpd |  -.0032275   .0049212    -0.66   0.512    -.0128743    .0064194

       _cons |   1.679037   11.68455     0.14   0.886    -21.22578    24.58385

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-------------------------------------------------------------------------------

-> Agegroup = 35 - 39


Linear regression                                      Number of obs =    7885

                                                       F( 27,  7857) =   92.92

                                                       Prob > F      =  0.0000

                                                       R-squared     =  0.2678

                                                       Root MSE      =  1.7161

------------------------------------------------------------------------------
             |               Robust
   nchildren |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------

nchildeath~F |   4.019656   .7583096     5.30   0.000     2.533167    5.506144
```

pformal1hatF	.5939779	.5179512	1.15	0.252	-.4213443	1.6093
pinformal~tF	.4507145	.5405974	0.83	0.404	-.6090003	1.510429
polaforce~tF	-1.421318	.9646831	-1.47	0.141	-3.312353	.4697177
marital1	.7915468	.3848886	2.06	0.040	.0370629	1.546031
marital2	.7382744	.812655	0.91	0.364	-.8547456	2.331294
marital3	.7264513	.3051491	2.38	0.017	.1282778	1.324625
residence1	-.0083946	.0909578	-0.09	0.926	-.1866961	.1699069
religion1	-.1944998	.4029619	-0.48	0.629	-.9844122	.5954126
religion2	-.2955306	.2997882	-0.99	0.324	-.8831952	.2921341
religion4	.1007088	.6962091	0.14	0.885	-1.264046	1.465464
geozone1	.2972927	.3766113	0.79	0.430	-.4409657	1.035551
geozone2	.9392455	.8670323	1.08	0.279	-.7603685	2.638859
geozone3	-.0646253	.5787284	-0.11	0.911	-1.199087	1.069836
geozone4	.0723544	.453441	0.16	0.873	-.8165106	.9612194
geozone5	-.4400499	.4268824	-1.03	0.303	-1.276853	.3967531
age	1.719707	1.000103	1.72	0.086	-.2407604	3.680174

age2	-.0235443	.0136052	-1.73	0.084	-.0502142	.0031256
lnhhs	2.303974	.0911565	25.27	0.000	2.125283	2.482665
firstdevage	.0944809	.032826	2.88	0.004	.0301332	.1588287
firstdevage2	-.0024831	.0006447	-3.85	0.000	-.0037469	-.0012194
contrause1	.4664768	.1171357	3.98	0.000	.2368596	.6960941
costcontra	-.0000933	.000092	-1.01	0.311	-.0002736	.000087
educatn2	.1781147	.1433326	1.24	0.214	-.1028553	.4590847
educatn3	-.2383778	.2789417	-0.85	0.393	-.7851777	.3084221
educatn4	-.8003243	1.193776	-0.67	0.503	-3.140442	1.539793
lnpcexpd	.0027811	.0057659	0.48	0.630	-.0085216	.0140838
_cons	-35.10275	18.42905	-1.90	0.057	-71.22859	1.023084

-> Agegroup = 40 - 44

Linear regression Number of obs = 5978

F(27, 5950) = 58.83

Prob > F = 0.0000

R-squared = 0.2254

Root MSE = 2.0939

nchildren	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
nchildeath~F	2.550676	1.171259	2.18	0.029	.2545832	4.846769
pformal1hatF	1.187531	.754585	1.57	0.116	-.2917292	2.666791
pinformal~tF	-5.574268	1.065323	-5.23	0.000	-7.662688	-3.485848
polaforce~tF	2.160098	1.744414	1.24	0.216	-1.259587	5.579782
marital1	1.411896	.6827706	2.07	0.039	.0734176	2.750374
marital2	1.012945	1.101652	0.92	0.358	-1.146693	3.172582
marital3	.7314786	.5887143	1.24	0.214	-.422615	1.885572
residence1	.7419922	.1528404	4.85	0.000	.4423697	1.041615
religion1	1.24656	.7091515	1.76	0.079	-.1436343	2.636754
religion2	2.729517	.5880252	4.64	0.000	1.576774	3.88226
religion4	2.262598	1.086528	2.08	0.037	.1326092	4.392587

geozone1	-3.005959	.7409853	-4.06	0.000	-4.458559	-1.553359
geozone2	-5.357761	1.698311	-3.15	0.002	-8.687067	-2.028455
geozone3	-4.47524	1.084993	-4.12	0.000	-6.60222	-2.34826
geozone4	-4.63158	.8325923	-5.56	0.000	-6.263763	-2.999398
geozone5	-3.410384	.6397307	-5.33	0.000	-4.664488	-2.15628
age	2.718723	1.560682	1.74	0.082	-.3407798	5.778225
age2	-.0324151	.0187203	-1.73	0.083	-.0691136	.0042835
lnhhs	1.989885	.115669	17.20	0.000	1.763132	2.216638
firstdevage	.0802527	.0424891	1.89	0.059	-.0030412	.1635467
firstdevage2	-.0035012	.0007504	-4.67	0.000	-.0049721	-.0020302
contrause1	-.2332457	.2133057	-1.09	0.274	-.6514022	.1849108
costcontra	.0000959	.0001523	0.63	0.529	-.0002026	.0003945
educatn2	1.166633	.2511481	4.65	0.000	.6742918	1.658975
educatn3	1.243534	.49993	2.49	0.013	.26349	2.223578
educatn4	-4.786607	1.698724	-2.82	0.005	-8.116721	-1.456492
lnpcexpd	.0035481	.0095568	0.37	0.710	-.0151867	.0222829

_cons | -52.40776 32.48814 -1.61 0.107 -116.0963 11.28078

-> Agegroup = 45 - 49

Linear regression Number of obs = 4596

F(27, 4568) = 42.65

Prob > F = 0.0000

R-squared = 0.1943

Root MSE = 2.0982

| Robust

nchildren | Coef. Std. Err. t P>|t| [95% Conf. Interval]

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nchildeath~F | 6.734661 1.28324 5.25 0.000 4.21889 9.250433

pformal1hatF | .0959695 .8390827 0.11 0.909 -1.549038 1.740977

pinformal~tF | -1.329499 .9597043 -1.39 0.166 -3.210983 .5519859

polaforce~tF	1.281909	1.615875	0.79	0.428	-1.885987	4.449805
marital1	1.212058	.6599116	1.84	0.066	-.0816882	2.505804
marital2	.9319731	1.055682	0.88	0.377	-1.137674	3.00162
marital3	1.783882	.5295777	3.37	0.001	.7456533	2.82211
residence1	.3973263	.1461984	2.72	0.007	.1107068	.6839458
religion1	.2253676	.6533603	0.34	0.730	-1.055534	1.50627
religion2	.1665098	.4896501	0.34	0.734	-.7934411	1.126461
religion4	1.172818	1.025316	1.14	0.253	-.8372971	3.182934
geozone1	-1.162661	.6514085	-1.78	0.074	-2.439737	.1144143
geozone2	-3.082654	1.490177	-2.07	0.039	-6.004121	-.1611861
geozone3	-3.175745	1.007516	-3.15	0.002	-5.150963	-1.200527
geozone4	-2.015485	.789403	-2.55	0.011	-3.563097	-.4678739
geozone5	-1.407832	.7251092	-1.94	0.052	-2.829397	.0137323
age	-.2344825	1.998762	-0.12	0.907	-4.153022	3.684057
age2	.0031815	.0213727	0.15	0.882	-.0387193	.0450823
lnhhs	2.266307	.1316579	17.21	0.000	2.008194	2.524421

firstdevage	.1106783	.0487466	2.27	0.023	.0151113	.2062452
firstdevage2	-.0020924	.0008187	-2.56	0.011	-.0036975	-.0004874
contrause1	.3304612	.2022424	1.63	0.102	-.0660317	.7269541
costcontra	.0001248	.0001495	0.83	0.404	-.0001683	.000418
educatn2	.6851565	.2368266	2.89	0.004	.2208618	1.149451
educatn3	.4878024	.4519983	1.08	0.281	-.3983329	1.373938
educatn4	-.0823278	1.947857	-0.04	0.966	-3.901069	3.736414
lnpcexpd	-.0094685	.0094618	-1.00	0.317	-.0280182	.0090811
_cons	1.659233	46.64975	0.04	0.972	-89.79684	93.1153

.

end of do-file

. do "C:\DOCUME~1\Ovi\LOCALS~1\Temp\STD0k000000.tmp"

. *CALCULATING REPLACEMENT RATE

. *Using OLS estimator

. regress nchildren nchildeath

```
      Source |       SS       df       MS              Number of obs =   41575
-------------+------------------------------           F(  1, 41573) =10783.74
       Model |  40165.4043     1  40165.4043           Prob > F      =  0.0000
    Residual |  154843.856 41573  3.72462551           R-squared     =  0.2060
-------------+------------------------------           Adj R-squared =  0.2059
       Total |  195009.261 41574  4.69065427           Root MSE      =  1.9299

------------------------------------------------------------------------------
   nchildren |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 nchildeath |   .9008173   .0086746   103.84   0.000     .8838148    .9178198
       _cons |   3.399563    .010104   336.46   0.000     3.379759    3.419368
------------------------------------------------------------------------------

. bysort sector: regress nchildren nchildeath

------------------------------------------------------------------------------
```

```
-> sector = URBAN

      Source |       SS       df       MS              Number of obs =    9798

-------------+------------------------------           F(  1,  9796) = 1993.73

       Model |  6979.53577     1  6979.53577           Prob > F      =  0.0000

    Residual |  34293.3432  9796  3.50074961           R-squared     =  0.1691

-------------+------------------------------           Adj R-squared =  0.1690

       Total |   41272.879  9797   4.2128079           Root MSE      =   1.871
------------------------------------------------------------------------------

  nchildren |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]

-------------+----------------------------------------------------------------

 nchildeath |   .9135714   .0204602    44.65   0.000     .8734652    .9536776

       _cons |    3.32508   .0198819   167.24   0.000     3.286108    3.364053

------------------------------------------------------------------------------



-------------------------------------------------------------------------------

-> sector = RURAL

      Source |       SS       df       MS              Number of obs =   31777
```

```
-------------+------------------------------           F(  1, 31775) = 8675.88

       Model |  32897.1172     1  32897.1172           Prob > F      =  0.0000

    Residual |   120484.18 31775  3.79179166           R-squared     =  0.2145

-------------+------------------------------           Adj R-squared =  0.2145

       Total |  153381.297 31776  4.82695422           Root MSE      =  1.9473
------------------------------------------------------------------------------

  nchildren |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]

-------------+----------------------------------------------------------------

 nchildeath |   .8958659    .009618    93.14   0.000     .8770142    .9147177

      _cons |   3.423525   .0117161   292.21   0.000     3.400561    3.446489

------------------------------------------------------------------------------



. bysort Zone: regress nchildren nchildeath
-------------------------------------------------------------------------------

-> Zone = North Cent



     Source |       SS       df       MS              Number of obs =    7516
```

```
-------------+------------------------------           F(  1,  7514) = 1457.23

       Model |  5127.64445     1  5127.64445           Prob > F      =  0.0000

    Residual |  26439.9291  7514  3.51875554           R-squared     =  0.1624

-------------+------------------------------           Adj R-squared =  0.1623

       Total |  31567.5736  7515  4.20060859           Root MSE      =  1.8758
------------------------------------------------------------------------------

  nchildren |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]

-------------+----------------------------------------------------------------
 nchildeath |   .9672467    .025338    38.17   0.000     .9175771    1.016916

      _cons |   3.349419   .0229127   146.18   0.000     3.304504    3.394335

------------------------------------------------------------------------------




------------------------------------------------------------------------------

-> Zone = North East



      Source |       SS       df       MS              Number of obs =    7364

-------------+------------------------------           F(  1,  7362) = 1909.80
```

```
     Model |  7665.15875     1  7665.15875           Prob > F      =  0.0000

  Residual |   29548.129  7362  4.01360079           R-squared     =  0.2060

-------------+------------------------------           Adj R-squared =  0.2059

     Total |  37213.2878  7363  5.05409313           Root MSE      =  2.0034

------------------------------------------------------------------------------

  nchildren |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 nchildeath |   .8931207    .020437    43.70   0.000     .8530584     .933183

      _cons |   3.536995   .0251713   140.52   0.000     3.487652    3.586337

------------------------------------------------------------------------------




-------------------------------------------------------------------------------

-> Zone = North West



     Source |       SS       df       MS              Number of obs =   12473

-------------+------------------------------           F(  1, 12471) = 4184.91

     Model |  17058.9255     1  17058.9255           Prob > F      =  0.0000
```

```
    Residual |  50835.5063 12471  4.07629752           R-squared     =  0.2513

-------------+------------------------------           Adj R-squared =  0.2512

       Total |  67894.4318 12472  5.44374854           Root MSE      =   2.019

------------------------------------------------------------------------------
  nchildren |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------

 nchildeath |   .8786749   .0135827    64.69   0.000     .8520508     .905299

       _cons |   3.392324   .0196409   172.72   0.000     3.353825    3.430824

------------------------------------------------------------------------------




-------------------------------------------------------------------------------

-> Zone = South East



      Source |       SS       df       MS              Number of obs =    3708

-------------+------------------------------           F(  1,  3706) =  710.46

       Model |  2580.66937     1  2580.66937           Prob > F      =  0.0000

    Residual |  13461.6629  3706  3.63239689           R-squared     =  0.1609

-------------+------------------------------           Adj R-squared =  0.1606
```

```
       Total |  16042.3323  3707  4.32757816           Root MSE      =  1.9059

------------------------------------------------------------------------------
   nchildren |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------

  nchildeath |   .8780049   .0329403    26.65   0.000      .813422    .9425877

       _cons |    3.61785   .0336043   107.66   0.000     3.551965    3.683735

------------------------------------------------------------------------------



------------------------------------------------------------------------------

-> Zone = South Sout

      Source |       SS       df       MS              Number of obs =    4954

-------------+------------------------------           F(  1,  4952) = 1131.75

       Model |  4579.08454     1  4579.08454           Prob > F      =  0.0000

    Residual |  20035.9338  4952  4.04602864           R-squared     =  0.1860

-------------+------------------------------           Adj R-squared =  0.1859

       Total |  24615.0184  4953  4.96971903           Root MSE      =  2.0115
------------------------------------------------------------------------------
```

```
  nchildren |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]

-------------+----------------------------------------------------------------

 nchildeath |   .8891083   .0264289    33.64   0.000     .8372959    .9409208

      _cons |   3.463715   .0303801   114.01   0.000     3.404156    3.523273

------------------------------------------------------------------------------




------------------------------------------------------------------------------

-> Zone = South West

     Source |       SS       df       MS              Number of obs =    5560

-------------+------------------------------           F(  1,  5558) =  776.96

      Model |  1916.25246     1  1916.25246           Prob > F      =  0.0000

   Residual |  13707.9914  5558  2.46635326           R-squared     =  0.1226

-------------+------------------------------           Adj R-squared =  0.1225

      Total |  15624.2439  5559  2.81062131           Root MSE      =  1.5705

------------------------------------------------------------------------------
  nchildren |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]

-------------+----------------------------------------------------------------
```

```
 nchildeath |   .8868822   .0318176    27.87   0.000     .8245073    .9492571

      _cons |   3.117013   .0217662   143.20   0.000     3.074343    3.159683

------------------------------------------------------------------------------

.

. *Using IV estimator

. ivregress 2sls nchildren (nchildeath = mortrate)



Instrumental variables (2SLS) regression               Number of obs =   41575

                                                       Wald chi2(1)  = 2319.13

                                                       Prob > chi2   =  0.0000

                                                       R-squared     =  0.1694

                                                       Root MSE      =  1.9738
------------------------------------------------------------------------------
  nchildren |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------

 nchildeath |   .5213458   .0108259    48.16   0.000     .5001275    .5425641

      _cons |   3.554245   .0106387   334.09   0.000     3.533394    3.575097

------------------------------------------------------------------------------
```

Instrumented: nchildeath

Instruments: mortrate

. bysort sector: ivregress 2sls nchildren (nchildeath = mortrate)

-> sector = URBAN

Instrumental variables (2SLS) regression Number of obs = 9798

Wald chi2(1) = 379.75

Prob > chi2 = 0.0000

R-squared = 0.1349

Root MSE = 1.909

----

nchildren	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
nchildeath	.5026474	.0257939	19.49	0.000	.4520923	.5532024
_cons	3.448886	.0207924	165.87	0.000	3.408134	3.489638

Instrumented: nchildeath

Instruments: mortrate

-> sector = RURAL

Instrumental variables (2SLS) regression Number of obs = 31777

Wald chi2(1) = 1890.80

Prob > chi2 = 0.0000

R-squared = 0.1769

Root MSE = 1.9932

----

nchildren	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
nchildeath	.5211086	.0119841	43.48	0.000	.4976202	.544597
_cons	3.588573	.0123643	290.24	0.000	3.564339	3.612807

Instrumented: nchildeath

Instruments: mortrate

. bysort Zone: ivregress 2sls nchildren (nchildeath = mortrate)

-> Zone = North Cent

Instrumental variables (2SLS) regression Number of obs = 7516

Wald chi2(1) = 292.98

Prob > chi2 = 0.0000

R-squared = 0.1294

Root MSE = 1.9122

----

nchildren	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
nchildeath	.5313127	.0310407	17.12	0.000	.4704741	.5921514
_cons	3.479109	.0239115	145.50	0.000	3.432244	3.525975

Instrumented: nchildeath

Instruments: mortrate

-> Zone = North East

Instrumental variables (2SLS) regression   Number of obs =   7364

Wald chi2(1) = 406.12

Prob > chi2   = 0.0000

R-squared   = 0.1681

Root MSE   = 2.0503

----

nchildren	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
nchildeath	.510265	.0253203	20.15	0.000	.4606382	.5598918
_cons	3.713293	.0265857	139.67	0.000	3.661186	3.7654

Instrumented: nchildeath

Instruments: mortrate

-> Zone = North West

Instrumental variables (2SLS) regression   Number of obs =   12473

Wald chi2(1) = 1087.42

Prob > chi2   = 0.0000

R-squared   = 0.2164

Root MSE   = 2.0652

----

nchildren	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
nchildeath	.5515655	.0167263	32.98	0.000	.5187827	.5843484
_cons	3.57724	.0207692	172.24	0.000	3.536533	3.617947

Instrumented: nchildeath

Instruments: mortrate

-> Zone = South East

Instrumental variables (2SLS) regression Number of obs = 3708

Wald chi2(1) = 71.96

Prob > chi2 = 0.0000

R-squared = 0.1057

Root MSE = 1.967

----

nchildren	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
nchildeath	.3637127	.0428744	8.48	0.000	.2796804	.4477449
_cons	3.808837	.0360137	105.76	0.000	3.738252	3.879423

Instrumented: nchildeath

Instruments: mortrate

```
------------------------------------------------------------------------------

-> Zone = South Sout

Instrumental variables (2SLS) regression              Number of obs =    4954

                                                      Wald chi2(1)  =  154.73

                                                      Prob > chi2   =  0.0000

                                                      R-squared     =  0.1361

                                                      Root MSE      =  2.0718
------------------------------------------------------------------------------

   nchildren |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]

-------------+----------------------------------------------------------------

 nchildeath |   .4284117   .0344406    12.44   0.000     .3609094    .4959139

       _cons |   3.643381   .0323556   112.60   0.000     3.579965    3.706797

------------------------------------------------------------------------------

Instrumented:  nchildeath

Instruments:   mortrate
```

```
------------------------------------------------------------------------------

-> Zone = South West

Instrumental variables (2SLS) regression          Number of obs =    5560

                                                  Wald chi2(1)  =  110.46

                                                  Prob > chi2   =  0.0000

                                                  R-squared     =  0.0903

                                                  Root MSE      =  1.5988
------------------------------------------------------------------------------

  nchildren |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]

-------------+----------------------------------------------------------------

 nchildeath |   .4317444   .0410787    10.51   0.000     .3512316    .5122571

      _cons |   3.195598   .0225845   141.49   0.000     3.151333    3.239863

------------------------------------------------------------------------------

Instrumented:  nchildeath
Instruments:   mortrate


end of do-file

 *Second stage regression
```

```
. *Determinants of child mortality

. regress nchildeath nchildrenhatM pformal1 pinformal1hatM polaforce2hatM age a

> ge2 marital1 marital2 marital3 lnhhs residence1 uvaccine1 uvaccine2 cvaccine

> dplace1 birthwgt pcare1 pcare2 pcare3 cprecare cposcare educatn2 educatn3 edu

> catn4 mosqnet1 costelect drwater1 drwater2 drwater4 toilettyp1 toilettyp2 dho

> sp1 dhosp2 dclinic1 dclinic2 lnpcexpd geozone1 geozone2 geozone3 geozone4 geo

> zone5, robust


Linear regression                Number of obs =   40382

                                 F( 41, 40340) =   33.32

                                 Prob > F      =  0.0000

                                 R-squared     =  0.0358

                                 Root MSE      =  1.0692
------------------------------------------------------------------------------
             |               Robust
  nchildeath |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------

nchildrenh~M |   .0974927   .1450957     0.67   0.502    -.1868983    .3818836
```

pformal1	-.0503287	.0212667	-2.37	0.018	-.092012	-.0086454
pinformal~tM	-.2948973	.4616824	-0.64	0.523	-1.199805	.6100107
polaforce~tM	-.1155015	.1993008	-0.58	0.562	-.5061357	.2751326
age	.0128984	.032122	0.40	0.688	-.0500614	.0758582
age2	-.0000977	.0002453	-0.40	0.691	-.0005785	.0003832
marital1	.0599306	.2167808	0.28	0.782	-.3649647	.484826
marital2	.1047632	.2826344	0.37	0.711	-.4492067	.6587332
marital3	-.1579441	.0971271	-1.63	0.104	-.3483153	.0324272
lnhhs	-.2573021	.2570061	-1.00	0.317	-.7610399	.2464357
residence1	.0675304	.1336423	0.51	0.613	-.1944117	.3294724
uvaccine1	.0567628	.0921066	0.62	0.538	-.1237682	.2372938
uvaccine2	-.0864903	.1960853	-0.44	0.659	-.4708218	.2978413
cvaccine	.0021857	.001676	1.30	0.192	-.0010993	.0054708
dplace1	-.0258661	.1015855	-0.25	0.799	-.224976	.1732437
birthwgt	-.0064707	.0055927	-1.16	0.247	-.0174326	.0044913
pcare1	.0147934	.0557453	0.27	0.791	-.0944686	.1240553

pcare2	.0146781	.0650207	0.23	0.821	-.112764	.1421202
pcare3	.0254964	.0296487	0.86	0.390	-.0326158	.0836086
cprecare	-.0000105	.0000101	-1.05	0.295	-.0000303	9.18e-06
cposcare	9.88e-06	.0000103	0.96	0.335	-.0000102	.00003
educatn2	-.1459679	.1521981	-0.96	0.338	-.4442796	.1523438
educatn3	-.097122	.0861256	-1.13	0.259	-.2659301	.0716862
educatn4	-.4252406	.520606	-0.82	0.414	-1.44564	.595159
mosqnet1	.0312872	.1175466	0.27	0.790	-.1991068	.2616813
costelect	7.76e-06	.0000139	0.56	0.577	-.0000195	.000035
drwater1	.029972	.0585505	0.51	0.609	-.0847883	.1447324
drwater2	.0463047	.0769739	0.60	0.547	-.1045658	.1971752
drwater4	.142995	.1289492	1.11	0.267	-.1097483	.3957384
toilettyp1	-.0238502	.0185456	-1.29	0.198	-.0602	.0124997
toilettyp2	.0016922	.0132676	0.13	0.899	-.0243127	.027697
dhosp1	.002741	.0670029	0.04	0.967	-.1285861	.1340682
dhosp2	-.020005	.03164	-0.63	0.527	-.0820201	.0420102
dclinic1	.1195705	.0853147	1.40	0.161	-.0476482	.2867893

```
dclinic2 |    .086471   .0572299     1.51   0.131    -.0257009    .1986429

lnpcexpd |   .0006749   .0012888     0.52   0.601    -.0018511     .003201

geozone1 |   .1139861   .0150778     7.56   0.000     .0844334    .1435389

geozone2 |   .2949287   .0201791    14.62   0.000     .2553772    .3344803

geozone3 |    .412038   .0206906    19.91   0.000      .371484     .452592

geozone4 |   .1523125   .0192036     7.93   0.000     .1146731    .1899519

geozone5 |   .2021272   .0188337    10.73   0.000     .1652127    .2390417

   _cons |  -.2661091   .5590229    -0.48   0.634    -1.361807    .8295884
------------------------------------------------------------------------------
.

end of do-file




. bysort sector: regress nchildeath nchildrenhatM pformal1 pinformal1hatM polaf

> orce2hatM age age2 marital1 marital2 marital3 lnhhs uvaccine1 uvaccine2 cvacc

> ine dplace1 birthwgt pcare1 pcare2 pcare3 cprecare cposcare educatn2 educatn3
```

```
>  educatn4 mosqnet1 costelect drwater1 drwater2 drwater4 toilettyp1 toilettyp2

>  dhosp1 dhosp2 dclinic1 dclinic2 lnpcexpd geozone1 geozone2 geozone3 geozone4

>  geozone5, robust
------------------------------------------------------------------------------

-> sector = URBAN


Linear regression                               Number of obs =    9550

                                                F( 40,  9509) =    7.42

                                                Prob > F      =  0.0000

                                                R-squared     =  0.0399

                                                Root MSE      =  .90285
------------------------------------------------------------------------------
             |               Robust
  nchildeath |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------

nchildrenh~M |  -.2003556   .2714736    -0.74   0.461    -.7325018    .3317906

    pformal1 |   -.042428    .025179    -1.69   0.092    -.0917842    .0069282

pinformal~tM |  -3.523575    1.49816    -2.35   0.019    -6.460288   -.5868627

polaforce~tM |  -1.551711   .6449341    -2.41   0.016     -2.81592   -.2875026

         age |   .0751719   .0650168     1.16   0.248    -.0522748    .2026186
```

age2	-.00101	.0006385	-1.58	0.114	-.0022616	.0002416
marital1	1.177208	.5253766	2.24	0.025	.1473573	2.207058
marital2	1.872031	.658653	2.84	0.004	.5809309	3.163132
marital3	-.731713	.3136047	-2.33	0.020	-1.346445	-.1169807
lnhhs	.1133721	.4396016	0.26	0.796	-.7483408	.9750851
uvaccine1	-.1651164	.1646557	-1.00	0.316	-.4878768	.1576439
uvaccine2	1.48288	1.303339	1.14	0.255	-1.071942	4.037703
cvaccine	.0049433	.0023003	2.15	0.032	.0004342	.0094524
dplace1	-.4260467	.1940617	-2.20	0.028	-.806449	-.0456444
birthwgt	.0110246	.0166436	0.66	0.508	-.0216004	.0436496
pcare1	.0476282	.0903055	0.53	0.598	-.1293899	.2246463
pcare2	.2438124	.1516209	1.61	0.108	-.0533968	.5410217
pcare3	.044283	.0474356	0.93	0.351	-.0487009	.1372669
cprecare	-.000091	.0000357	-2.55	0.011	-.000161	-.0000211
cposcare	-.0000329	.0000222	-1.48	0.138	-.0000764	.0000106
educatn2	-1.123471	.4566745	-2.46	0.014	-2.01865	-.2282911

educatn3	-.8138416	.316705	-2.57	0.010	-1.434651	-.1930322
educatn4	-4.337113	1.790871	-2.42	0.015	-7.847603	-.8266222
mosqnet1	.7003204	.3151233	2.22	0.026	.0826114	1.318029
costelect	.000089	.0000379	2.35	0.019	.0000147	.0001632
drwater1	.338035	.1744766	1.94	0.053	-.0039763	.6800464
drwater2	.4605494	.2237851	2.06	0.040	.0218828	.899216
drwater4	.7805722	.3275657	2.38	0.017	.1384735	1.422671
toilettyp1	-.0252946	.0280257	-0.90	0.367	-.080231	.0296419
toilettyp2	-.0123887	.026966	-0.46	0.646	-.0652477	.0404704
dhosp1	.4038225	.1868733	2.16	0.031	.0375109	.7701341
dhosp2	.0795928	.0709302	1.12	0.262	-.0594455	.218631
dclinic1	.6391413	.2759902	2.32	0.021	.0981416	1.180141
dclinic2	.4366381	.1826159	2.39	0.017	.0786719	.7946043
lnpcexpd	.0039203	.002925	1.34	0.180	-.0018133	.0096539
geozone1	.0831023	.0242247	3.43	0.001	.0356167	.1305878
geozone2	.3432687	.0505815	6.79	0.000	.2441183	.4424192

geozone3 | .3270753 .0391642 8.35 0.000 .2503052 .4038454

geozone4 | .1134428 .0293287 3.87 0.000 .0559523 .1709332

geozone5 | .0844931 .0276746 3.05 0.002 .030245 .1387412

_cons | -2.496681 1.483501 -1.68 0.092 -5.40466 .4112973

-

> sector = RURAL

Linear regression Number of obs = 30832

F(40, 30791) = 25.21

Prob > F = 0.0000

R-squared = 0.0340

Root MSE = 1.1148

| Robust

nchildeath | Coef. Std. Err. t P>|t| [95% Conf. Interval]

-------------+--

nchildrenh~M |	.1427427	.1717367	0.83	0.406	-.1938684	.4793537
pformal1 |	-.0540111	.0314856	-1.72	0.086	-.1157242	.0077021
pinformal~tM |	-.2604474	.4895596	-0.53	0.595	-1.220004	.6991096
polaforce~tM |	-.0877967	.2114811	-0.42	0.678	-.5023083	.326715
age |	.0043895	.0377832	0.12	0.908	-.0696672	.0784462
age2 |	-.0000139	.0002808	-0.05	0.960	-.0005644	.0005365
marital1 |	.0535157	.2450307	0.22	0.827	-.4267546	.5337859
marital2 |	-.1206823	.3156438	-0.38	0.702	-.7393571	.4979926
marital3 |	-.1539752	.1061753	-1.45	0.147	-.3620832	.0541327
lnhhs |	-.3428639	.3053712	-1.12	0.262	-.941404	.2556761
uvaccine1 |	.0645628	.1084711	0.60	0.552	-.148045	.2771706
uvaccine2 |	-.2663315	.0849034	-3.14	0.002	-.4327457	-.0999173
cvaccine |	.0024994	.0019792	1.26	0.207	-.0013799	.0063787
dplace1 |	-.0185797	.1217659	-0.15	0.879	-.2572458	.2200865
birthwgt |	-.0060742	.0065345	-0.93	0.353	-.0188822	.0067338
pcare1 |	-.0067411	.0666625	-0.10	0.919	-.1374024	.1239201

pcare2	.0106292	.0764767	0.14	0.889	-.1392682	.1605267
pcare3	.0155928	.0370381	0.42	0.674	-.0570034	.0881891
cprecare	-2.92e-06	.0000111	-0.26	0.793	-.0000247	.0000188
cposcare	9.08e-06	.0000118	0.77	0.441	-.000014	.0000322
educatn2	-.1414065	.1648064	-0.86	0.391	-.4644338	.1816207
educatn3	-.0701857	.0883505	-0.79	0.427	-.2433563	.102985
educatn4	-.347213	.5443288	-0.64	0.524	-1.41412	.7196939
mosqnet1	.0208698	.1303124	0.16	0.873	-.2345479	.2762874
costelect	3.57e-06	.000014	0.26	0.799	-.0000238	.000031
drwater1	.0506188	.0656048	0.77	0.440	-.0779692	.1792069
drwater2	.0549365	.0837779	0.66	0.512	-.1092716	.2191446
drwater4	.0683662	.1554643	0.44	0.660	-.2363501	.3730826
toilettyp1	-.0259423	.0257826	-1.01	0.314	-.0764773	.0245927
toilettyp2	-.0027571	.0151369	-0.18	0.855	-.032426	.0269119
dhosp1	-.0072337	.0737967	-0.10	0.922	-.1518783	.137411
dhosp2	-.0128347	.0358306	-0.36	0.720	-.0830641	.0573947

```
    dclinic1 |   .1214515   .0906683     1.34   0.180    -.0562622    .2991652

    dclinic2 |   .0812163   .0609808     1.33   0.183    -.0383085    .2007411

    lnpcexpd |   .0011365   .0015052     0.76   0.450    -.0018137    .0040867

    geozone1 |   .1645041    .019274     8.54   0.000     .1267263    .2022819

    geozone2 |   .3369808   .0231721    14.54   0.000     .2915624    .3823991

    geozone3 |   .4703533   .0246632    19.07   0.000     .4220125    .5186941

    geozone4 |   .1955002   .0248668     7.86   0.000     .1467603    .2442401

    geozone5 |   .2738798   .0243623    11.24   0.000     .2261287    .3216309

       _cons |  -.1347351   .6115958    -0.22   0.826    -1.333488    1.064018

------------------------------------------------------------------------------


end of do-file

.. *Child mortality interaction model

. regress nchildeath educmfertility2 educmfertility3 educmfertility4 educmpform

> al2 educmpformal3 educmpformal4 educmpinformal2 educmpinformal3 educmpinforma

> l4 educmpolaforce2 educmpolaforce3 educmpolaforce4 age age2 marital1 marital2

>  marital3 lnhhs residence1 uvaccine1 uvaccine2 cvaccine dplace1 birthwgt pcar
```

```
> e1 pcare2 pcare3 cprecare cposcare educatn2 educatn3 educatn4 mosqnet1 costel
> ect drwater1 drwater2 drwater4 toilettyp1 toilettyp2 dhosp1 dhosp2 dclinic1 d
> clinic2 lnpcexpd geozone1 geozone2 geozone3 geozone4 geozone5, robust

Linear regression                          Number of obs =   40382
                                           F( 49, 40332) =   29.00
                                           Prob > F      =  0.0000
                                           R-squared     =  0.0366
                                           Root MSE      =  1.0689
------------------------------------------------------------------------------
             |               Robust
 nchildeath |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
educmferti~2 |   -.038652   .0106622    -3.63   0.000    -.0595501   -.0177538
educmferti~3 |  -.0328649   .0125393    -2.62   0.009    -.0574422   -.0082877
educmferti~4 |  -.0460206      .0165    -2.79   0.005    -.0783609   -.0136803
educmpform~2 |  -.0356858   .0530261    -0.67   0.501    -.1396182    .0682466
educmpform~3 |  -.0139436   .0403876    -0.35   0.730    -.0931043    .0652171
```

educmpform~4	-.0878978	.0337788	-2.60	0.009	-.1541049	-.0216906
educmpinfo~2	.0960275	.0494117	1.94	0.052	-.0008205	.1928755
educmpinfo~3	-.0123341	.0518158	-0.24	0.812	-.1138942	.0892261
educmpinfo~4	-.0149224	.0740344	-0.20	0.840	-.1600315	.1301867
educmpolaf~2	-.0153044	.0320005	-0.48	0.632	-.0780262	.0474174
educmpolaf~3	.0101726	.0320643	0.32	0.751	-.0526743	.0730194
educmpolaf~4	.0390492	.0407824	0.96	0.338	-.0408852	.1189836
age	.0331417	.0056502	5.87	0.000	.0220672	.0442163
age2	-.0001802	.0000865	-2.08	0.037	-.0003498	-.0000106
marital1	-.1171181	.0490101	-2.39	0.017	-.213179	-.0210571
marital2	-.1144025	.122476	-0.93	0.350	-.3544583	.1256533
marital3	-.1211758	.0550915	-2.20	0.028	-.2291565	-.0131952
lnhhs	-.0394878	.0178768	-2.21	0.027	-.0745268	-.0044488
residence1	-.0333856	.0173448	-1.92	0.054	-.0673818	.0006105
uvaccine1	.0957423	.0798273	1.20	0.230	-.060721	.2522056
uvaccine2	-.090722	.1954887	-0.46	0.643	-.4738843	.2924404
cvaccine	.0018912	.0015487	1.22	0.222	-.0011444	.0049267

dplace1	.0361848	.0921382	0.39	0.695	-.1444081	.2167778
birthwgt	-.0104768	.0025216	-4.15	0.000	-.0154192	-.0055344
pcare1	.0622021	.0174513	3.56	0.000	.027997	.0964071
pcare2	.0149898	.0549028	0.27	0.785	-.0926209	.1226006
pcare3	.0382738	.0208837	1.83	0.067	-.0026587	.0792063
cprecare	-7.64e-06	3.39e-06	-2.25	0.024	-.0000143	-9.86e-07
cposcare	.0000164	7.15e-06	2.29	0.022	2.37e-06	.0000304
educatn2	.0952226	.0537839	1.77	0.077	-.0101951	.2006403
educatn3	.0731104	.0417109	1.75	0.080	-.0086438	.1548646
educatn4	.1097706	.0822091	1.34	0.182	-.0513611	.2709023
mosqnet1	-.0684825	.0152957	-4.48	0.000	-.0984625	-.0385026
costelect	1.36e-06	8.43e-06	0.16	0.872	-.0000152	.0000179
drwater1	-.0122153	.0201531	-0.61	0.544	-.0517158	.0272852
drwater2	-.0142093	.0131792	-1.08	0.281	-.0400409	.0116223
drwater4	.0319894	.0436247	0.73	0.463	-.0535159	.1174947
toilettyp1	-.0176744	.0186914	-0.95	0.344	-.0543099	.0189611

toilettyp2	.0029466	.0132686	0.22	0.824	-.0230601	.0289533
dhosp1	-.0487666	.0191255	-2.55	0.011	-.086253	-.0112802
dhosp2	-.0471033	.0149666	-3.15	0.002	-.0764382	-.0177684
dclinic1	.0619204	.019034	3.25	0.001	.0246132	.0992275
dclinic2	.0480614	.0176404	2.72	0.006	.0134858	.082637
lnpcexpd	.0001196	.0010065	0.12	0.905	-.0018532	.0020924
geozone1	.118008	.01511	7.81	0.000	.088392	.1476239
geozone2	.3040368	.0198524	15.31	0.000	.2651257	.3429479
geozone3	.4240889	.0200899	21.11	0.000	.3847122	.4634656
geozone4	.1558523	.0192467	8.10	0.000	.1181284	.1935762
geozone5	.2034317	.0186321	10.92	0.000	.1669125	.239951
_cons	-.4979228	.0950681	-5.24	0.000	-.6842584	-.3115872

.

end of do-file

```
. do "C:\DOCUME~1\Ovi\LOCALS~1\Temp\STD0m000000.tmp"

. bysort Zone: regress nchildeath nchildrenhatM pformal1 pinformal1hatM polafor

> ce2hatM age age2 marital1 marital2 marital3 lnhhs residence1 uvaccine1 uvacci

> ne2 cvaccine dplace1 birthwgt pcare1 pcare2 pcare3 cprecare cposcare educatn2

>  educatn3 educatn4 mosqnet1 costelect drwater1 drwater2 drwater4 toilettyp1 t

> oilettyp2 dhosp1 dhosp2 dclinic1 dclinic2 lnpcexpd, robust

-------------------------------------------------------------------------------

-> Zone = North Cent

Linear regression                              Number of obs =    7378

                                               F( 36,  7341) =    7.71

                                               Prob > F      =  0.0000

                                               R-squared     =  0.0345

                                               Root MSE      =  .83115
------------------------------------------------------------------------------
             |               Robust
  nchildeath |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]

-------------+----------------------------------------------------------------

nchildrenh~M |   -.358083   .4613541    -0.78   0.438    -1.262469    .5463035
```

pformal1	-.1418168	.0317746	-4.46	0.000	-.204104	-.0795295
pinformal~tM	.1016133	.9880917	0.10	0.918	-1.83533	2.038557
polaforce~tM	.0079479	.42648	0.02	0.985	-.8280755	.8439712
age	.0940198	.0993475	0.95	0.344	-.1007299	.2887694
age2	-.000568	.0006706	-0.85	0.397	-.0018827	.0007466
marital1	-.2791733	.5875057	-0.48	0.635	-1.430853	.8725067
marital2	-.5528149	.71009	-0.78	0.436	-1.944795	.8391654
marital3	.0465056	.1625269	0.29	0.775	-.2720938	.365105
lnhhs	.5846456	.8275741	0.71	0.480	-1.037637	2.206929
residence1	-.0350077	.3036862	-0.12	0.908	-.6303198	.5603044
uvaccine1	-.2562963	.148317	-1.73	0.084	-.5470402	.0344476
uvaccine2	1.744851	1.17646	1.48	0.138	-.5613474	4.05105
cvaccine	.0020755	.0017671	1.17	0.240	-.0013886	.0055396
dplace1	-.1877452	.3113043	-0.60	0.546	-.797991	.4225006
birthwgt	.0710535	.0849019	0.84	0.403	-.0953786	.2374856
pcare1	.2373464	.1755025	1.35	0.176	-.1066889	.5813816

pcare2	.1026414	.1263777	0.81	0.417	-.1450951	.3503779
pcare3	.0857304	.0798682	1.07	0.283	-.0708341	.2422949
cprecare	.0000119	.0000244	0.49	0.627	-.000036	.0000597
cposcare	-4.80e-06	.0000296	-0.16	0.871	-.0000628	.0000532
educatn2	.0214684	.3603108	0.06	0.952	-.6848442	.7277811
educatn3	-.14915	.1428428	-1.04	0.296	-.4291628	.1308629
educatn4	-.1615814	1.015479	-0.16	0.874	-2.152211	1.829049
mosqnet1	-.1369741	.303937	-0.45	0.652	-.732778	.4588298
costelect	4.98e-06	.000028	0.18	0.859	-.00005	.00006
drwater1	-.0475204	.1302216	-0.36	0.715	-.3027921	.2077513
drwater2	-.0875437	.187906	-0.47	0.641	-.4558934	.280806
drwater4	-.2147261	.3377997	-0.64	0.525	-.8769105	.4474583
toilettyp1	-.0731956	.0334334	-2.19	0.029	-.1387347	-.0076566
toilettyp2	-.0141572	.0237598	-0.60	0.551	-.0607332	.0324189
dhosp1	-.1226759	.1600961	-0.77	0.444	-.4365102	.1911585
dhosp2	-.1229326	.0842679	-1.46	0.145	-.2881218	.0422567

```
    dclinic1 |   .0873234   .1782192     0.49   0.624    -.2620375    .4366842

    dclinic2 |   .0819711   .1210059     0.68   0.498    -.1552351    .3191774

   lnpcexpd |  -.0009677   .0025632    -0.38   0.706    -.0059922    .0040568

       _cons |  -1.405993    1.34755    -1.04   0.297    -4.047578    1.235591

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-> Zone = North East

Linear regression                                      Number of obs =    7086

                                                       F( 36,  7049) =    9.74

                                                       Prob > F      =  0.0000

                                                       R-squared     =  0.0361

                                                       Root MSE      =   1.121

------------------------------------------------------------------------------
             |               Robust
 nchildeath |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------

nchildrenh~M |  -.5333625   .4470161    -1.19   0.233    -1.409648    .3429234
```

pformal1	-.0206449	.0597721	-0.35	0.730	-.1378162	.0965263
pinformal~tM	.8193762	.7941616	1.03	0.302	-.7374193	2.376172
polaforce~tM	.4551652	.3433109	1.33	0.185	-.2178273	1.128158
age	.1612742	.0981288	1.64	0.100	-.0310877	.3536362
age2	-.0010691	.0006744	-1.59	0.113	-.0023912	.000253
marital1	-.9080528	.5612006	-1.62	0.106	-2.008175	.192069
marital2	-1.450835	.697603	-2.08	0.038	-2.818347	-.0833238
marital3	-.309444	.1944604	-1.59	0.112	-.6906448	.0717567
lnhhs	.8690079	.798184	1.09	0.276	-.6956727	2.433688
residence1	-.1748268	.2568957	-0.68	0.496	-.6784196	.3287659
uvaccine1	.6005883	.2397961	2.50	0.012	.1305158	1.070661
uvaccine2	-.4322894	.1072256	-4.03	0.000	-.6424839	-.2220949
cvaccine	-.0019978	.0011537	-1.73	0.083	-.0042595	.0002639
dplace1	.504898	.342621	1.47	0.141	-.166742	1.176538
birthwgt	-.0150773	.0629034	-0.24	0.811	-.1383868	.1082322
pcare1	.2326936	.1754301	1.33	0.185	-.1112022	.5765894

pcare2	.0337184	.1133122	0.30	0.766	-.1884076	.2558444
pcare3	.1184437	.0912411	1.30	0.194	-.0604163	.2973037
cprecare	-.0000106	.0000318	-0.33	0.739	-.000073	.0000518
cposcare	-4.42e-06	.0000441	-0.10	0.920	-.0000908	.000082
educatn2	.274228	.3084245	0.89	0.374	-.3303766	.8788326
educatn3	-.0550042	.10284	-0.53	0.593	-.2566015	.1465931
educatn4	.4940746	.7702912	0.64	0.521	-1.015928	2.004077
mosqnet1	-.4684015	.2754944	-1.70	0.089	-1.008453	.0716504
costelect	-.0000903	.0000273	-3.31	0.001	-.0001439	-.0000368
drwater1	-.0759593	.1175919	-0.65	0.518	-.3064748	.1545561
drwater2	-.1658843	.1613273	-1.03	0.304	-.4821343	.1503658
drwater4	-.1585863	.3371476	-0.47	0.638	-.8194969	.5023243
toilettyp1	.0344276	.0621284	0.55	0.580	-.0873626	.1562179
toilettyp2	.0694175	.0307409	2.26	0.024	.0091562	.1296789
dhosp1	-.2290672	.1457061	-1.57	0.116	-.5146949	.0565605
dhosp2	-.1370477	.0815261	-1.68	0.093	-.2968634	.022768
dclinic1	-.0972908	.1522207	-0.64	0.523	-.3956891	.2011075

```
    dclinic2 |  -.1029122   .1063088    -0.97   0.333    -.3113094     .105485

   lnpcexpd |  -.0006437   .0030096    -0.21   0.831    -.0065434     .005256

      _cons |  -1.520299   1.274181    -1.19   0.233    -4.018076    .9774784

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-> Zone = North West

Linear regression                               Number of obs =   12063

                                                F( 36, 12026) =    9.44

                                                Prob > F      =  0.0000

                                                R-squared     =  0.0293
                                                Root MSE      =  1.3146
------------------------------------------------------------------------------
             |               Robust
  nchildeath |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------

nchildrenh~M |   .3674101   .4833151     0.76   0.447    -.5799654    1.314786

    pformal1 |  -.1010601   .0528363    -1.91   0.056    -.2046277    .0025076

pinformal~tM |   .0246696   1.245946     0.02   0.984    -2.417586    2.466925

polaforce~tM |  -.0198713   .5361908    -0.04   0.970    -1.070892    1.031149
```

age |	-.0547945	.1057467	-0.52	0.604	-.2620751	.152486
age2 |	.0006417	.0007816	0.82	0.412	-.0008903	.0021737
marital1 |	.1568679	.6202135	0.25	0.800	-1.058851	1.372586
marital2 |	-.1736407	.761231	-0.23	0.820	-1.665776	1.318495
marital3 |	-.3375537	.2483789	-1.36	0.174	-.8244165	.1493091
lnhhs |	-.8021633	.8504371	-0.94	0.346	-2.469157	.8648306
residence1 |	-.0593537	.3629936	-0.16	0.870	-.7708798	.6521724
uvaccine1 |	-.0206246	.2057443	-0.10	0.920	-.4239166	.3826673
uvaccine2 |	-.2660797	.1228115	-2.17	0.030	-.5068101	-.0253493
cvaccine |	.0007666	.0031635	0.24	0.809	-.0054344	.0069676
dplace1 |	-.0346093	.2594148	-0.13	0.894	-.5431041	.4738855
birthwgt |	-.0016609	.016731	-0.10	0.921	-.0344563	.0311345
pcare1 |	-.1206359	.1778037	-0.68	0.497	-.4691598	.227888
pcare2 |	-.106764	.1621935	-0.66	0.510	-.4246893	.2111613
pcare3 |	.0642798	.0954538	0.67	0.501	-.1228251	.2513847
cprecare |	2.58e-07	.0000269	0.01	0.992	-.0000524	.0000529

cposcare	-.0000153	.0000397	-0.39	0.699	-.0000931	.0000624
educatn2	-.0727452	.4173853	-0.17	0.862	-.8908878	.7453974
educatn3	.0253971	.2322333	0.11	0.913	-.4298177	.4806118
educatn4	.0256824	1.389101	0.02	0.985	-2.697179	2.748544
mosqnet1	.042324	.330346	0.13	0.898	-.6052074	.6898554
costelect	1.35e-06	.0000309	0.04	0.965	-.0000593	.000062
drwater1	-.018926	.1567431	-0.12	0.904	-.3261678	.2883159
drwater2	.0159059	.2102259	0.08	0.940	-.3961709	.4279826
drwater4	.1449698	.6518381	0.22	0.824	-1.132738	1.422678
toilettyp1	.0216394	.0485564	0.45	0.656	-.0735389	.1168177
toilettyp2	.0149304	.0363916	0.41	0.682	-.0564029	.0862637
dhosp1	.0106478	.1843158	0.06	0.954	-.350641	.3719365
dhosp2	.028705	.0904766	0.32	0.751	-.1486438	.2060539
dclinic1	.066987	.2281921	0.29	0.769	-.3803063	.5142803
dclinic2	.0383274	.151614	0.25	0.800	-.2588605	.3355153
lnpcexpd	.0004864	.0032368	0.15	0.881	-.0058582	.0068309

_cons | 1.436635   1.752732   0.82   0.412   -1.999002   4.872272

-> Zone = South East

note: uvaccine2 omitted because of collinearity

Linear regression   Number of obs =   3601

F(35, 3565) =   2.82

Prob > F   = 0.0000

R-squared   = 0.0211

Root MSE   = .94407

| Robust

nchildeath | Coef.   Std. Err.   t   P>|t| [95% Conf. Interval]

-------------+--

nchildrenh~M | -.3325568   .2897582   -1.15   0.251   -.9006653   .2355516

pformal1 | -.1319723   .0473226   -2.79   0.005   -.2247545   -.0391902

pinformal~tM | -1.701201   3.23019   -0.53   0.598   -8.034406   4.632005

polaforce~tM	-.7490735	1.393025	-0.54	0.591	-3.480279	1.982132
age	.091891	.0706609	1.30	0.194	-.0466488	.2304308
age2	-.0008648	.0008479	-1.02	0.308	-.0025273	.0007977
marital1	.3181872	1.175777	0.27	0.787	-1.987077	2.623451
marital2	-.0071785	1.391718	-0.01	0.996	-2.735823	2.721466
marital3	-.5287681	.6620517	-0.80	0.425	-1.826806	.7692701
lnhhs	.4622369	.5008584	0.92	0.356	-.5197609	1.444235
residence1	.3342953	.8996687	0.37	0.710	-1.429622	2.098212
uvaccine1	-.0157412	.394163	-0.04	0.968	-.7885488	.7570664
uvaccine2	0 (omitted)					
cvaccine	.0057968	.0047262	1.23	0.220	-.0034695	.0150632
dplace1	.1863699	.5801099	0.32	0.748	-.9510107	1.323751
birthwgt	-.0390742	.141588	-0.28	0.783	-.3166759	.2385275
pcare1	.1286374	.1249487	1.03	0.303	-.1163406	.3736155
pcare2	.1247504	.2363755	0.53	0.598	-.3386943	.5881952
pcare3	.001817	.0574543	0.03	0.975	-.1108296	.1144636

cprecare	-.0000344	.0000706	-0.49	0.626	-.0001728	.000104
cposcare	-.0000377	.0000456	-0.83	0.408	-.000127	.0000516
educatn2	-.4148434	1.003754	-0.41	0.679	-2.382834	1.553147
educatn3	-.3381859	.6327133	-0.53	0.593	-1.578702	.9023305
educatn4	-2.094766	3.772914	-0.56	0.579	-9.492054	5.302522
mosqnet1	.1895157	.7130986	0.27	0.790	-1.208607	1.587638
costelect	.0000811	.0000833	0.97	0.331	-.0000823	.0002445
drwater1	.285434	.3807875	0.75	0.454	-.4611493	1.032017
drwater2	.3073959	.4944745	0.62	0.534	-.6620855	1.276877
drwater4	.2975475	.7373041	0.40	0.687	-1.148033	1.743128
toilettyp1	.1196864	.0634689	1.89	0.059	-.0047525	.2441254
toilettyp2	.0657252	.0418125	1.57	0.116	-.0162536	.147704
dhosp1	.149288	.4111484	0.36	0.717	-.6568217	.9553977
dhosp2	.0164745	.1477897	0.11	0.911	-.2732863	.3062353
dclinic1	.3722897	.5905542	0.63	0.528	-.7855682	1.530148
dclinic2	.2885664	.3841559	0.75	0.453	-.4646211	1.041754
lnpcexpd	.0007637	.0058003	0.13	0.895	-.0106085	.012136

_cons | -2.54906   2.790606   -0.91   0.361   -8.020405   2.922286

-> Zone = South Sout

Linear regression   Number of obs =   4789

F(36, 4752) =   5.27

Prob > F   = 0.0000

R-squared   = 0.0373

Root MSE   =   1.065

| Robust

nchildeath | Coef.   Std. Err.   t   P>|t| [95% Conf. Interval]

-------------+--

nchildrenh~M | -.0460263   .1588683   -0.29   0.772   -.3574818   .2654291

pformal1 | .0483625   .066516   0.73   0.467   -.0820396   .1787646

pinformal~tM | -.9776658   .9528717   -1.03   0.305   -2.845736   .8904043

polaforce~tM | -.4152107   .4129456   -1.01   0.315   -1.224775   .3943541

age | .0023875   .0388657   0.06   0.951   -.0738073   .0785824

age2 |	.0001309	.0003869	0.34	0.735	-.0006277	.0008895
marital1 |	.2536708	.378798	0.67	0.503	-.4889488	.9962905
marital2 |	.3230517	.5335518	0.61	0.545	-.722957	1.36906
marital3 |	-.0827741	.2030765	-0.41	0.684	-.4808982	.31535
lnhhs |	.0770705	.2859394	0.27	0.788	-.4835032	.6376441
residence1 |	.21862	.2699396	0.81	0.418	-.3105867	.7478268
uvaccine1 |	.1214752	.2214683	0.55	0.583	-.3127052	.5556556
uvaccine2 |	-.2318617	.0799877	-2.90	0.004	-.3886746	-.0750489
cvaccine |	-.00103	.0022126	-0.47	0.642	-.0053677	.0033078
dplace1 |	-.4781829	.139403	-3.43	0.001	-.7514773	-.2048884
birthwgt |	.0535426	.0596103	0.90	0.369	-.0633211	.1704063
pcare1 |	.0466947	.0760771	0.61	0.539	-.1024517	.1958412
pcare2 |	.2143979	.2022491	1.06	0.289	-.182104	.6108999
pcare3 |	.0671024	.0648312	1.04	0.301	-.0599969	.1942016
cprecare |	-.0000309	.000021	-1.47	0.142	-.000072	.0000103
cposcare |	.0000128	.000018	0.71	0.478	-.0000225	.000048
educatn2 |	-.3024084	.3045213	-0.99	0.321	-.8994113	.2945945

educatn3	-.2513579	.1904385	-1.32	0.187	-.6247056	.1219898
educatn4	-1.218047	1.107539	-1.10	0.271	-3.389336	.9532426
mosqnet1	.2016482	.2216031	0.91	0.363	-.2327967	.636093
costelect	7.23e-06	.0000286	0.25	0.800	-.0000488	.0000633
drwater1	.051425	.1195608	0.43	0.667	-.1829695	.2858195
drwater2	.1113454	.1524427	0.73	0.465	-.187513	.4102037
drwater4	.2575279	.2595909	0.99	0.321	-.2513906	.7664465
toilettyp1	-.2643439	.0516737	-5.12	0.000	-.3656484	-.1630395
toilettyp2	-.2143453	.0437213	-4.90	0.000	-.3000592	-.1286313
dhosp1	.0908503	.1351551	0.67	0.501	-.1741163	.355817
dhosp2	-.0419282	.0601358	-0.70	0.486	-.1598223	.0759658
dclinic1	.1024522	.1809122	0.57	0.571	-.2522195	.4571239
dclinic2	.1041237	.1234485	0.84	0.399	-.1378925	.34614
lnpcexpd	.0023274	.0032888	0.71	0.479	-.0041201	.0087749
_cons	-.3241933	.907212	-0.36	0.721	-2.102749	1.454362

-> Zone = South West

note: uvaccine2 omitted because of collinearity

Linear regression Number of obs = 5465

F(35, 5429) = 2.67

Prob > F = 0.0000

R-squared = 0.0161

Root MSE = .65992

nchildeath	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
nchildrenh~M	.7811405	.4589291	1.70	0.089	-.1185447	1.680826
pformal1	.0156851	.0292366	0.54	0.592	-.0416304	.0730007
pinformal~tM	.7081835	1.39898	0.51	0.613	-2.034377	3.450744
polaforce~tM	.2764817	.5998796	0.46	0.645	-.899523	1.452486
age	-.1835276	.110751	-1.66	0.098	-.4006441	.0335888
age2	.0016145	.0010305	1.57	0.117	-.0004057	.0036346
marital1	.2652934	.3448323	0.77	0.442	-.4107161	.9413029

marital2	.6956846	.4356352	1.60	0.110	-.1583352	1.549704
marital3	.330634	.3502079	0.94	0.345	-.355914	1.017182
lnhhs	-1.329682	.7233598	-1.84	0.066	-2.747757	.0883933
residence1	-.1067845	.3578775	-0.30	0.765	-.808368	.5947989
uvaccine1	-.1195558	.0965524	-1.24	0.216	-.3088372	.0697256
uvaccine2	0 (omitted)					
cvaccine	-.0029197	.0024943	-1.17	0.242	-.0078096	.0019701
dplace1	-.1179105	.0553985	-2.13	0.033	-.2265138	-.0093071
birthwgt	.0209631	.0130667	1.60	0.109	-.0046528	.046579
pcare1	-.2131301	.1389977	-1.53	0.125	-.4856214	.0593611
pcare2	-.2382701	.1914709	-1.24	0.213	-.6136298	.1370896
pcare3	-.099558	.069453	-1.43	0.152	-.2357137	.0365976
cprecare	.0000186	.0000407	0.46	0.647	-.0000611	.0000983
cposcare	.0000199	.0000171	1.17	0.244	-.0000136	.0000534
educatn2	.0778068	.3896686	0.20	0.842	-.6860998	.8417135
educatn3	.246517	.3546126	0.70	0.487	-.448666	.9417

educatn4 |	1.065084	1.795995	0.59	0.553	-2.455787	4.585956
mosqnet1 |	-.0093956	.2359229	-0.04	0.968	-.4718991	.453108
costelect |	-.0000206	.0000325	-0.63	0.527	-.0000842	.0000431
drwater1 |	-.0261841	.1556913	-0.17	0.866	-.3314015	.2790332
drwater2 |	-.0385632	.1827381	-0.21	0.833	-.3968031	.3196767
drwater4 |	.1245527	.2412845	0.52	0.606	-.3484616	.597567
toilettyp1 |	-.0152266	.0244639	-0.62	0.534	-.0631857	.0327325
toilettyp2 |	.0196341	.0236954	0.83	0.407	-.0268184	.0660866
dhosp1 |	-.0297468	.148313	-0.20	0.841	-.3204998	.2610061
dhosp2 |	.0470874	.0471732	1.00	0.318	-.045391	.1395658
dclinic1 |	-.079539	.2562829	-0.31	0.756	-.5819563	.4228783
dclinic2 |	-.0072424	.1646281	-0.04	0.965	-.3299795	.3154948
lnpcexpd |	-.0003546	.0027331	-0.13	0.897	-.0057126	.0050035
_cons |	3.556175	2.681359	1.33	0.185	-1.700363	8.812714

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end of do-file

```
. do "C:\DOCUME~1\Ovi\LOCALS~1\Temp\STD0m000000.tmp"

. *Determinants of child mortality using the mortality rate

. regress mortrate nchildrenhatM pformal1 pinformal1hatM polaforce2hatM age age

> 2 marital1 marital2 marital3 lnhhs residence1 uvaccine1 uvaccine2 cvaccine dp

> lace1 birthwgt pcare1 pcare2 pcare3 cprecare cposcare educatn2 educatn3 educa

> tn4 mosqnet1 costelect drwater1 drwater2 drwater4 toilettyp1 toilettyp2 dhosp

> 1 dhosp2 dclinic1 dclinic2 lnpcexpd geozone1 geozone2 geozone3 geozone4 geozo

> ne5, robust

Linear regression                Number of obs =   40382

                           F( 41, 40340) =   22.56

                           Prob > F      =  0.0000

                           R-squared     =  0.0224

                           Root MSE      =  .19901
------------------------------------------------------------------------------
             |               Robust

    mortrate |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------

nchildrenh~M |   -.000507   .0236501    -0.02   0.983    -.0468618    .0458477
```

pformal1	-.0108295	.0039822	-2.72	0.007	-.0186348	-.0030243
pinformal~tM	-.0594499	.1026203	-0.58	0.562	-.2605881	.1416883
polaforce~tM	-.0183158	.0442655	-0.41	0.679	-.1050771	.0684456
age	.005041	.0053185	0.95	0.343	-.0053834	.0154654
age2	-.0000569	.0000438	-1.30	0.194	-.0001429	.000029
marital1	-.0017731	.0435841	-0.04	0.968	-.0871989	.0836527
marital2	.0107615	.055855	0.19	0.847	-.0987155	.1202385
marital3	-.0377065	.0219669	-1.72	0.086	-.0807621	.0053491
lnhhs	-.0385553	.0417422	-0.92	0.356	-.120371	.0432604
residence1	.0120608	.0291062	0.41	0.679	-.044988	.0691096
uvaccine1	.0052194	.0183701	0.28	0.776	-.0307863	.0412252
uvaccine2	.0421949	.0571995	0.74	0.461	-.0699174	.1543073
cvaccine	.0002883	.0002543	1.13	0.257	-.0002101	.0007867
dplace1	-.0203735	.0194291	-1.05	0.294	-.058455	.017708
birthwgt	-.0014533	.0010867	-1.34	0.181	-.0035832	.0006766
pcare1	.0101461	.0093711	1.08	0.279	-.0082213	.0285136

pcare2	.0028677	.0127857	0.22	0.823	-.0221925	.0279279
pcare3	.0069266	.0056658	1.22	0.222	-.0041785	.0180317
cprecare	-2.18e-06	2.67e-06	-0.82	0.414	-7.42e-06	3.06e-06
cposcare	2.23e-06	2.30e-06	0.97	0.333	-2.28e-06	6.74e-06
educatn2	-.0275569	.0328749	-0.84	0.402	-.0919924	.0368786
educatn3	-.0212128	.0198467	-1.07	0.285	-.0601127	.0176871
educatn4	-.0842096	.1181177	-0.71	0.476	-.3157229	.1473037
mosqnet1	.003799	.024369	0.16	0.876	-.0439648	.0515628
costelect	5.97e-07	2.69e-06	0.22	0.824	-4.68e-06	5.87e-06
drwater1	.0081124	.0125454	0.65	0.518	-.0164769	.0327017
drwater2	.0105153	.0163814	0.64	0.521	-.0215927	.0426233
drwater4	.0351324	.0270362	1.30	0.194	-.0178591	.0881239
toilettyp1	-.002973	.0035414	-0.84	0.401	-.0099141	.0039681
toilettyp2	-.0010541	.0025139	-0.42	0.675	-.0059814	.0038732
dhosp1	-.0024911	.0140689	-0.18	0.859	-.0300664	.0250843
dhosp2	-.003884	.0060464	-0.64	0.521	-.0157351	.0079672

```
    dclinic1 |   .0231331   .0188935     1.22   0.221    -.0138987    .0601648

    dclinic2 |   .0165436   .0125295     1.32   0.187    -.0080144    .0411016

    lnpcexpd |   .0001892   .0002563     0.74   0.460    -.0003132    .0006917

    geozone1 |   .0202377   .0031885     6.35   0.000     .0139882    .0264871

    geozone2 |   .0482499    .003906    12.35   0.000     .0405941    .0559057

    geozone3 |   .0671658   .0038592    17.40   0.000     .0596017    .0747298

    geozone4 |   .0356326   .0039849     8.94   0.000      .027822    .0434431

    geozone5 |   .0385919   .0039163     9.85   0.000      .030916    .0462679

       _cons |  -.0102253   .1100503    -0.09   0.926    -.2259264    .2054757
------------------------------------------------------------------------------

. bysort sector: regress mortrate nchildrenhatM pformal1 pinformal1hatM polafor

> ce2hatM age age2 marital1 marital2 marital3 lnhhs uvaccine1 uvaccine2 cvaccin

> e dplace1 birthwgt pcare1 pcare2 pcare3 cprecare cposcare educatn2 educatn3 e

> ducatn4 mosqnet1 costelect drwater1 drwater2 drwater4 toilettyp1 toilettyp2 d

> hosp1 dhosp2 dclinic1 dclinic2 lnpcexpd geozone1 geozone2 geozone3 geozone4 g

> eozone5, robust
-------------------------------------------------------------------------------

-> sector = URBAN
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```
Linear regression                               Number of obs =    9550

                                          F( 40,  9509) =    5.53

                                          Prob > F      =  0.0000

                                          R-squared     =  0.0235

                                          Root MSE      =  .17925
------------------------------------------------------------------------------
             |               Robust
    mortrate |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------

nchildrenh~M |  -.0394155   .0491162    -0.80   0.422    -.1356937    .0568628

    pformal1 |  -.0098889   .0057988    -1.71   0.088    -.0212558    .0014781

pinformal~tM |  -.5944436   .2617927    -2.27   0.023    -1.107613    -.081274

polaforce~tM |  -.2562809   .1128609    -2.27   0.023    -.4775125   -.0350494

         age |   .0137977   .0117084     1.18   0.239    -.0091533    .0367487

        age2 |   -.000197   .0001147    -1.72   0.086    -.0004218    .0000278

    marital1 |   .1974273    .091592     2.16   0.031     .0178873    .3769672

    marital2 |   .3544266   .1180019     3.00   0.003     .1231177    .5857354

    marital3 |  -.1183441   .0556689    -2.13   0.034    -.2274671   -.0092212
```

lnhhs	.0071595	.0793578	0.09	0.928	-.1483988	.1627178
uvaccine1	-.0312441	.0327868	-0.95	0.341	-.0955133	.033025
uvaccine2	.1431545	.1480086	0.97	0.333	-.146974	.4332829
cvaccine	.0007928	.0004106	1.93	0.054	-.000012	.0015976
dplace1	-.1013147	.0328513	-3.08	0.002	-.1657102	-.0369191
birthwgt	.0057174	.0073198	0.78	0.435	-.0086309	.0200657
pcare1	.0138366	.0165594	0.84	0.403	-.0186233	.0462965
pcare2	.0284873	.0280132	1.02	0.309	-.0264246	.0833992
pcare3	.0012211	.0089275	0.14	0.891	-.0162788	.0187209
cprecare	-.0000164	6.36e-06	-2.58	0.010	-.0000289	-3.96e-06
cposcare	-3.79e-06	4.11e-06	-0.92	0.356	-.0000118	4.26e-06
educatn2	-.1908424	.0796021	-2.40	0.017	-.3468794	-.0348053
educatn3	-.1408624	.0559687	-2.52	0.012	-.2505729	-.0311518
educatn4	-.7286393	.3136332	-2.32	0.020	-1.343427	-.1138513
mosqnet1	.1141245	.0547341	2.09	0.037	.0068339	.2214151
costelect	.0000132	6.44e-06	2.04	0.041	5.29e-07	.0000258

drwater1	.0651572	.030583	2.13	0.033	.005208	.1251065
drwater2	.0824973	.0389266	2.12	0.034	.0061928	.1588018
drwater4	.1470518	.0572819	2.57	0.010	.034767	.2593367
toilettyp1	-.0038738	.0059796	-0.65	0.517	-.015595	.0078475
toilettyp2	-.0033263	.0055399	-0.60	0.548	-.0141858	.0075331
dhosp1	.0678541	.0325816	2.08	0.037	.0039872	.1317211
dhosp2	.0152203	.0126245	1.21	0.228	-.0095264	.0399671
dclinic1	.1190078	.0485609	2.45	0.014	.023818	.2141976
dclinic2	.0865949	.0322238	2.69	0.007	.0234295	.1497604
lnpcexpd	.0006626	.0005364	1.24	0.217	-.000389	.0017141
geozone1	.014428	.0054468	2.65	0.008	.0037511	.0251048
geozone2	.0460576	.0085435	5.39	0.000	.0293105	.0628047
geozone3	.050666	.0070159	7.22	0.000	.0369132	.0644187
geozone4	.0349044	.0071606	4.87	0.000	.0208681	.0489407
geozone5	.0246055	.0069419	3.54	0.000	.0109979	.038213
_cons	-.3785775	.2675771	-1.41	0.157	-.9030858	.1459308

-> sector = RURAL

Linear regression Number of obs = 30832

F(40, 30791) = 16.77

Prob > F = 0.0000

R-squared = 0.0210

Root MSE = .20465

| Robust

mortrate	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
nchildrenh~M	.0044485	.0271995	0.16	0.870	-.0488637	.0577608
pformal1	-.0117058	.0054074	-2.16	0.030	-.0223045	-.001107
pinformal~tM	-.0477484	.1065069	-0.45	0.654	-.2565063	.1610095
polaforce~tM	-.0107231	.0459866	-0.23	0.816	-.1008588	.0794125
age	.0042421	.006077	0.70	0.485	-.007669	.0161532
age2	-.0000487	.0000485	-1.01	0.315	-.0001438	.0000463

marital1	-.0100681	.0475672	-0.21	0.832	-.1033018	.0831656
marital2	-.0525245	.0588209	-0.89	0.372	-.1678158	.0627668
marital3	-.0419877	.0237521	-1.77	0.077	-.0885428	.0045674
lnhhs	-.0488339	.0482756	-1.01	0.312	-.143456	.0457882
uvaccine1	.0081858	.0218591	0.37	0.708	-.0346588	.0510305
uvaccine2	.0322356	.0612581	0.53	0.599	-.0878327	.152304
cvaccine	.00032	.0002907	1.10	0.271	-.0002498	.0008898
dplace1	-.0164238	.0226895	-0.72	0.469	-.0608961	.0280484
birthwgt	-.0017555	.0011337	-1.55	0.122	-.0039775	.0004665
pcare1	.006457	.0109561	0.59	0.556	-.0150174	.0279314
pcare2	.0065954	.014773	0.45	0.655	-.0223603	.0355512
pcare3	.0103957	.0072681	1.43	0.153	-.0038499	.0246414
cprecare	5.90e-07	3.58e-06	0.16	0.869	-6.44e-06	7.62e-06
cposcare	1.08e-06	2.46e-06	0.44	0.660	-3.74e-06	5.90e-06
educatn2	-.024627	.0345457	-0.71	0.476	-.0923379	.043084
educatn3	-.0141974	.0203328	-0.70	0.485	-.0540505	.0256557

educatn4	-.0649111	.1217397	-0.53	0.594	-.303526	.1737038
mosqnet1	.0019884	.0260309	0.08	0.939	-.0490333	.05301
costelect	5.88e-07	2.81e-06	0.21	0.834	-4.93e-06	6.10e-06
drwater1	.0078147	.013469	0.58	0.562	-.018585	.0342145
drwater2	.0104577	.0172864	0.60	0.545	-.0234243	.0443398
drwater4	.0184022	.0330073	0.56	0.577	-.0462935	.0830978
toilettyp1	-.0031483	.0047121	-0.67	0.504	-.0123843	.0060877
toilettyp2	-.0017769	.002837	-0.63	0.531	-.0073376	.0037838
dhosp1	-.0065583	.0149819	-0.44	0.662	-.0359234	.0228068
dhosp2	-.0034462	.0066082	-0.52	0.602	-.0163985	.0095062
dclinic1	.0216765	.0196508	1.10	0.270	-.0168398	.0601929
dclinic2	.0133201	.0130662	1.02	0.308	-.0122902	.0389303
lnpcexpd	.00029	.0002895	1.00	0.317	-.0002775	.0008575
geozone1	.0296828	.0041532	7.15	0.000	.0215423	.0378232
geozone2	.0575126	.0047478	12.11	0.000	.0482068	.0668185
geozone3	.0785184	.004826	16.27	0.000	.0690594	.0879775
geozone4	.0421672	.0050346	8.38	0.000	.0322992	.0520352

geozone5 | .0498914   .0049581   10.06   0.000   .0401735   .0596094

_cons | .0115905   .1162184   0.10   0.921   -.2162024   .2393834

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end of do-file

. do "C:\DOCUME~1\Ovi\LOCALS~1\Temp\STD0k000000.tmp"

. *Determinants of MLP (marginal effects)

. *Probability of labour participation in the formal sector

. dprobit pformal1 nchildrenhatPf nchildeath residence1 geozone1 geozone2 geozo

> ne3 geozone4 geozone5 age age2 lnhhs educatn2 educatn3 educatn4 lnpcexpd hour

> sdy, robust

Iteration 0:   log pseudolikelihood = -11192.319

Iteration 1:   log pseudolikelihood = -8457.6364

Iteration 2:   log pseudolikelihood = -8407.5683

Iteration 3:   log pseudolikelihood = -8407.2593

Iteration 4:   log pseudolikelihood = -8407.2593

Probit regression, reporting marginal effects   Number of obs = 41575

Wald chi2(16) =5073.50

Prob > chi2 = 0.0000

Log pseudolikelihood = -8407.2593 Pseudo R2 = 0.2488

pformal1	dF/dx	Robust Std. Err.	z	P>|z|	x-bar	[95% C.I.	]
nchi~tPf	.0276927	.0115293	2.40	0.016	3.76676	.005096	.05029
nchild~h	-.0025089	.0010974	-2.29	0.022	.407625	-.00466	-.000358
reside~1*	.0281125	.0032725	9.56	0.000	.23567	.021698	.034527
geozone1*	.0074861	.0054589	1.42	0.155	.180782	-.003213	.018185
geozone2*	.006665	.0103826	0.66	0.507	.177126	-.013684	.027014
geozone3*	.0273308	.0111519	2.67	0.008	.300012	.005473	.049188
geozone4*	.0040029	.0058444	0.70	0.482	.089188	-.007452	.015458
geozone5*	.0159144	.0077945	2.23	0.026	.119158	.000637	.031191
age	-.0039271	.001996	-1.97	0.049	32.6383	-.007839	-.000015
age2	.000024	.0000164	1.47	0.142	1131.23	-8.1e-06	.000056
lnhhs	-.0519853	.0189619	-2.74	0.006	1.67401	-.08915	-.014821
educatn2*	.001036	.005333	0.20	0.845	.235478	-.009416	.011488
educatn3*	.0730001	.0054125	16.94	0.000	.170271	.062392	.083608

educatn4*| .5718247 .0199416 37.16 0.000 .058882 .53274 .610909

lnpcexpd | -.0001495 .0001974 -0.76 0.449 4.85093 -.000536 .000237

hoursdy | .0040287 .0002533 15.57 0.000 5.84948 .003532 .004525

---------+--

obs. P | .0761275

pred. P | .0483099 (at x-bar)

(*) dF/dx is for discrete change of dummy variable from 0 to 1

z and P>|z| correspond to the test of the underlying coefficient being 0

. bysort sector:dprobit pformal1 nchildrenhatPf nchildeath geozone1 geozone2 ge

> ozone3 geozone4 geozone5 age age2 lnhhs educatn2 educatn3 educatn4 lnpcexpd h

> oursdy, robust

-> sector = URBAN

Iteration 0: log pseudolikelihood = -4095.103

Iteration 1: log pseudolikelihood = -3079.2812

Iteration 2: log pseudolikelihood = -3059.4474

Iteration 3:   log pseudolikelihood = -3059.3023

Iteration 4:   log pseudolikelihood = -3059.3023

Probit regression, reporting marginal effects   Number of obs =   9798

Wald chi2(15) =1818.95

Prob > chi2   = 0.0000

Log pseudolikelihood = -3059.3023   Pseudo R2   = 0.2529

| Robust

pformal1 | dF/dx   Std. Err.   z   P>|z| x-bar [95% C.I.   ]

---------+--

nchi~tPf | .0915905   .0345612   2.65   0.008   3.60033   .023852 .159329

nchild~h | -.0066302   .003973   -1.67   0.095   .301286 -.014417 .001157

geozone1*| .032749   .0156597   2.23   0.025   .149826   .002057 .063441

geozone2*| -.0045437   .0293776   -0.15   0.879   .08022 -.062123 .053035

geozone3*| -.0186601   .0260697   -0.69   0.492   .20198 -.069756 .032436

geozone4*| .0090981   .0161127   0.58   0.563   .087467 -.022482 .040678

```
geozone5*|    .006315   .0195895     0.33   0.743   .109818   -.03208   .04471

     age |  -.0119545   .0063954    -1.87   0.061   33.9263  -.024489   .00058

    age2 |   .0000513   .0000548     0.94   0.349   1213.37  -.000056  .000159

   lnhhs |  -.1615877   .0560524    -2.89   0.004   1.61693  -.271448 -.051727

educatn2*|  -.0100235   .0164392    -0.60   0.549   .248622  -.042244  .022197

educatn3*|   .0956371   .0130469     7.96   0.000   .318432   .070066  .121209

educatn4*|   .6245223    .029628    21.63   0.000   .145948   .566453  .682592

lnpcexpd |  -.0001217   .0005891    -0.21   0.836   4.87595  -.001276  .001033

 hoursdy |   .0073356   .0008026     8.95   0.000   6.42668   .005763  .008909
---------+--------------------------------------------------------------------
  obs. P |    .147275

 pred. P |   .1039538  (at x-bar)
------------------------------------------------------------------------------
(*) dF/dx is for discrete change of dummy variable from 0 to 1

    z and P>|z| correspond to the test of the underlying coefficient being 0
------------------------------------------------------------------------------


-> sector = RURAL

Iteration 0:   log pseudolikelihood = -6694.5473

Iteration 1:   log pseudolikelihood = -5336.7161
```

Iteration 2:   log pseudolikelihood = -5315.0711

Iteration 3:   log pseudolikelihood = -5314.9935

Iteration 4:   log pseudolikelihood = -5314.9935

Probit regression, reporting marginal effects   Number of obs = 31777

Wald chi2(15) =2580.27

Prob > chi2   = 0.0000

Log pseudolikelihood = -5314.9935   Pseudo R2   = 0.2061

pformal1	dF/dx (Robust)	Std. Err.	z	P>|z|	x-bar	[95% C.I.	]
nchi~tPf	.009276	.0117046	0.79	0.428	3.81808	-.013665	.032217
nchild~h	-.0017539	.001007	-1.74	0.082	.440413	-.003728	.00022
geozone1*	.0009276	.006059	0.15	0.878	.190326	-.010948	.012803
geozone2*	.0123878	.011773	1.13	0.257	.207005	-.010687	.035462
geozone3*	.0360431	.0128605	3.19	0.001	.330239	.010837	.061249
geozone4*	.0015424	.0065823	0.24	0.812	.089719	-.011359	.014444

```
geozone5*|   .0172647    .009214     2.12   0.034   .122038  -.000794  .035324

     age |  -.0011853   .0019708    -0.60   0.548   32.2411  -.005048  .002677

    age2 |   .0000108   .0000158     0.68   0.494   1105.91   -.00002  .000042

   lnhhs |  -.0196897   .0193851    -1.02   0.310    1.6916  -.057684  .018304

educatn2*|   .0049584   .0055367     0.92   0.357   .231425  -.005893   .01581

educatn3*|   .0686459   .0061485    14.93   0.000   .124587   .056595  .080697

educatn4*|   .5631685   .0267667    29.14   0.000   .032036   .510707   .61563

lnpcexpd |  -.0001577   .0001978    -0.80   0.425   4.84321  -.000545   .00023

 hoursdy |   .0031862   .0002488    12.54   0.000   5.67151   .002699  .003674
---------+--------------------------------------------------------------------
  obs. P |   .0541901

 pred. P |   .0364803  (at x-bar)
------------------------------------------------------------------------------

(*) dF/dx is for discrete change of dummy variable from 0 to 1

    z and P>|z| correspond to the test of the underlying coefficient being
. bysort Zone:dprobit pformal1 nchildrenhatPf nchildeath residence1 age age2 ln

> hhs educatn2 educatn3 educatn4 lnpcexpd hoursdy, robust
------------------------------------------------------------------------------

-> Zone = North Cent
```

```
Iteration 0:   log pseudolikelihood = -1869.6208

Iteration 1:   log pseudolikelihood = -1135.3933

Iteration 2:   log pseudolikelihood = -1108.8591

Iteration 3:   log pseudolikelihood =  -1107.677

Iteration 4:   log pseudolikelihood = -1107.6694

Iteration 5:   log pseudolikelihood = -1107.6694

Probit regression, reporting marginal effects           Number of obs =   7516

                                                        Wald chi2(11) =1167.78

                                                        Prob > chi2   = 0.0000

Log pseudolikelihood = -1107.6694                       Pseudo R2     = 0.4075
------------------------------------------------------------------------------
         |               Robust
pformal1 |      dF/dx   Std. Err.      z    P>|z|     x-bar  [    95% C.I.   ]
---------+--------------------------------------------------------------------

nchi~tPf |   .0601967   .0232964     2.59   0.010   3.63717   .014537  .105857

nchild~h |  -.0125157   .0033213    -3.74   0.000   .297499  -.019025 -.006006

reside~1*|   .0368104   .0072021     6.46   0.000   .195317   .022695  .050926

     age |  -.0059632   .0041782    -1.43   0.151   32.9089  -.014152  .002226
```

age2 | 5.49e-07 .0000347 0.02 0.987 1143.65 -.000067 .000069

lnhhs | -.1081717 .0378356 -2.86 0.004 1.68813 -.182328 -.034015

educatn2*| -.0020415 .0092428 -0.22 0.828 .237759 -.020157 .016074

educatn3*| .0777753 .0117432 9.00 0.000 .142895 .054759 .100792

educatn4*| .7613215 .0441149 17.46 0.000 .054417 .674858 .847785

lnpcexpd | .0006054 .0003567 1.69 0.091 5.15988 -.000094 .001304

hoursdy | .0031063 .0005177 5.63 0.000 6.7725 .002092 .004121

---------+---

obs. P | .0681213

pred. P | .0291099 (at x-bar)

(*) dF/dx is for discrete change of dummy variable from 0 to 1

z and P>|z| correspond to the test of the underlying coefficient being 0

-> Zone = North East

Iteration 0: log pseudolikelihood = -1356.3947

Iteration 1: log pseudolikelihood = -1048.191

Iteration 2: log pseudolikelihood = -1043.0407

Iteration 3:   log pseudolikelihood = -1043.0188

Iteration 4:   log pseudolikelihood = -1043.0188

Probit regression, reporting marginal effects   Number of obs =   7364

Wald chi2(11) = 573.09

Prob > chi2   = 0.0000

Log pseudolikelihood = -1043.0188   Pseudo R2   = 0.2310

pformal1	dF/dx	Robust Std. Err.	z	P>|z|	x-bar	[95%	C.I.]
nchi~tPf	.0418993	.0208169	2.01	0.044	3.94826	.001099	.0827
nchild~h	-.0004807	.0015912	-0.30	0.762	.460483	-.0036	.002638
reside~1*	.027839	.0082663	4.13	0.000	.106735	.011637	.044041
age	-.0090246	.0033494	-2.70	0.007	31.1013	-.015589	-.00246
age2	.0000665	.000027	2.46	0.014	1033.41	.000014	.000119
lnhhs	-.0676963	.0349221	-1.94	0.052	1.74954	-.136142	.00075
educatn2*	-.0097794	.0076766	-1.13	0.258	.123574	-.024825	.005266
educatn3*	.0863269	.0138579	9.25	0.000	.075367	.059166	.113488
educatn4*	.6175519	.0564142	14.83	0.000	.023628	.506982	.728122

lnpcexpd | .00074 .000363 2.02 0.043 4.77501 .000029 .001451

hoursdy | .0022811 .0004361 5.09 0.000 4.69127 .001426 .003136

---------+---

obs. P | .04522

pred. P | .0288714 (at x-bar)

(*) dF/dx is for discrete change of dummy variable from 0 to 1

z and P>|z| correspond to the test of the underlying coefficient being 0

-> Zone = North West

Iteration 0: log pseudolikelihood = -2535.654

Iteration 1: log pseudolikelihood = -2249.2507

Iteration 2: log pseudolikelihood = -2244.1833

Iteration 3: log pseudolikelihood = -2244.1771

Iteration 4: log pseudolikelihood = -2244.1771

Probit regression, reporting marginal effects Number of obs = 12473

Wald chi2(11) = 608.19

Prob > chi2 = 0.0000

Log pseudolikelihood = -2244.1771 Pseudo R2 = 0.1150

pformal1	dF/dx	Robust Std. Err.	z	P>|z|	x-bar	[95% C.I.]	
nchi~tPf	-.066799	.0330231	-2.02	0.044	3.88904	-.131523	-.002075
nchild~h	-.0027401	.0014822	-1.84	0.065	.565301	-.005645	.000165
reside~1*	.0023469	.0052006	0.46	0.646	.158663	-.007846	.01254
age	.0103055	.0055009	1.87	0.062	30.7046	-.000476	.021087
age2	-.000024	.0000329	-0.73	0.465	1004.88	-.000088	.00004
lnhhs	.1095235	.0546675	2.00	0.046	1.7595	.002377	.21667
educatn2*	.0426756	.021492	2.46	0.014	.125631	.000552	.084799
educatn3*	.0510282	.0109072	6.05	0.000	.06029	.029651	.072406
educatn4*	.2697199	.0556629	7.89	0.000	.022368	.160623	.378817
lnpcexpd	-.000504	.0003429	-1.47	0.142	4.74399	-.001176	.000168
hoursdy	.0045952	.0004047	11.07	0.000	3.25956	.003802	.005388
obs. P	.0516315						
pred. P	.0411113 (at x-bar)						

(*) dF/dx is for discrete change of dummy variable from 0 to 1

z and P>|z| correspond to the test of the underlying coefficient being 0

-> Zone = South East

Iteration 0: log pseudolikelihood = -1280.9434

Iteration 1: log pseudolikelihood = -971.61023

Iteration 2: log pseudolikelihood = -962.20252

Iteration 3: log pseudolikelihood = -962.03339

Iteration 4: log pseudolikelihood = -962.03318

Probit regression, reporting marginal effects Number of obs = 3708

Wald chi2(11) = 554.21

Prob > chi2 = 0.0000

Log pseudolikelihood = -962.03318 Pseudo R2 = 0.2490

| Robust

pformal1 | dF/dx Std. Err. z P>|z| x-bar [95% C.I.]

---------+--

nchi~tPf	-.0290093	.0428119	-0.68	0.498	3.94391	-.112919	.054901
nchild~h	-.009052	.004886	-1.85	0.065	.371359	-.018628	.000524
reside~1*	.0476905	.0120506	4.45	0.000	.231122	.024072	.071309
age	.0000235	.00765	0.00	0.998	36.1103	-.01497	.015017
age2	.0000626	.0000694	0.90	0.368	1363.73	-.000073	.000199
lnhhs	.0572164	.0713893	0.80	0.423	1.60918	-.082704	.197137
educatn2*	.0512364	.0254822	2.10	0.036	.418015	.001292	.101181
educatn3*	.1233229	.0271017	5.25	0.000	.324434	.070205	.176441
educatn4*	.5588069	.0673872	9.97	0.000	.105987	.426731	.690883
lnpcexpd	-.0012881	.0007643	-1.68	0.092	5.0517	-.002786	.00021
hoursdy	.0066063	.001024	6.48	0.000	8.19391	.004599	.008613
obs. P	.109493						
pred. P	.0684014 (at x-bar)						

(*) dF/dx is for discrete change of dummy variable from 0 to 1

z and P>|z| correspond to the test of the underlying coefficient being 0

-> Zone = South Sout

Iteration 0:   log pseudolikelihood = -1830.6965

Iteration 1:   log pseudolikelihood = -1468.7103

Iteration 2:   log pseudolikelihood = -1462.0954

Iteration 3:   log pseudolikelihood = -1462.0603

Iteration 4:   log pseudolikelihood = -1462.0603

Probit regression, reporting marginal effects   Number of obs =   4954

Wald chi2(11) = 681.92

Prob > chi2   = 0.0000

Log pseudolikelihood = -1462.0603   Pseudo R2   = 0.2014

	Robust					
pformal1	dF/dx	Std. Err.	z	P>|z|	x-bar	[95% C.I.]	
nchi~tPf	.0710668	.032839	2.16	0.031	3.81046	.006703	.13543
nchild~h	.0024947	.0040454	0.62	0.537	.389988	-.005434	.010424
reside~1*	.0515413	.0120845	4.72	0.000	.217198	.027856	.075227

```
     age |  -.0033343   .0060569    -0.55   0.582   34.3843  -.015206  .008537

    age2 |  -.0000516    .000062    -0.83   0.405   1249.83  -.000173   .00007

    lnhhs |  -.1320636   .0535561    -2.46   0.014   1.54869  -.237032 -.027095

educatn2*|   -.054793   .0169551    -3.16   0.002   .442673  -.088024 -.021562

educatn3*|    .043566   .0156299     2.95   0.003   .318329   .012932    .0742

educatn4*|   .5169608   .0446539    13.87   0.000   .091038   .429441  .604481

lnpcexpd |   -.000161    .000764    -0.21   0.833   4.82932  -.001658  .001337

 hoursdy |   .0073665   .0009431     7.66   0.000   8.37942   .005518  .009215
---------+--------------------------------------------------------------------
  obs. P |   .1213161

 pred. P |   .0890451  (at x-bar)
------------------------------------------------------------------------------
(*) dF/dx is for discrete change of dummy variable from 0 to 1

    z and P>|z| correspond to the test of the underlying coefficient being 0

------------------------------------------------------------------------------

-> Zone = South West

Iteration 0:   log pseudolikelihood = -2043.6866

Iteration 1:   log pseudolikelihood = -1476.6816
```

```
Iteration 2:   log pseudolikelihood =  -1465.468

Iteration 3:   log pseudolikelihood = -1465.3206

Iteration 4:   log pseudolikelihood = -1465.3206



Probit regression, reporting marginal effects          Number of obs =   5560

                                                  Wald chi2(11) =1056.52

                                                  Prob > chi2   = 0.0000

Log pseudolikelihood = -1465.3206                    Pseudo R2     = 0.2830
------------------------------------------------------------------------------
         |               Robust
pformal1 |      dF/dx   Std. Err.      z    P>|z|     x-bar  [    95% C.I.   ]
---------+--------------------------------------------------------------------
nchi~tPf |   .0478007   .0401847     1.19   0.234   3.27014   -.03096  .126561

nchild~h |   .0029941   .0052562     0.57   0.569   .172662  -.007308  .013296

reside~1*|   .0268097   .0084529     3.05   0.002   .653237   .010242  .043377

     age |  -.0062201   .0076045    -0.82   0.413    34.775  -.021125  .008684

    age2 |   .0000335   .0000668     0.50   0.616   1266.73  -.000097  .000164

   lnhhs |  -.0876842   .0652545    -1.35   0.179   1.51797  -.215581  .040212

educatn2*|   .0055155   .0202595     0.27   0.784   .320683  -.034192  .045223
```

educatn3*| .0833302   .0169518   5.39   0.000   .344964   .050105 .116555

educatn4*| .6198571   .0468146   14.66   0.000   .133453   .528102 .711612

lnpcexpd | -.0012103   .0006748   -1.79   0.073   4.65908 -.002533 .000112

hoursdy | .0004928   .0010559   0.47   0.641   8.12815 -.001577 .002562
---------+--
obs. P | .1203237

pred. P | .0763058 (at x-bar)

(*) dF/dx is for discrete change of dummy variable from 0 to 1

z and P>|z| correspond to the test of the underlying coefficient being 0

.
end of do-file

.

. do "C:\DOCUME~1\Ovi\LOCALS~1\Temp\STD0k000000.tmp"

. *Probability of labour participation in the informal sector

. dprobit pinformal1 nchildrenhatPinf nchildeath residence1 geozone1 geozone2 g

```
> eozone3 geozone4 geozone5 age age2 lnhhs educatn2 educatn3 educatn4 lnpcexpd

> hoursdy, robust

Iteration 0:   log pseudolikelihood = -28756.518

Iteration 1:   log pseudolikelihood = -26877.246

Iteration 2:   log pseudolikelihood = -26863.482

Iteration 3:   log pseudolikelihood = -26863.479

Probit regression, reporting marginal effects           Number of obs =  41575

                                                        Wald chi2(16) =3417.54

                                                        Prob > chi2   = 0.0000

Log pseudolikelihood = -26863.479                       Pseudo R2     = 0.0658
------------------------------------------------------------------------------
         |               Robust
pinfor~1 |      dF/dx   Std. Err.      z    P>|z|     x-bar  [    95% C.I.   ]
---------+--------------------------------------------------------------------
nc~tPinf |  -.3188455   .0320957    -9.93   0.000   3.76676  -.381752 -.255939

nchild~h |   .0055086   .0023604     2.33   0.020   .407625   .000882  .010135

reside~1*|   .1034597   .0068246    14.92   0.000    .23567   .090084  .116836

geozone1*|  -.0388449   .0135182    -2.88   0.004   .180782   -.06534  -.01235
```

geozone2*	.0965899	.0254706	3.73	0.000	.177126	.046668	.146511
geozone3*	.1957254	.0239206	7.88	0.000	.300012	.148842	.242609
geozone4*	-.2372235	.0134591	-16.34	0.000	.089188	-.263603	-.210844
geozone5*	-.1285544	.0176469	-7.18	0.000	.119158	-.163142	-.093967
age	.0583602	.0054003	10.81	0.000	32.6383	.047776	.068945
age2	-.0003289	.0000397	-8.28	0.000	1131.23	-.000407	-.000251
lnhhs	.5172211	.0530248	9.75	0.000	1.67401	.413295	.621148
educatn2*	.0887945	.0130663	6.71	0.000	.235478	.063185	.114404
educatn3*	.0430567	.0083044	5.16	0.000	.170271	.02678	.059333
educatn4*	-.3771298	.0119386	-23.86	0.000	.058882	-.400529	-.35373
lnpcexpd	.000109	.0004797	0.23	0.820	4.85093	-.000831	.001049
hoursdy	.0232239	.0006898	33.66	0.000	5.84948	.021872	.024576
obs. P	.5270956						
pred. P	.5297065 (at x-bar)						

(*) dF/dx is for discrete change of dummy variable from 0 to 1

z and P>|z| correspond to the test of the underlying coefficient being 0

. bysort sector:dprobit pinformal1 nchildrenhatPinf nchildeath geozone1 geozone

> 2 geozone3 geozone4 geozone5 age age2 lnhhs educatn2 educatn3 educatn4 lnpcex

> pd hoursdy, robust

-> sector = URBAN

Iteration 0:   log pseudolikelihood = -6487.4628

Iteration 1:   log pseudolikelihood = -5535.9842

Iteration 2:   log pseudolikelihood =   -5522.22

Iteration 3:   log pseudolikelihood = -5522.2061

Probit regression, reporting marginal effects   Number of obs =   9798

Wald chi2(15) =1528.37

Prob > chi2   = 0.0000

Log pseudolikelihood = -5522.2061   Pseudo R2   = 0.1488

| Robust

pinfor~1 | dF/dx   Std. Err.   z   P>|z| x-bar [95% C.I.   ]

nc~tPinf	-.2325799	.0556131	-4.18	0.000	3.60033	-.34158	-.12358
nchild~h	-.0050739	.0055769	-0.91	0.363	.301286	-.016004	.005857
geozone1*	-.0845757	.0234504	-3.67	0.000	.149826	-.130538	-.038614
geozone2*	-.0257493	.0485309	-0.54	0.592	.08022	-.120868	.06937
geozone3*	.0262768	.0436243	0.60	0.550	.20198	-.059225	.111779
geozone4*	-.233909	.0266697	-8.78	0.000	.087467	-.286181	-.181637
geozone5*	-.1065073	.0327359	-3.33	0.001	.109818	-.170668	-.042346
age	.0526367	.0098502	5.34	0.000	33.9263	.033331	.071943
age2	-.0003735	.0000813	-4.59	0.000	1213.37	-.000533	-.000214
lnhhs	.3946997	.0910562	4.33	0.000	1.61693	.216233	.573167
educatn2*	.1170381	.0229193	4.88	0.000	.248622	.072117	.161959
educatn3*	.0436017	.0151103	2.86	0.004	.318432	.013986	.073217
educatn4*	-.4492865	.024899	-15.66	0.000	.145948	-.498088	-.400485
lnpcexpd	.0003141	.000949	0.33	0.741	4.87595	-.001546	.002174
hoursdy	.0322788	.0014473	22.17	0.000	6.42668	.029442	.035115
obs. P	.6239028						

pred. P | .6449309 (at x-bar)

(*) dF/dx is for discrete change of dummy variable from 0 to 1

z and P>|z| correspond to the test of the underlying coefficient being 0

-> sector = RURAL

Iteration 0:   log pseudolikelihood = -22025.656

Iteration 1:   log pseudolikelihood = -21081.183

Iteration 2:   log pseudolikelihood = -21078.366

Iteration 3:   log pseudolikelihood = -21078.366

Probit regression, reporting marginal effects   Number of obs = 31777

Wald chi2(15) =1725.68

Prob > chi2   = 0.0000

Log pseudolikelihood = -21078.366   Pseudo R2   = 0.0430

| Robust

pinfor~1 | dF/dx   Std. Err.   z   P>|z| x-bar [95% C.I.   ]

---------+--

nc~tPinf | -.3555979   .0395196   -9.00   0.000   3.81808 -.433055 -.278141

nchild~h |	.0075322	.0025576	2.95	0.003	.440413	.00252	.012545
geozone1*|	.0369443	.0175994	2.10	0.036	.190326	.00245	.071438
geozone2*|	.1875025	.0308371	5.86	0.000	.207005	.127063	.247942
geozone3*|	.2931367	.0289341	9.52	0.000	.330239	.236427	.349847
geozone4*|	-.1841108	.0176891	-9.81	0.000	.089719	-.218781	-.149441
geozone5*|	-.0692761	.0226385	-3.04	0.002	.122038	-.113647	-.024905
age |	.0631491	.0065631	9.62	0.000	32.2411	.050286	.076013
age2 |	-.0003424	.0000459	-7.45	0.000	1105.91	-.000432	-.000252
lnhhs |	.5776023	.065467	8.82	0.000	1.6916	.449289	.705915
educatn2*|	.0907742	.0158625	5.68	0.000	.231425	.059684	.121864
educatn3*|	.0463044	.0100232	4.61	0.000	.124587	.026659	.06595
educatn4*|	-.3071133	.0168807	-14.43	0.000	.032036	-.340199	-.274028
lnpcexpd |	.0001111	.0005497	0.20	0.840	4.84321	-.000966	.001188
hoursdy |	.0199058	.0007791	25.55	0.000	5.67151	.018379	.021433

---------+---

obs. P | .4972464

pred. P | .4958603 (at x-bar)

(*) dF/dx is for discrete change of dummy variable from 0 to 1

z and P>|z| correspond to the test of the underlying coefficient being 0

bysort Zone:dprobit pinformal1 nchildrenhatPinf nchildeath residence1 age age

> 2 lnhhs educatn2 educatn3 educatn4 lnpcexpd hoursdy, robust

----

-> Zone = North Cent

Iteration 0: log pseudolikelihood = -5191.5527

Iteration 1: log pseudolikelihood = -5014.653

Iteration 2: log pseudolikelihood = -5014.0169

Iteration 3: log pseudolikelihood = -5014.0169

Probit regression, reporting marginal effects Number of obs = 7516

Wald chi2(11) = 316.97

Prob > chi2 = 0.0000

Log pseudolikelihood = -5014.0169 Pseudo R2 = 0.0342

| Robust

pinfor~1 | dF/dx Std. Err. z P>|z| x-bar [95% C.I.]

---------+--

nc~tPinf	-.3974333	.088748	-4.48	0.000	3.63717	-.571376	-.22349
nchild~h	.0204105	.0071581	2.85	0.004	.297499	.006381	.03444
reside~1*	.1125537	.0157432	6.99	0.000	.195317	.081698	.14341
age	.0736952	.0150484	4.90	0.000	32.9089	.044201	.103189
age2	-.0004129	.0001044	-3.95	0.000	1143.65	-.000618	-.000208
lnhhs	.6159668	.1462386	4.21	0.000	1.68813	.329344	.902589
educatn2*	.1182958	.0324629	3.57	0.000	.237759	.05467	.181922
educatn3*	-.0088763	.0182266	-0.49	0.626	.142895	-.0446	.026847
educatn4*	-.449122	.0235275	-11.92	0.000	.054417	-.495235	-.403009
lnpcexpd	-.0013005	.0011159	-1.17	0.244	5.15988	-.003488	.000887
hoursdy	.0183329	.0016961	10.81	0.000	6.7725	.015009	.021657
obs. P	.5347259						
pred. P	.5349851 (at x-bar)						

(*) dF/dx is for discrete change of dummy variable from 0 to 1

z and P>|z| correspond to the test of the underlying coefficient being 0

-> Zone = North East

Iteration 0:   log pseudolikelihood = -5097.9763

Iteration 1:   log pseudolikelihood = -5005.7916

Iteration 2:   log pseudolikelihood = -5005.687

Iteration 3:   log pseudolikelihood = -5005.687

Probit regression, reporting marginal effects   Number of obs =   7364

Wald chi2(11) = 171.07

Prob > chi2   = 0.0000

Log pseudolikelihood = -5005.687   Pseudo R2   = 0.0181

```
------------------------------------------------------------------------------
         |               Robust
pinfor~1 |      dF/dx   Std. Err.      z    P>|z|     x-bar  [    95% C.I.   ]
---------+--------------------------------------------------------------------
nc~tPinf |  -.5825076    .109271    -5.33   0.000   3.94826  -.796675 -.368341

nchild~h |   .0077675   .0052144     1.49   0.136   .460483  -.002452  .017988

reside~1*|   .0046878   .0202014     0.23   0.816   .106735  -.034906  .044282

     age |   .0877224   .0173326     5.06   0.000   31.1013   .053751  .121694

    age2 |  -.0003104   .0001011    -3.07   0.002   1033.41  -.000509 -.000112

   lnhhs |   1.005435    .182622     5.51   0.000   1.74954   .647502  1.36337
```

educatn2*| .1150245 .0425974 2.67 0.008 .123574 .031535 .198514

educatn3*| -.1086897 .0222461 -4.76 0.000 .075367 -.152291 -.065088

educatn4*| -.3680486 .0307976 -7.65 0.000 .023628 -.428411 -.307686

lnpcexpd | .0013765 .0011421 1.21 0.228 4.77501 -.000862 .003615

hoursdy | .0170371 .00156 10.92 0.000 4.69127 .01398 .020095

---------+--

obs. P | .4792232

pred. P | .4784523 (at x-bar)

(*) dF/dx is for discrete change of dummy variable from 0 to 1

z and P>|z| correspond to the test of the underlying coefficient being 0

-> Zone = North West

Iteration 0: log pseudolikelihood = -8550.4365

Iteration 1: log pseudolikelihood = -8234.6966

Iteration 2: log pseudolikelihood = -8233.8874

Iteration 3: log pseudolikelihood = -8233.8873

Probit regression, reporting marginal effects Number of obs = 12473

Wald chi2(11) = 546.02

Prob > chi2 = 0.0000

Log pseudolikelihood = -8233.8873 Pseudo R2 = 0.0370

pinfor~1	dF/dx	Robust Std. Err.	z	P>|z|	x-bar	[95% C.I.	]
nc~tPinf	-.7618677	.0844167	-9.03	0.000	3.88904	-.927321	-.596414
nchild~h	.0029497	.0034611	0.85	0.394	.565301	-.003834	.009733
reside~1*	-.0649667	.0136621	-4.77	0.000	.158663	-.091744	-.038189
age	.1256451	.0137715	9.13	0.000	30.7046	.098653	.152637
age2	-.0005397	.0000835	-6.47	0.000	1004.88	-.000703	-.000376
lnhhs	1.240732	.1401833	8.85	0.000	1.7595	.965978	1.51549
educatn2*	.205571	.0296132	6.27	0.000	.125631	.14753	.263612
educatn3*	-.0505139	.0201012	-2.52	0.012	.06029	-.089911	-.011116
educatn4*	-.4474862	.0245777	-11.54	0.000	.022368	-.495658	-.399315
lnpcexpd	-.0002697	.0008785	-0.31	0.759	4.74399	-.001991	.001452
hoursdy	.0289426	.0013348	21.64	0.000	3.25956	.026326	.031559
obs. P	.5616933						
pred. P	.5639713 (at x-bar)						

(*) dF/dx is for discrete change of dummy variable from 0 to 1

z and P>|z| correspond to the test of the underlying coefficient being 0

-> Zone = South East

Iteration 0: log pseudolikelihood = -2418.8884

Iteration 1: log pseudolikelihood = -2181.8149

Iteration 2: log pseudolikelihood = -2180.2099

Iteration 3: log pseudolikelihood = -2180.2096

Probit regression, reporting marginal effects Number of obs = 3708

Wald chi2(11) = 406.70

Prob > chi2 = 0.0000

Log pseudolikelihood = -2180.2096 Pseudo R2 = 0.0987

	Robust					
pinfor~1	dF/dx	Std. Err.	z	P>|z|	x-bar	[95% C.I.]
nc~tPinf	-.2234865	.080643	-2.77	0.006	3.94391	-.381544 -.065429
nchild~h	-.0084382	.0091039	-0.93	0.354	.371359	-.026281 .009405
reside~1*	.1789104	.0211311	8.61	0.000	.231122	.137494 .220327
age	.0289472	.0152027	1.90	0.057	36.1103	-.00085 .058744
age2	-.0000801	.0001336	-0.60	0.549	1363.73	-.000342 .000182

lnhhs | .3690303   .1312765   2.81   0.005   1.60918   .111733 .626328

educatn2*| .1882742   .0369839   5.06   0.000   .418015   .115787 .260761

educatn3*| .2361249   .0290074   8.14   0.000   .324434   .179272 .292978

educatn4*| -.1144773   .0432371   -2.45   0.014   .105987 -.199221 -.029734

lnpcexpd | -.0005953   .0015031   -0.40   0.692   5.0517 -.003541 .002351

hoursdy | .0288712   .0021485   13.41   0.000   8.19391   .02466 .033082

---------+--

obs. P | .3581446

pred. P | .3442552 (at x-bar)

(*) dF/dx is for discrete change of dummy variable from 0 to 1

z and P>|z| correspond to the test of the underlying coefficient being 0

-> Zone = South Sout

Iteration 0:   log pseudolikelihood = -3377.1647

Iteration 1:   log pseudolikelihood = -3163.8924

Iteration 2:   log pseudolikelihood = -3163.2375

Iteration 3:   log pseudolikelihood = -3163.2375

Probit regression, reporting marginal effects Number of obs = 4954

Wald chi2(11) = 385.00

Prob > chi2 = 0.0000

Log pseudolikelihood = -3163.2375 Pseudo R2 = 0.0633

pinfor~1	dF/dx	Robust Std. Err.	z	P>|z|	x-bar	[95% C.I.	]
nc~tPinf	-.0856902	.0617382	-1.39	0.165	3.81046	-.206695	.035314
nchild~h	.0013293	.0067285	0.20	0.843	.389988	-.011858	.014517
reside~1*	.2260972	.0179468	12.33	0.000	.217198	.190922	.261272
age	.0237218	.011282	2.10	0.036	34.3843	.00161	.045834
age2	-.000238	.000105	-2.27	0.023	1249.83	-.000444	-.000032
lnhhs	.0984206	.1009147	0.98	0.329	1.54869	-.099369	.29621
educatn2*	.1202731	.030313	3.95	0.000	.442673	.060861	.179686
educatn3*	.1882765	.023576	7.91	0.000	.318329	.142068	.234485
educatn4*	-.1283974	.0367408	-3.30	0.001	.091038	-.200408	-.056387
lnpcexpd	.0019696	.0013255	1.49	0.137	4.82932	-.000628	.004567

hoursdy | .0174147 .0017172 10.13 0.000 8.37942 .014049 .02078

---------+---

obs. P | .4245055

pred. P | .4208118 (at x-bar)

(*) dF/dx is for discrete change of dummy variable from 0 to 1

z and P>|z| correspond to the test of the underlying coefficient being 0

-> Zone = South West

Iteration 0: log pseudolikelihood = -3364.4667

Iteration 1: log pseudolikelihood = -2798.0953

Iteration 2: log pseudolikelihood = -2789.5947

Iteration 3: log pseudolikelihood = -2789.5838

Probit regression, reporting marginal effects Number of obs = 5560

Wald chi2(1) = 873.11

Prob > chi2 = 0.0000

Log pseudolikelihood = -2789.5838 Pseudo R2 = 0.1709

| Robust

pinfor~1 | dF/dx Std. Err. z P>|z| x-bar [95% C.I.]

---------+--

nc~tPinf	.0142008	.0689906	0.21	0.837	3.27014	-.121018	.14942
nchild~h	-.010627	.0090468	-1.17	0.240	.172662	-.028358	.007104
reside~1*	.2058255	.0152695	13.82	0.000	.653237	.175898	.235753
age	.0057722	.0126031	0.46	0.647	34.775	-.018929	.030474
age2	-.0001154	.0001067	-1.08	0.280	1266.73	-.000325	.000094
lnhhs	.0164636	.1126206	0.15	0.884	1.51797	-.204269	.237196
educatn2*	.1284241	.0260755	4.64	0.000	.320683	.077317	.179531
educatn3*	.156671	.0159736	9.12	0.000	.344964	.125363	.187979
educatn4*	-.2901284	.0411039	-7.43	0.000	.133453	-.370691	-.209566
lnpcexpd	.0001023	.0011575	0.09	0.930	4.65908	-.002166	.002371
hoursdy	.0315484	.0019856	15.71	0.000	8.12815	.027657	.03544

---------+--

obs. P | .7066547

pred. P | .7391947 (at x-bar)

(*) dF/dx is for discrete change of dummy variable from 0 to 1

z and P>|z| correspond to the test of the underlying coefficient being 0

```
. do "C:\DOCUME~1\Ovi\LOCALS~1\Temp\STD0k000000.tmp"

. *Probability of being out of the labour force

. dprobit polaforce2 nchildren nchildeath residence1 geozone1 geozone2 geozone3

>  geozone4 geozone5 age age2 marital1 marital2 marital3 lnhhs educatn2 educatn

> 3 educatn4 lnpcexpd hoursdy, robust

Iteration 0:   log pseudolikelihood = -19644.357

Iteration 1:   log pseudolikelihood = -17042.648

Iteration 2:   log pseudolikelihood = -16935.534

Iteration 3:   log pseudolikelihood = -16934.481

Iteration 4:   log pseudolikelihood = -16934.481

Probit regression, reporting marginal effects          Number of obs =  41575

                                                       Wald chi2(19) =3671.03

                                                       Prob > chi2   = 0.0000

Log pseudolikelihood = -16934.481                      Pseudo R2     = 0.1379
------------------------------------------------------------------------------
         |               Robust
polafo~2 |      dF/dx   Std. Err.      z    P>|z|     x-bar  [    95% C.I.   ]
```

nchild~n	-.0039449	.0011488	-3.43	0.001	3.76676	-.006196	-.001693
nchild~h	.000557	.0018589	0.30	0.764	.407625	-.003086	.0042
reside~1*	.0123108	.0048045	2.60	0.009	.23567	.002894	.021727
geozone1*	.0415236	.0082823	5.29	0.000	.180782	.025291	.057757
geozone2*	.1729147	.0108913	18.49	0.000	.177126	.151568	.194261
geozone3*	.0563218	.0083014	7.13	0.000	.300012	.040051	.072592
geozone4*	-.0065073	.0091128	-0.70	0.481	.089188	-.024368	.011353
geozone5*	-.038329	.0078518	-4.48	0.000	.119158	-.053718	-.02294
age	.0043706	.0017358	2.52	0.012	32.6383	.000969	.007773
age2	-.0000651	.0000261	-2.49	0.013	1131.23	-.000116	-.000014
marital1*	.0535326	.0138056	3.34	0.001	.939627	.026474	.080591
marital2*	.1521609	.0657172	2.77	0.006	.002189	.023358	.280964
marital3*	-.0075463	.0212406	-0.35	0.727	.044666	-.049177	.034084
lnhhs	-.0263935	.004857	-5.43	0.000	1.67401	-.035913	-.016874
educatn2*	-.0160754	.0048537	-3.24	0.001	.235478	-.025589	-.006562
educatn3*	-.0064416	.0058485	-1.09	0.276	.170271	-.017904	.005021

educatn4*| -.0367747   .0079498   -4.21   0.000   .058882 -.052356 -.021193

lnpcexpd | .000753   .0003319   2.27   0.023   4.85093   .000103 .001403

hoursdy | -.0224974   .0005102   -40.18   0.000   5.84948 -.023497 -.021497

---------+--

obs. P | .1807336

pred. P | .142816 (at x-bar)

(*) dF/dx is for discrete change of dummy variable from 0 to 1

z and P>|z| correspond to the test of the underlying coefficient being 0

. bysort sector:dprobit polaforce2 nchildren nchildeath geozone1 geozone2 geozo

> ne3 geozone4 geozone5 age age2 marital1 marital2 marital3 lnhhs educatn2 educ

> atn3 educatn4 lnpcexpd hoursdy, robust

-> sector = URBAN

Iteration 0:   log pseudolikelihood = -4216.0674

Iteration 1:   log pseudolikelihood = -3482.742

Iteration 2:   log pseudolikelihood = -3449.7755

Iteration 3:   log pseudolikelihood = -3449.2966

Iteration 4:   log pseudolikelihood = -3449.2964

Probit regression, reporting marginal effects   Number of obs =   9798

Wald chi2(18) =1070.59

Prob > chi2   = 0.0000

Log pseudolikelihood = -3449.2964   Pseudo R2   = 0.1819

```
------------------------------------------------------------------------------
         |               Robust
polafo~2 |      dF/dx   Std. Err.      z    P>|z|     x-bar  [    95% C.I.   ]
---------+--------------------------------------------------------------------

nchild~n |   .0013591   .0022302     0.61   0.542   3.60033  -.003012   .00573

nchild~h |  -.0002581   .0038082    -0.07   0.946   .301286  -.007722  .007206

geozone1*|   .0186856   .0111751     1.74   0.081   .149826  -.003217  .040588

geozone2*|    .120607   .0199014     7.43   0.000    .08022   .081601  .159613

geozone3*|   .0309624   .0120673     2.73   0.006    .20198   .007311  .054614

geozone4*|  -.0650786   .0089935    -5.55   0.000   .087467  -.082705 -.047452

geozone5*|  -.0487474   .0098681    -4.15   0.000   .109818  -.068089 -.029406

     age |   .0008471   .0034181     0.25   0.804   33.9263  -.005852  .007546
```

age2	-.0000406	.0000503	-0.81	0.421	1213.37	-.000139	.000058
marital1*	.0679518	.0181659	2.78	0.005	.919167	.032347	.103556
marital2*	.2286142	.1310112	2.26	0.024	.003062	-.028163	.485391
marital3*	.047994	.0451355	1.18	0.237	.06338	-.04047	.136458
lnhhs	-.0350402	.009263	-3.78	0.000	1.61693	-.053195	-.016885
educatn2*	.0059729	.0095884	0.63	0.530	.248622	-.01282	.024766
educatn3*	-.0039693	.00897	-0.44	0.660	.318432	-.02155	.013612
educatn4*	-.0203712	.0102831	-1.88	0.060	.145948	-.040526	-.000217
lnpcexpd	.0005885	.0005837	1.01	0.314	4.87595	-.000555	.001732
hoursdy	-.0217427	.0008861	-21.50	0.000	6.42668	-.023479	-.020006
obs. P	.1544193						
pred. P	.1093165 (at x-bar)						

(*) dF/dx is for discrete change of dummy variable from 0 to 1

z and P>|z| correspond to the test of the underlying coefficient being 0

-> sector = RURAL

Iteration 0: log pseudolikelihood = -15397.456

Iteration 1: log pseudolikelihood = -13522.868

Iteration 2: log pseudolikelihood = -13443.433

Iteration 3: log pseudolikelihood = -13442.597

Iteration 4: log pseudolikelihood = -13442.597

Probit regression, reporting marginal effects Number of obs = 31777

Wald chi2(18) =2649.78

Prob > chi2 = 0.0000

Log pseudolikelihood = -13442.597 Pseudo R2 = 0.1270

	Robust						
polafo~2	dF/dx	Std. Err.	z	P>|z|	x-bar	[95%	C.I.]
nchild~n	-.0053992	.0013321	-4.05	0.000	3.81808	-.00801	-.002788
nchild~h	.0009052	.0021223	0.43	0.670	.440413	-.003254	.005065
geozone1*	.0710414	.0135877	5.63	0.000	.190326	.04441	.097673
geozone2*	.2115883	.0161561	15.06	0.000	.207005	.179923	.243254

geozone3*|	.0863401	.012935	7.05	0.000	.330239	.060988	.111692
geozone4*|	.037931	.0153363	2.62	0.009	.089719	.007872	.06799
geozone5*|	-.0148251	.0128947	-1.12	0.263	.122038	-.040098	.010448
age |	.0046287	.0020139	2.30	0.022	32.2411	.000682	.008576
age2 |	-.0000605	.0000304	-1.99	0.047	1105.91	-.00012	-9.2e-07
marital1*|	.0464959	.0176102	2.35	0.019	.945936	.011981	.081011
marital2*|	.1303883	.0760146	2.01	0.045	.00192	-.018597	.279374
marital3*|	-.0261325	.023944	-1.03	0.304	.038896	-.073062	.020797
lnhhs |	-.0230223	.0056662	-4.06	0.000	1.6916	-.034128	-.011917
educatn2*|	-.0242141	.0056356	-4.17	0.000	.231425	-.03526	-.013169
educatn3*|	-.0046765	.0075603	-0.61	0.539	.124587	-.019494	.010141
educatn4*|	-.0425362	.0125201	-3.04	0.002	.032036	-.067075	-.017997
lnpcexpd |	.0007859	.0003945	1.99	0.046	4.84321	.000013	.001559
hoursdy |	-.0224954	.0006092	-34.05	0.000	5.67151	-.023689	-.021301

---------+---

obs. P |	.1888473
pred. P |	.1527226 (at x-bar)

(*) dF/dx is for discrete change of dummy variable from 0 to 1

z and P>|z| correspond to the test of the underlying coefficient being 0

. bysort Zone:dprobit polaforce2 nchildren nchildeath residence1 age age2 marit

> al1 marital2 marital3 lnhhs educatn2 educatn3 educatn4 lnpcexpd hoursdy, robu

> st

-> Zone = North Cent

Iteration 0: log pseudolikelihood = -3037.8182

Iteration 1: log pseudolikelihood = -2694.4131

Iteration 2: log pseudolikelihood = -2685.4133

Iteration 3: log pseudolikelihood = -2685.3909

Iteration 4: log pseudolikelihood = -2685.3909

Probit regression, reporting marginal effects Number of obs = 7516

Wald chi2(14) = 386.74

Prob > chi2 = 0.0000

Log pseudolikelihood = -2685.3909 Pseudo R2 = 0.1160

		Robust					
polafo~2	dF/dx	Std. Err.	z	P>|z|	x-bar	[95%	C.I.]
nchild~n	.0042419	.0026566	1.60	0.111	3.63717	-.000965	.009449
nchild~h	-.0026372	.0053764	-0.49	0.624	.297499	-.013175	.0079
reside~1*	-.0001022	.0097365	-0.01	0.992	.195317	-.019185	.018981
age	.0082384	.0041505	1.98	0.047	32.9089	.000104	.016373
age2	-.0001426	.0000612	-2.33	0.020	1143.65	-.000263	-.000023
marital1*	.0313519	.0413247	0.68	0.497	.959021	-.049643	.112347
marital2*	.0011529	.1009522	0.01	0.991	.001597	-.19671	.199015
marital3*	-.0043998	.0555866	-0.08	0.938	.033262	-.113348	.104548
lnhhs	-.0265386	.010972	-2.41	0.016	1.68813	-.048043	-.005034
educatn2*	-.0168312	.00892	-1.83	0.067	.237759	-.034314	.000652
educatn3*	-.0114508	.0106993	-1.04	0.298	.142895	-.032421	.009519
educatn4*	.0195974	.0197854	1.04	0.298	.054417	-.019181	.058376

lnpcexpd | .0009852 .0007022 1.40 0.161 5.15988 -.000391 .002362

hoursdy | -.0250988 .0011282 -18.83 0.000 6.7725 -.02731 -.022888

---------+--

obs. P | .1395689

pred. P | .114163 (at x-bar)

(*) dF/dx is for discrete change of dummy variable from 0 to 1

z and P>|z| correspond to the test of the underlying coefficient being 0

-> Zone = North East

Iteration 0: log pseudolikelihood = -4619.6674

Iteration 1: log pseudolikelihood = -4391.5294

Iteration 2: log pseudolikelihood = -4389.6651

Iteration 3: log pseudolikelihood = -4389.6639

Probit regression, reporting marginal effects Number of obs = 7364

Wald chi2(14) = 365.32

Prob > chi2 = 0.0000

Log pseudolikelihood = -4389.6639 Pseudo R2 = 0.0498

	Robust					
polafo~2	dF/dx	Std. Err.	z	P>|z|	x-bar	[95% C.I.]
nchild~n	-.0072443	.0035493	-2.04	0.041	3.94826	-.014201 -.000288
nchild~h	.0004294	.0055597	0.08	0.938	.460483	-.010467 .011326
reside~1*	.0180827	.0182103	1.00	0.316	.106735	-.017609 .053774
age	.0161584	.0054073	2.99	0.003	31.1013	.00556 .026756
age2	-.0002255	.0000823	-2.74	0.006	1033.41	-.000387 -.000064
marital1*	.1783672	.0409605	3.35	0.001	.969989	.098086 .258648
marital2*	.1394467	.2157358	0.68	0.499	.000951	-.283388 .562281
marital3*	.034735	.0868161	0.41	0.683	.016703	-.135421 .204891
lnhhs	.0150394	.0154974	0.97	0.332	1.74954	-.015335 .045414
educatn2*	.0687608	.0179956	3.93	0.000	.123574	.03349 .104032
educatn3*	.0615064	.0230912	2.74	0.006	.075367	.016249 .106764
educatn4*	-.0708378	.0374692	-1.77	0.076	.023628	-.144276 .0026
lnpcexpd	.0008578	.0010676	0.80	0.422	4.77501	-.001235 .00295
hoursdy	-.026102	.0014819	-17.36	0.000	4.69127	-.029006 -.023198

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obs. P | .3206138

pred. P | .3104428 (at x-bar)

(*) dF/dx is for discrete change of dummy variable from 0 to 1

z and P>|z| correspond to the test of the underlying coefficient being 0

-> Zone = North West

Iteration 0: log pseudolikelihood = -6947.0354

Iteration 1: log pseudolikelihood = -6323.5383

Iteration 2: log pseudolikelihood = -6298.3423

Iteration 3: log pseudolikelihood = -6298.1041

Iteration 4: log pseudolikelihood = -6298.1039

Probit regression, reporting marginal effects Number of obs = 12473

Wald chi2(14) = 833.91

Prob > chi2 = 0.0000

Log pseudolikelihood = -6298.1039 Pseudo R2 = 0.0934

	Robust					
polafo~2	dF/dx	Std. Err.	z	P>|z|	x-bar	[95% C.I.]
nchild~n	-.0087246	.0023123	-3.78	0.000	3.88904	-.013257 -.004192
nchild~h	.0020519	.0034617	0.59	0.553	.565301	-.004733 .008837
reside~1*	.0370842	.011377	3.36	0.001	.158663	.014786 .059383
age	.0045648	.0037	1.23	0.217	30.7046	-.002687 .011817
age2	-.0000524	.0000575	-0.91	0.362	1004.88	-.000165 .00006
marital1*	.0883729	.0289114	2.58	0.010	.971218	.031708 .145038
marital2*	.1667739	.1685992	1.10	0.270	.000802	-.163674 .497222
marital3*	-.1345868	.0339592	-2.77	0.006	.016035	-.201146 -.068028
lnhhs	-.0617464	.0102834	-6.01	0.000	1.7595	-.081902 -.041591
educatn2*	-.053412	.0111927	-4.48	0.000	.125631	-.075349 -.031475
educatn3*	-.0133597	.0159068	-0.83	0.409	.06029	-.044536 .017817
educatn4*	-.0905344	.0222914	-3.39	0.001	.022368	-.134225 -.046844
lnpcexpd	.0003412	.0007288	0.47	0.640	4.74399	-.001087 .00177

hoursdy | -.0355622   .0012981   -25.21   0.000   3.25956 -.038106 -.033018

---------+--

obs. P | .2451696

pred. P | .216283 (at x-bar)

(*) dF/dx is for discrete change of dummy variable from 0 to 1

z and P>|z| correspond to the test of the underlying coefficient being 0

-> Zone = South East

Iteration 0:   log pseudolikelihood = -990.01309

Iteration 1:   log pseudolikelihood = -902.46618

Iteration 2:   log pseudolikelihood = -898.41377

Iteration 3:   log pseudolikelihood = -898.37828

Iteration 4:   log pseudolikelihood = -898.37827

Probit regression, reporting marginal effects   Number of obs =   3708

Wald chi2(14) = 172.92

Prob > chi2 = 0.0000

Log pseudolikelihood = -898.37827 Pseudo R2 = 0.0926

polafo~2	dF/dx	Robust Std. Err.	z	P>|z|	x-bar	[95% C.I.]	
nchild~n	-.0047017	.0026818	-1.74	0.081	3.94391	-.009958	.000555
nchild~h	.0064949	.0043439	1.49	0.137	.371359	-.002019	.015009
reside~1*	-.0281342	.0075103	-3.45	0.001	.231122	-.042854	-.013414
age	.0014721	.0040156	0.37	0.714	36.1103	-.006398	.009343
age2	-.0000518	.0000571	-0.91	0.365	1363.73	-.000164	.00006
marital1*	.0186056	.0230044	0.72	0.472	.890507	-.026482	.063693
marital2*	.4132548	.3301063	1.81	0.070	.000539	-.233742	1.06025
marital3*	-.0061995	.0302199	-0.20	0.843	.096818	-.065429	.05303
lnhhs	-.0226262	.0104461	-2.18	0.029	1.60918	-.0431	-.002152
educatn2*	-.0437842	.0096134	-4.43	0.000	.418015	-.062626	-.024942
educatn3*	-.0438329	.0092215	-4.25	0.000	.324434	-.061907	-.025759

educatn4*| -.0510213   .0070987   -4.47   0.000   .105987 -.064934 -.037108

lnpcexpd | .0006133   .0006825   0.90   0.368   5.0517 -.000724 .001951

hoursdy | -.0084472   .001019   -7.67   0.000   8.19391 -.010444 -.00645

---------+--

obs. P | .0752427

pred. P | .0572384 (at x-bar)

(*) dF/dx is for discrete change of dummy variable from 0 to 1

z and P>|z| correspond to the test of the underlying coefficient being 0

-> Zone = South Sout

Iteration 0:   log pseudolikelihood = -1082.0413

Iteration 1:   log pseudolikelihood = -1008.2169

Iteration 2:   log pseudolikelihood = -1006.2564

Iteration 3:   log pseudolikelihood = -1006.2518

Iteration 4:   log pseudolikelihood = -1006.2518

Probit regression, reporting marginal effects Number of obs = 4954

Wald chi2(14) = 118.20

Prob > chi2 = 0.0000

Log pseudolikelihood = -1006.2518 Pseudo R2 = 0.0700

polafo~2	dF/dx	Robust Std. Err.	z	P>|z|	x-bar	[95% C.I.	]
nchild~n	-.0029068	.0020418	-1.41	0.157	3.81046	-.006909	.001095
nchild~h	.0004466	.0032537	0.14	0.891	.389988	-.005931	.006824
reside~1*	.0061931	.0072813	0.87	0.382	.217198	-.008078	.020464
age	-.0102558	.0027642	-3.73	0.000	34.3843	-.015674	-.004838
age2	.0001283	.0000403	3.20	0.001	1249.83	.000049	.000207
marital1*	.0145041	.0133197	0.98	0.326	.855268	-.011602	.04061
marital2*	-.0089559	.0379858	-0.22	0.829	.004643	-.083407	.065495
marital3*	-.0041688	.0193455	-0.21	0.834	.106581	-.042085	.033748

lnhhs | .0075816 .0084707 0.89 0.371 1.54869 -.009021 .024184

educatn2*| -.011571 .0089879 -1.28 0.202 .442673 -.029187 .006045

educatn3*| -.0028298 .0090997 -0.31 0.758 .318329 -.020665 .015005

educatn4*| -.0118415 .010571 -1.02 0.308 .091038 -.03256 .008877

lnpcexpd | .0007442 .0005329 1.39 0.163 4.82932 -.0003 .001789

hoursdy | -.0052252 .0006898 -7.02 0.000 8.37942 -.006577 -.003873

---------+--

obs. P | .0569237

pred. P | .0469115 (at x-bar)

(*) dF/dx is for discrete change of dummy variable from 0 to 1

z and P>|z| correspond to the test of the underlying coefficient being 0

-> Zone = South West

Iteration 0: log pseudolikelihood = -1646.2175

Iteration 1: log pseudolikelihood = -1425.4646

Iteration 2: log pseudolikelihood = -1418.8942

```
Iteration 3:   log pseudolikelihood = -1418.8676

Iteration 4:   log pseudolikelihood = -1418.8676

Probit regression, reporting marginal effects           Number of obs =   5560

                                                  Wald chi2(14) = 315.01

                                                  Prob > chi2   = 0.0000

Log pseudolikelihood = -1418.8676                      Pseudo R2     = 0.1381

------------------------------------------------------------------------------
         |               Robust
polafo~2 |      dF/dx   Std. Err.      z    P>|z|     x-bar  [    95% C.I.   ]
---------+--------------------------------------------------------------------

nchild~n |   .0050102   .0027478     1.83   0.068   3.27014  -.000375  .010396

nchild~h |   -.003732   .0058002    -0.64   0.520   .172662    -.0151  .007636

reside~1*|   .0264488       .007     3.60   0.000   .653237   .012729  .040168

     age |  -.0095147   .0037011    -2.57   0.010    34.775  -.016769 -.002261

    age2 |   .0001263   .0000528     2.39   0.017   1266.73   .000023   .00023

marital1*|   .0496434   .0195365     1.64   0.102   .910252   .011353  .087934

marital2*|   .3078498   .1646836     2.72   0.007   .006655  -.014924  .630624

marital3*|   .0978848   .0846973     1.51   0.132   .071403  -.068119  .263888
```

```
   lnhhs |  -.0305588   .0090284    -3.41   0.001   1.51797  -.048254 -.012863

educatn2*|  -.0019359   .0091872    -0.21   0.834   .320683  -.019943  .016071

educatn3*|  -.0099281   .0093268    -1.04   0.297   .344964  -.028208  .008352

educatn4*|  -.0141505   .0104391    -1.26   0.207   .133453  -.034611   .00631

lnpcexpd |   .0004814   .0005748     0.83   0.404   4.65908  -.000645  .001608

 hoursdy |  -.0159741    .000898   -15.62   0.000   8.12815  -.017734 -.014214

---------+--------------------------------------------------------------------

  obs. P |   .0872302

 pred. P |   .0639303  (at x-bar)

------------------------------------------------------------------------------

(*) dF/dx is for discrete change of dummy variable from 0 to 1

    z and P>|z| correspond to the test of the underlying coefficient being 0
.
end of do-file
```

FIRST STAGE REGRESSION RESULTS

*First Stage Regression of Determinnats of Fertility AT NATIONAL LEVEL

end of do-file

. do "C:\DOCUME~1\Ovi\LOCALS~1\Temp\STD0k000000.tmp"

. *CHILD MORTALITY

. regress nchildeath toilettyp1 marital1 marital2 marital3 residence1 religion1

> religion2 religion4 geozone1 geozone2 geozone3 geozone4 geozone5 age age2 ln

> hhs firstdevage firstdevage2 genderpref1 genderpref2 contrause1 costcontra ed

> ucatn2 educatn3 educatn4 lnpcexpd, robust

Linear regression Number of obs = 41575

F(26, 41548) = 54.81

Prob > F = 0.0000

R-squared = 0.0396

Root MSE = 1.0697

| Robust

nchildeath	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
toilettyp1	-.0342388	.0152584	-2.24	0.025	-.0641456	-.0043321
marital1	-.1199444	.0462945	-2.59	0.010	-.2106826	-.0292062
marital2	-.1232367	.1182164	-1.04	0.297	-.3549433	.1084698
marital3	-.1571105	.053655	-2.93	0.003	-.2622755	-.0519455
residence1	-.0267158	.0135198	-1.98	0.048	-.0532148	-.0002168
religion1	.0124158	.0545702	0.23	0.820	-.0945429	.1193745
religion2	.0308572	.0548918	0.56	0.574	-.0767318	.1384462
religion4	-.2059217	.0784255	-2.63	0.009	-.3596374	-.052206
geozone1	.0988862	.0146329	6.76	0.000	.0702054	.127567
geozone2	.2563375	.0188898	13.57	0.000	.2193132	.2933619
geozone3	.3598804	.018932	19.01	0.000	.3227733	.3969875
geozone4	.1758172	.018904	9.30	0.000	.1387649	.2128695
geozone5	.1941091	.0185902	10.44	0.000	.1576719	.2305462
age	.040544	.0055333	7.33	0.000	.0296985	.0513894
age2	-.0002977	.0000838	-3.55	0.000	-.0004619	-.0001335

```
      lnhhs |  -.1007001   .0151445    -6.65   0.000    -.1303836   -.0710166

 firstdevage |  -.0139787   .0045477    -3.07   0.002    -.0228923   -.0050652

firstdevage2 |  -.0000527   .0001019    -0.52   0.605    -.0002524     .000147

 genderpref1 |  -.0592672   .0122536    -4.84   0.000    -.0832844   -.0352499

 genderpref2 |  -.0915416   .0130421    -7.02   0.000    -.1171043   -.0659789

  contrause1 |  -.0260436   .0131584    -1.98   0.048    -.0518344   -.0002528

  costcontra |   4.16e-06   .0000109     0.38   0.703    -.0000172    .0000256

    educatn2 |  -.0323556   .0145014    -2.23   0.026    -.0607787   -.0039326

    educatn3 |  -.0388257   .0160969    -2.41   0.016    -.0703761   -.0072754

    educatn4 |  -.1198078   .0210819    -5.68   0.000    -.1611288   -.0784867

    lnpcexpd |   .0003618   .0009919     0.36   0.715    -.0015824    .0023059

       _cons |  -.1597737   .1147867    -1.39   0.164    -.3847581    .0652106

------------------------------------------------------------------------------
.
end of do-file

. do "C:\DOCUME~1\Ovi\LOCALS~1\Temp\STD0k000000.tmp"

. *MATERNAL LABOUR PARTICIPATION
```

```
. probit pformal1 costelect marital1 marital2 marital3 residence1 religion1 rel
> igion2 religion4 geozone1 geozone2 geozone3 geozone4 geozone5 age age2 lnhhs
> firstdevage firstdevage2 genderpref1 genderpref2 contrause1 costcontra educat
> n2 educatn3 educatn4  lnpcexpd, robust

Iteration 0:   log pseudolikelihood = -11192.319
Iteration 1:   log pseudolikelihood = -8543.0011
Iteration 2:   log pseudolikelihood = -8503.2275
Iteration 3:   log pseudolikelihood = -8503.0389
Iteration 4:   log pseudolikelihood = -8503.0389

Probit regression                              Number of obs   =      41575
                                               Wald chi2(26)   =    4982.14
                                               Prob > chi2     =     0.0000
Log pseudolikelihood = -8503.0389              Pseudo R2       =     0.2403

------------------------------------------------------------------------------
             |               Robust
    pformal1 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
```

-------------+--

costelect |	.0000237	.0000116	2.03	0.042	8.43e-07	.0000465
marital1 |	-.0343095	.0912652	-0.38	0.707	-.213186	.1445671
marital2 |	-.0904803	.2379823	-0.38	0.704	-.5569169	.3759564
marital3 |	.1124973	.1019563	1.10	0.270	-.0873335	.312328
residence1 |	.1989506	.0256789	7.75	0.000	.1486209	.2492804
religion1 |	.4564326	.1567045	2.91	0.004	.1492975	.7635678
religion2 |	.3013174	.1571271	1.92	0.055	-.006646	.6092808
religion4 |	.6469384	.2246021	2.88	0.004	.2067263	1.08715
geozone1 |	.1334064	.0382942	3.48	0.000	.0583512	.2084616
geozone2 |	.2282442	.043921	5.20	0.000	.1421607	.3143278
geozone3 |	.3706448	.0406839	9.11	0.000	.2909057	.4503838
geozone4 |	.0669837	.0432161	1.55	0.121	-.0177183	.1516856
geozone5 |	.2394544	.0399373	6.00	0.000	.1611788	.31773
age |	.0022721	.0108838	0.21	0.835	-.0190598	.023604
age2 |	.0000991	.0001579	0.63	0.530	-.0002104	.0004086

lnhhs	-.0343339	.0268197	-1.28	0.200	-.0868995	.0182318
firstdevage	-.0205868	.0070382	-2.92	0.003	-.0343815	-.0067921
firstdevage2	.0006606	.0001598	4.13	0.000	.0003474	.0009737
genderpref1	.0072349	.0253189	0.29	0.775	-.0423893	.0568591
genderpref2	.0232596	.0275348	0.84	0.398	-.0307076	.0772268
contrause1	.0961419	.0280453	3.43	0.001	.0411742	.1511096
costcontra	.000018	.0000184	0.98	0.328	-.000018	.000054
educatn2	.1054542	.0318032	3.32	0.001	.0431212	.1677873
educatn3	.5115532	.0326665	15.66	0.000	.4475281	.5755784
educatn4	1.895572	.0369145	51.35	0.000	1.823221	1.967923
lnpcexpd	-.0018252	.0019533	-0.93	0.350	-.0056537	.0020033
_cons	-2.47974	.2498752	-9.92	0.000	-2.969486	-1.989994

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end of do-file

*First Stage Regression of Determinants of Child Mortality AT NATIONAL LEVEL

Fertility

```
. regress nchildren costcontra age age2 marital1 marital2 marital3 lnhhs reside

> nce1 geozone1 geozone2 geozone3 geozone4 geozone5 uvaccine1 uvaccine3 cvaccin

> e dplace1 birthwgt pcare1 pcare2 pcare3 cprecare cposcare educatn2 educatn3 e

> ducatn4 mosqnet1 costelect drwater1 drwater2 drwater4 toilettyp1 toilettyp2 d

> hosp1 dhosp2 dclinic1 dclinic2 lnpcexpd, robust

Linear regression                          Number of obs =   40382

                                           F( 38, 40343) =  636.24

                                           Prob > F      =  0.0000

                                           R-squared     =  0.3781

                                           Root MSE      =  1.7087

------------------------------------------------------------------------------
             |               Robust
   nchildren |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]

-------------+----------------------------------------------------------------

  costcontra |   .0000677   .0000188     3.60   0.000     .0000309    .0001046

         age |   .1632378   .0087228    18.71   0.000     .1461409    .1803347

        age2 |  -.0006533   .0001329    -4.92   0.000    -.0009139   -.0003928
```

marital1	-.4850868	.0911702	-5.32	0.000	-.6637825	-.3063912
marital2	-.5013044	.2287859	-2.19	0.028	-.94973	-.0528789
marital3	-.1739065	.1024828	-1.70	0.090	-.3747752	.0269623
lnhhs	1.667017	.0253534	65.75	0.000	1.617324	1.716711
residence1	.0116443	.0242238	0.48	0.631	-.0358349	.0591235
geozone1	.257461	.0278772	9.24	0.000	.2028211	.312101
geozone2	.7275246	.0336906	21.59	0.000	.6614903	.793559
geozone3	.7108655	.0323722	21.96	0.000	.6474152	.7743158
geozone4	.2448758	.0350406	6.99	0.000	.1761953	.3135562
geozone5	.4137232	.032511	12.73	0.000	.3500008	.4774456
uvaccine1	.6896061	.3681715	1.87	0.061	-.0320184	1.411231
uvaccine3	.5461619	.3352577	1.63	0.103	-.1109508	1.203275
cvaccine	.0014868	.0018578	0.80	0.424	-.0021546	.0051281
dplace1	.1229353	.1355131	0.91	0.364	-.1426735	.3885442
birthwgt	-.0276559	.0076029	-3.64	0.000	-.0425577	-.0127541
pcare1	.3584769	.0296876	12.07	0.000	.3002885	.4166652
pcare2	.2452881	.0839051	2.92	0.003	.0808322	.4097439

pcare3	.1796143	.0342477	5.24	0.000	.1124881	.2467406
cprecare	-.0000216	7.53e-06	-2.86	0.004	-.0000363	-6.80e-06
cposcare	.0000173	8.67e-06	2.00	0.046	3.23e-07	.0000343
educatn2	.3218444	.0245673	13.10	0.000	.2736919	.3699969
educatn3	-.0288888	.0264548	-1.09	0.275	-.0807407	.0229631
educatn4	-.3444494	.0378756	-9.09	0.000	-.4186863	-.2702124
mosqnet1	-.1669448	.0234638	-7.11	0.000	-.2129344	-.1209552
costelect	-3.88e-06	.0000128	-0.30	0.761	-.0000289	.0000212
drwater1	-.0808231	.0314243	-2.57	0.010	-.1424155	-.0192308
drwater2	-.0845675	.0198469	-4.26	0.000	-.1234678	-.0456671
drwater4	-.1519277	.0642465	-2.36	0.018	-.2778523	-.0260031
toilettyp1	.0164156	.0318989	0.51	0.607	-.046107	.0789381
toilettyp2	-.0772765	.0210427	-3.67	0.000	-.1185206	-.0360323
dhosp1	-.0952013	.0301963	-3.15	0.002	-.1543867	-.0360158
dhosp2	-.0914576	.0237804	-3.85	0.000	-.1380678	-.0448474
dclinic1	.0045593	.0301325	0.15	0.880	-.054501	.0636196

```
   dclinic2 |  -.0120046   .0277502    -0.43   0.665    -.0663957    .0423865

   lnpcexpd |  -.0010682   .0016106    -0.66   0.507     -.004225    .0020886

      _cons |  -4.076616   .3673783   -11.10   0.000    -4.796686   -3.356546

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```

end of do-file

. do "C:\DOCUME~1\Ovi\LOCALS~1\Temp\STD0m000000.tmp"

. *MATERNAL LABOUR PARTicipation

end of do-file

. do "C:\DOCUME~1\Ovi\LOCALS~1\Temp\STD0m000000.tmp"

. probit pinformal1 hoursdy costelect age age2 marital1 marital2 marital3 lnhhs

> residence1 geozone1 geozone2 geozone3 geozone4 geozone5 uvaccine1 uvaccine3

> cvaccine dplace1 birthwgt pcare1 pcare2 pcare3 cprecare cposcare educatn2 edu

> catn3 educatn4 mosqnet1 drwater1 drwater2 drwater4 toilettyp1 toilettyp2 dhos

> p1 dhosp2 dclinic1 dclinic2 lnpcexpd, robust

Iteration 0:   log pseudolikelihood = -27926.157

Iteration 1:   log pseudolikelihood = -25763.02

Iteration 2:   log pseudolikelihood = -25760.512

Iteration 3:   log pseudolikelihood = -25760.512

Probit regression   Number of obs   =   40382

Wald chi2(38)   =   3794.24

Prob > chi2   =   0.0000

Log pseudolikelihood = -25760.512   Pseudo R2   =   0.0775

| Robust

pinformal1 | Coef.   Std. Err.   z   P>|z| [95% Conf. Interval]

-------------+--

hoursdy | .0584357   .0017377   33.63   0.000   .0550299   .0618414

costelect | .0000292   9.71e-06   3.01   0.003   .0000102   .0000482

age | .0255415   .0063951   3.99   0.000   .0130074   .0380756

age2 | -.0004103   .0000952   -4.31   0.000   -.0005968   -.0002238

marital1 | .1198168   .0584127   2.05   0.040   .00533   .2343035

marital2	.1032313	.1509253	0.68	0.494	-.1925769	.3990394
marital3	-.2005805	.0670641	-2.99	0.003	-.3320236	-.0691373
lnhhs	-.0580368	.0164851	-3.52	0.000	-.0903469	-.0257267
residence1	.1607663	.0189247	8.50	0.000	.1236746	.197858
geozone1	-.3065247	.0256575	-11.95	0.000	-.3568124	-.256237
geozone2	-.3667075	.0286341	-12.81	0.000	-.4228293	-.3105856
geozone3	-.130466	.027663	-4.72	0.000	-.1846844	-.0762476
geozone4	-.860904	.0300554	-28.64	0.000	-.9198115	-.8019965
geozone5	-.6935364	.0279822	-24.78	0.000	-.7483805	-.6386923
uvaccine1	.0512092	.2862178	0.18	0.858	-.5097675	.6121858
uvaccine3	-.0199273	.263727	-0.08	0.940	-.5368226	.4969681
cvaccine	.0016622	.0010484	1.59	0.113	-.0003926	.003717
dplace1	-.1443985	.1306861	-1.10	0.269	-.4005385	.1117416
birthwgt	-.0001045	.0110709	-0.01	0.992	-.021803	.021594
pcare1	.0009582	.0226184	0.04	0.966	-.043373	.0452894
pcare2	.0894697	.0687215	1.30	0.193	-.045222	.2241614

pcare3 |	.0523802	.0287984	1.82	0.069	-.0040636	.108824
cprecare |	-4.57e-06	7.47e-06	-0.61	0.540	-.0000192	.0000101
cposcare |	1.48e-06	8.26e-06	0.18	0.858	-.0000147	.0000177
educatn2 |	-.0873154	.0179866	-4.85	0.000	-.1225685	-.0520623
educatn3 |	.0353654	.0219177	1.61	0.107	-.0075925	.0783232
educatn4 |	-.9529991	.0353348	-26.97	0.000	-1.022254	-.8837442
mosqnet1 |	.19865	.018894	10.51	0.000	.1616185	.2356815
drwater1 |	.0531634	.0233652	2.28	0.023	.0073685	.0989584
drwater2 |	.1337734	.0147152	9.09	0.000	.1049321	.1626147
drwater4 |	.1439714	.0683474	2.11	0.035	.0100129	.2779299
toilettyp1 |	.2049661	.0236856	8.65	0.000	.1585433	.251389
toilettyp2 |	.2203875	.0164081	13.43	0.000	.1882282	.2525468
dhosp1 |	.0742142	.0226157	3.28	0.001	.0298883	.1185402
dhosp2 |	.0363212	.0179128	2.03	0.043	.0012128	.0714296
dclinic1 |	.0703633	.0223242	3.15	0.002	.0266087	.114118
dclinic2 |	.0553509	.0207506	2.67	0.008	.0146804	.0960214

```
   lnpcexpd |   .0002445   .0012293     0.20   0.842    -.0021649    .0026539

      _cons |    -.61079   .2853281    -2.14   0.032    -1.170023   -.0515573
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.
end of do-file

. do "C:\DOCUME~1\Ovi\LOCALS~1\Temp\STD0m000000.tmp"

. probit polaforce2 hoursdy costelect age age2 marital1 marital2 marital3 lnhhs

>  residence1 geozone1 geozone2 geozone3 geozone4 geozone5 uvaccine1 uvaccine3

> cvaccine dplace1 birthwgt pcare1 pcare2 pcare3 cprecare cposcare educatn2 edu

> catn3 educatn4 mosqnet1 drwater1 drwater2 drwater4 toilettyp1 toilettyp2 dhos

> p1 dhosp2 dclinic1 dclinic2 lnpcexpd, robust

Iteration 0:   log pseudolikelihood =  -19016.45

Iteration 1:   log pseudolikelihood = -16434.161

Iteration 2:   log pseudolikelihood =  -16364.76

Iteration 3:   log pseudolikelihood = -16364.451

Iteration 4:   log pseudolikelihood = -16364.451

Probit regression                                 Number of obs   =      40382

                                                  Wald chi2(38)   =    3649.22
```

Prob > chi2 = 0.0000

Log pseudolikelihood = -16364.451 Pseudo R2 = 0.1395

polaforce2	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
hoursdy	-.0983368	.0025386	-38.74	0.000	-.1033124	-.0933613
costelect	-1.04e-06	8.73e-06	-0.12	0.905	-.0000182	.0000161
age	.017173	.0077826	2.21	0.027	.0019194	.0324267
age2	-.0002907	.0001175	-2.47	0.013	-.0005211	-.0000603
marital1	.2335485	.0815029	2.87	0.004	.0738058	.3932911
marital2	.5048978	.1903914	2.65	0.008	.1317375	.8780581
marital3	-.1079585	.0984813	-1.10	0.273	-.3009783	.0850614
lnhhs	-.154765	.0200379	-7.72	0.000	-.1940386	-.1154915
residence1	.0399765	.0228096	1.75	0.080	-.0047295	.0846826

geozone1	.1643242	.0334319	4.92	0.000	.0987989	.2298494
geozone2	.6072773	.0357829	16.97	0.000	.5371442	.6774105
geozone3	.204728	.0352007	5.82	0.000	.1357359	.2737201
geozone4	-.011631	.042623	-0.27	0.785	-.0951705	.0719085
geozone5	-.1923682	.0419384	-4.59	0.000	-.2745659	-.1101705
uvaccine1	-.66915	.310258	-2.16	0.031	-1.277244	-.0610555
uvaccine3	-.4493088	.2788076	-1.61	0.107	-.9957617	.0971441
cvaccine	.0001365	.0009686	0.14	0.888	-.0017619	.002035
dplace1	-.0143731	.1480105	-0.10	0.923	-.3044683	.275722
birthwgt	.0012874	.0105705	0.12	0.903	-.0194304	.0220052
pcare1	-.0396125	.0270383	-1.47	0.143	-.0926067	.0133816
pcare2	.0176645	.0838149	0.21	0.833	-.1466097	.1819388
pcare3	-.0584255	.0366537	-1.59	0.111	-.1302655	.0134145
cprecare	7.02e-06	7.89e-06	0.89	0.374	-8.45e-06	.0000225
cposcare	-.0000156	.0000162	-0.96	0.336	-.0000473	.0000162
educatn2	-.0814676	.0228278	-3.57	0.000	-.1262092	-.036726

```
   educatn3 |   -.042516   .0276647    -1.54   0.124    -.0967379    .0117058

   educatn4 |  -.1708195   .0447216    -3.82   0.000    -.2584722   -.0831668

   mosqnet1 |   .0233338   .0233595     1.00   0.318    -.0224499    .0691175

   drwater1 |  -.0009759   .0278297    -0.04   0.972    -.0555211    .0535693

   drwater2 |  -.0039064   .0177582    -0.22   0.826    -.0387118    .0308989

   drwater4 |   .0680911   .0858249     0.79   0.428    -.1001225    .2363048

 toilettyp1 |  -.0056392   .0297878    -0.19   0.850    -.0640223    .0527439

 toilettyp2 |   .0730644   .0207118     3.53   0.000       .03247    .1136587

     dhosp1 |    .001124   .0271848     0.04   0.967    -.0521573    .0544053

     dhosp2 |   -.062913   .0218456    -2.88   0.004    -.1057295   -.0200964

   dclinic1 |   .1486065   .0278246     5.34   0.000     .0940714    .2031417

   dclinic2 |   .1097885   .0258104     4.25   0.000     .0592009     .160376

  lnpcexpd |   .0032859   .0014956     2.20   0.028     .0003546    .0062171

      _cons |   -.509232   .3109933    -1.64   0.102    -1.118768    .1003038

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end of do-file
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. do "C:\DOCUME~1\Ovi\LOCALS~1\Temp\STD0k000000.tmp"

. First Stage Regression of Determinants of Maternl Labour Participation AT NATIONAL LEVEL

 *formal sector

 *fertility

. regress nchildren marital1 marital2 residence1 geozone1 geozone2 geozone3 geo

> zone4 geozone5 age age2 lnhhs educatn2 educatn3 educatn4 lnpcexpd hoursdy, ro

> bust

Linear regression                    Number of obs =   41575

                                     F( 16, 41558) = 1520.98

                                     Prob > F      =  0.0000

                                     R-squared     =  0.3731

                                     Root MSE      =  1.7151

------------------------------------------------------------------------------
             |               Robust
   nchildren |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]

-------------+----------------------------------------------------------------

    marital1 |  -.3512014   .0412987    -8.50   0.000    -.4321478   -.2702551

    marital2 |   -.371392   .2088569    -1.78   0.075    -.7807559     .037972
```

residence1 |	-.0546624	.0218386	-2.50	0.012	-.0974665	-.0118583
geozone1 |	.2887605	.0275663	10.48	0.000	.2347299	.3427911
geozone2 |	.74777	.0324542	23.04	0.000	.6841592	.8113809
geozone3 |	.7254676	.0312013	23.25	0.000	.6643123	.7866229
geozone4 |	.2933606	.0334199	8.78	0.000	.227857	.3588642
geozone5 |	.4364437	.0313263	13.93	0.000	.3750435	.4978438
age |	.1568582	.0085316	18.39	0.000	.1401361	.1735802
age2 |	-.0005995	.0001303	-4.60	0.000	-.000855	-.0003441
lnhhs |	1.670829	.0245441	68.07	0.000	1.622722	1.718936
educatn2 |	.339993	.0247775	13.72	0.000	.2914286	.3885574
educatn3 |	-.040976	.0251968	-1.63	0.104	-.0903623	.0084103
educatn4 |	-.3796816	.0352208	-10.78	0.000	-.448715	-.3106481
lnpcexpd |	-.0006756	.0015957	-0.42	0.672	-.0038033	.002452
hoursdy |	.0049077	.0021321	2.30	0.021	.0007288	.0090867
_cons |	-3.684512	.1348469	-27.32	0.000	-3.948815	-3.42021

```
.
end of do-file

. do "C:\DOCUME~1\Ovi\LOCALS~1\Temp\STD0k000000.tmp"

. *informal sector

. *fertility

. regress nchildren marital1 residence1 geozone1 geozone2 geozone3 geozone4 geo

> zone5 age age2 lnhhs educatn2 educatn3 educatn4 lnpcexpd hoursdy, robust

Linear regression                               Number of obs =   41575

                                                F( 15, 41559) = 1621.71

                                                Prob > F      =  0.0000

                                                R-squared     =  0.3731

                                                Root MSE      =  1.7152

------------------------------------------------------------------------------
             |               Robust
   nchildren |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------

    marital1 |  -.3372869   .0406664    -8.29   0.000    -.4169939   -.2575799

  residence1 |  -.0542364    .021837    -2.48   0.013    -.0970374   -.0114354
```

```
    geozone1 |   .2903586    .027551    10.54   0.000     .2363581    .3443591

    geozone2 |   .7496168   .0324427    23.11   0.000     .6860284    .8132053

    geozone3 |   .7273851    .031187    23.32   0.000      .666258    .7885121

    geozone4 |   .2960643   .0333996     8.86   0.000     .2306003    .3615283

    geozone5 |   .4380431   .0313108    13.99   0.000     .3766733    .4994128

         age |   .1565402   .0085329    18.35   0.000     .1398156    .1732649

        age2 |   -.000595   .0001303    -4.56   0.000    -.0008505   -.0003395

       lnhhs |   1.670231   .0245523    68.03   0.000     1.622108    1.718354

    educatn2 |   .3406159   .0247786    13.75   0.000     .2920494    .3891824

    educatn3 |  -.0408561   .0251926    -1.62   0.105    -.0902342    .0085219

    educatn4 |   -.379366   .0352317   -10.77   0.000    -.4484208   -.3103112

    lnpcexpd |  -.0006578   .0015957    -0.41   0.680    -.0037854    .0024697

     hoursdy |   .0049378   .0021322     2.32   0.021     .0007586    .0091171

       _cons |  -3.694356   .1347125   -27.42   0.000    -3.958396   -3.430317
------------------------------------------------------------------------------

end of do-file
```