LUND UNIVERSITY
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Master in Economic Development and Growth

The Response of Marital Fertility to Short term Macroeconomic Crisis An Event History Analysis, Ethiopia: 1973-2011

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Abstract: This thesis combined the individual level longitudinal data, from the 2011 Ethiopian demographic and health survey, with annual GDP and price indicators, to examine the response of marital fertility to short term macroeconomic stress that Ethiopians has been facing in the last forty years. A two-level discrete time random effect models were employed to estimate the risk of next birth. Rural households, landed and agrarians responded strongly to short term economic stresses. The death of the previous child, education and service sector employment are important moderates of the effect of economic hardships. Strong and significant response is observed only in the second year after the crisis, which evidenced to the absence of planned and deliberate birth controls in this agrarian society. Instead, it pointed to the importance of temporary migration of family member as a coping mechanism to shocks. Similarly, a crisis –induced malnutrition was a plausible mechanism to lower marital fertility in the second year of economic crisis. The study calls for policy measures in improving the productivity and diversified income sources of the small holder agrarians, and reduction of infant and child mortality as a an important tool to lower total fertility rate in the country.

Keywords: economic stress, birth intervals, hazards, marital fertility

EKHM52
Master thesis, second year (15 credits ECTS)
June 2014
Supervisor: Tommy Bengtsson
Examiner: Erik Green

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Acknowledgments

Above all, I am ever grateful to God, the Creator and the Guardian, and to whom I owe my very existence.

I am deeply grateful to Professor Tommy Bengtsson, my supervisor, for his invaluable comments and suggestions. His contributions to this thesis and his profound contribution to my knowledge are very much appreciated. Tommy, Your warm welcomes, in your office, encouragement and guidance helped me in all the time of research and writing of this thesis.

I am indebted to Luciana Quarantine, Lund University, Her inspiration, constructive comments and provision of important materials, helped to smooth the thesis work. I also offer my best regards and blessings to Ely Hernandez, for helping me get through the difficult times, and for all the emotional support, camaraderie, and caring she provided.

Finally, I wish to thank my parents, Belaynesh Aragaw and Birhanu Kebede. They raised me, supported me, taught me, and loved me. To them, I dedicate this thesis.

Chapter 1

Introduction

For centuries, whether induced and other human-made macroeconomic shocks has been threatening the welfare of mankind in different space and time. Such economic hardships had caused people to postpone births or affect their reproduction behaviour (Adserà, 2004). Starting from the Malthusian period, a large number of studies has been conducted by demographers, historians and economists, and discusses the demographic consequence of such crisis. Malthus (1803) explained that macroeconomic shocks diminish the resource base of the society and discourage marriage and sexual intercourse which led to lower fertility and depletion of population size. Similarly, in the late 20thc, more organized macro level studies had found a clear and strong response of fertility to short term macroeconomic crisis from the pre-industrialized society (see, for example: Galloway, 1988; Lee, 1981; Lee, 1990; Bengtsson and Reher, 1998; Bengtsson and ohlsson, 1985).

However, these studies employed a macro data analysis with distributed lag models and lack details to understand the mechanisms through which crisis affect demographic outcomes , to examine the differential impact of crisis by different socio-economic status and, hence, to measure their respective living standard (Bengtsson and Dribe, 2006). Thus, recently, demographers and economists are employing a more effective micro level studies, using event history method, by combining micro demographic data with macroeconomic variables. This enables to examine the fertility response by different socio-economic groups and to trace the timing of responses in greater detail. Most of the studies show that pre industrialized Europeans had been adjusting the number of children and birth timing following macroeconomic shocks and it greatly varies with their socio-economic status (see, Bengtsson and Dribe, 2002; 2006; Adserà, 2009). The degree of impact of this crisis ,on fertility, depend on whether the household is a net producer or a net consumer and its access to resources to smooth consumptions in times of difficulties, which is again determined by the demographic and socio-economic characteristics of the family.

Bengtsson et al (2004) explained that such a measure of demographic consequence of short term macroeconomic crisis has an important role in the study of the relationship between population and living standard. This is especially true in the settings where more direct measures of living standard (income and consumption based measures) are scare or poorly measured. They provide a more effective and indirect measure of living standard defined as the 'ability to overcome short term economic hardships'. That is, the response of migration, nupitality, fertility and mortality to economic stresses is an important indicator of individual's living standard. "If you can fulfil your long term plans to marry, have children, and survive, then you have a high standard of living". Thus, a family with a better standard of living has a range of options, to respond to shocks, other than demographically. It may respond by spending savings, and

borrowing from relatives and other sources, may receive rent and tax relief and other possible options to smooth consumption. On the other hand, a family with no access to these resources can respond only demographically: deliberate or involuntary adjustment of births, out migration, postponement of marriage or may even experience deaths. They further explained that the way households may respond to shocks is determined by its individual and socio-economic status: family size and stage of the family life cycle, land ownership and others.

1.1 Statement of the Problem

With more than 85 percent of the population employed in the agricultural sector, like the pre-industrialized Europeans, the contemporary Ethiopians are an agrarian society. The sector contributes more than 40 percent of the national GDP and generates more than 90 percent of the export earnings (MOFED, 2010). The agricultural production is mainly dominated by small holders who practiced mixed-subsistence farming on the fragmented lands of less than 1 hectare. This agricultural system is largely rain-fed and a modest change in the amount and temporal distribution of the rainfall would cause a considerable decline in crop yields and a rise in grain prices (Admassie, 2013). On the other hand, Ethiopian households are highly vulnerable and have a very low capacity to respond to such macroeconomic crisis (ILRI, 2006). Therefore, whether induced harvest failures had caused frequent droughts and famines in the past few decades. Beside the seasonal food shortages, the country experienced more than five major national droughts and a number of local droughts since 1980 (World Bank, 2008). These cycles of drought keep many rural and urban households in the poverty trap. Moreover, war and political crisis had been claiming the lives of people, caused separation of spouses and consumption losses (Rahmato, 1994).

In the last two decades, the Ethiopian government has been implementing the Economic Reform Program (ERP) with an objective of reducing the widespread poverty and building capacity to resist the recurrent macroeconomic crisis. While implementing the program, a series of Household Income and Consumption Expenditure Surveys (HICES) has been conducted to understand the poverty situation, its main determinates and the standard of living of the various socio-economic groups. A poverty analysis drawn from these HICES were the main official instruments to design policies and evaluate the reform programs on poverty (MOFED, 2013).

However, the poverty measures and analysis based on the cross sectional income and consumption expenditure data are less informative and may be misleading. First: not only these indicators are likely to be poorly measured and have less quality in such poor countries but also are imperfect indicators of living standard. The lower current income of the family, at a point, may not indicate the lower welfare status of the household as long as it can smooth consumptions by transferring future consumptions or selling assets. Similarly, in a society where consumption smoothing possibilities are low, the current consumption expenditure of a family informs only its current standard of living. That is, a consumption data collected in a good harvest season may overestimated the living standard of the household who is highly vulnerable to crisis (World Bank, 2005).Second: Cross sectional data is useful to measure only variation in welfare at a point in time. The poverty analysis, conducted by the government, focus on cataloguing who is currently poor, how poor they are and what is the main determinants of the current poverty situations. However, capable social policies should gobeyond ex-post poverty measures and ex-ante poverty prevention interventions are required. Thus, a clear understanding

of the vulnerability of households to whether induced and other macroeconomic shocks are required."A poverty reduction strategy that ignores the transient nature of poverty misses households that have a high probability of being poor and may instead devote scarce resources to households that are only transiently poor and could have found a way out of poverty without government assistance" (Shewmake, 2008).

The vulnerability to crisis should ideally be assessed with a longitudinal (panel) data of sufficient length and necessary information. The reason for using panel data is that without following households for several years, it is difficult to quantify the volatility faced by households and their responses to it. Nonetheless, panel data are rare in developing countries and, due to costs of data collection, panel data often suffer from small sample sizes and hence, lack of representativeness (Chaudhuri et al., 2002).

Thus, this thesis, employ a proxy measure of vulnerability and living standard of Ethiopian households, the 'ability to overcome short term macroeconomic crisis', following Bengtsson et al (2004). And, the response of marital fertility, of different socio-economic groups, to crisis is examined. Various studies in sub-Saharan Africa and other developing countries observeda clear demographic impact of short term macroeconomic crisis in the today's developing world (see, for example, Kondel et al., 1984; Lesthaeghe, 1989; National Research Council, 1993, Kinfu, 2000; Kabeer, 2001). Lee (1990) also concludes that the fertility response to short term macroeconomic crisis in these countries is similar to the response of pre-industrialized western society.Though these aggregate studiesfound a clear response of marital fertility to shocks, effective policy measures require detail analysis of the response of various socio-economic groups and the channels through which it works. Studies from the pre-industrialized Europe suggests that such a macroeconomic stresses would benefit the rural landholders and is a treat for the urban poor who spend majority of their budget on food, albeit the effect was not spread evenly across the population. But, the difference in time setting, socio-cultural factors, infrastructure and market integrations, economic basis, migration possibilities, degree of intervention of government and international communities in times of crisis may cause different response by socio-economic groups in the two settings.

The most extensive and comprehensive micro level study, in Ethiopia, was conducted by Lindstron and Berhanu (1999) and found a strong response of fertility to political and economic uncertainties (civil war, famine and economic decline), during the 1970s and 1980s. Despite the interesting effort and methods they employ in defining and measuring the macroeconomic shocks and relating its effect on marital fertility, the study is with some shortcomings which (partially) motivated this study. First: Although the study had examined the relationship between economic crisis and marital fertility, it didn't address the possible differential effects of the crisis on families of different individual characteristics and socio-economic status. Moreover, the study was not able to identify the mechanisms by which famine and political stress affect marital fertility. Was there a planned and deliberate response to shocks or a passive response? Second: they employed data from the 1990 national family and fertility survey which excludes the people in the war zones of Northern provinces of the country; Wollo, Gonder, Tigray and Eritrea. These areas were highly vulnerable and severely affected by military attacks and recurrent drought and famine in the1970s and 1980s (Rahmato, 1994). Thus, the inference from their study is likely to underestimate the effect of the crisis. Third: Methodologically, the study fails to control unobserved heterogeneities, among married women under study, which are likely to happen in such repeated event history analysis. There might be individual level unobserved

factors which would increase/decrease woman's risk of birth. Empirical literatures have confirmed that, in such event history analysis, the omission of unobserved variables will cause biased estimates (see: for example, Kravdal, 2001; Rohwer, 2002). That is, in a model which does not consider the endoginity issue, positive (negative) estimates will underestimate (overestimates) the 'true' estimates. Fourth: in their logistic regression analysis, they control only the current year values of macroeconomic variables (not lagged values). Since macroeconomic shocks are likely to have a delayed impact on vital rates, some of the covariates (GDP/capita and food price) appeared to have an insignificant impact in their study.

This thesis adopts a micro-level event history approach to examine the birth timing of married women in response to short term macroeconomic stresses that Ethiopian had been experiencing in the past four decades. The study combined the retrospectively collected individual level longitudinal data from the most recent Ethiopian demographic and household survey (2011 EDHS) and short term macroeconomic indicators (price variations and GDP growth rates) to investigates the differential responses of various demographic and socio-economic groups and the mechanism through which the macroeconomic uncertainty affect marital fertility. By doing so, this study analysed and compared the standard of livings across different socio-economic groups of Ethiopian women and households.

1.2 Objectives and Scope of the Study

The main objective of this study is to examine the response of marital fertility to short term macroeconomic crisis that Ethiopians has been experiencing in the past decades and to investigate how these responses varies by individual and socio-economic characteristics of households. The channels of the responses is also analysed by tracing the timing of the responses. However, detail analysis of the mechanism of responses was not possible due to the discrete nature of the data which observes birth events in annual basis. Clear identification of the mechanisms is possible by following response in monthly or quarterly basis.

The study is based on detail demographical and other socio-economic data of married women of reproductive age, from all regions of Ethiopia and both from rural and urban areas. Since births without marriage are very rare in Ethiopia, all single women of aged 15-49 are excluded from the analysis. The study further restricted women who had been married more than once. First births are highly affected by marriage decision of women and are excluded. Thus, the unit of analysis are ever married women of aged 15-49, never been in more than one union at the time of the interview.

The time delimitation of the study is the period 1970-2011. The macroeconomic data on GDP growth rate and price index for this period is collected from the World Bank and the Penn world table. In the retrospectively collected longitudinal data of the 2011 EDHS, the birth year of the oldest child is 1973 and, hence, I have considered the macroeconomic conditions of three years before this birth. Beside the estimate for the whole period 1970-2011,estimates are made and compared for the sub periods 1970-2003 (the period when whether induced drought was the man causes of price fluctuations) and 2003-2011(the period when high food price coincides with good harvest seasons).

In analysing the effect of short term macroeconomic shocks (food price inflation and growth)on the timing of birth of married women, the random effect discrete time hazardmodel is employed, in order to control the effect of unobserved heterogeneities.

Morespecifically, the main research questions this study attempted to address are:

i. Did married women under study responded to short term macroeconomic shocks? If so, was it parity specific?
ii. Was there a differential response by different socio-economic groups? How did the macroeconomic stress reinforce the effect of socioeconomic differential (if any) on birth timing?
iii. What was the mechanism through which the crisis affected marital fertility? Was there a deliberate and planned response or passive response to shocks?

1.3Organization of the Thesis

The rest of this paper is organized as follows. Chapter two presents backgrounds of the study. The conceptual framework and reviewed literatures are presented in the second chapter. The third chapter discusses data and methodology of the study. Results and finding of the study are presented in Chapter four. A brief conclusion and policy implication follow in chapter five.

Chapter 2

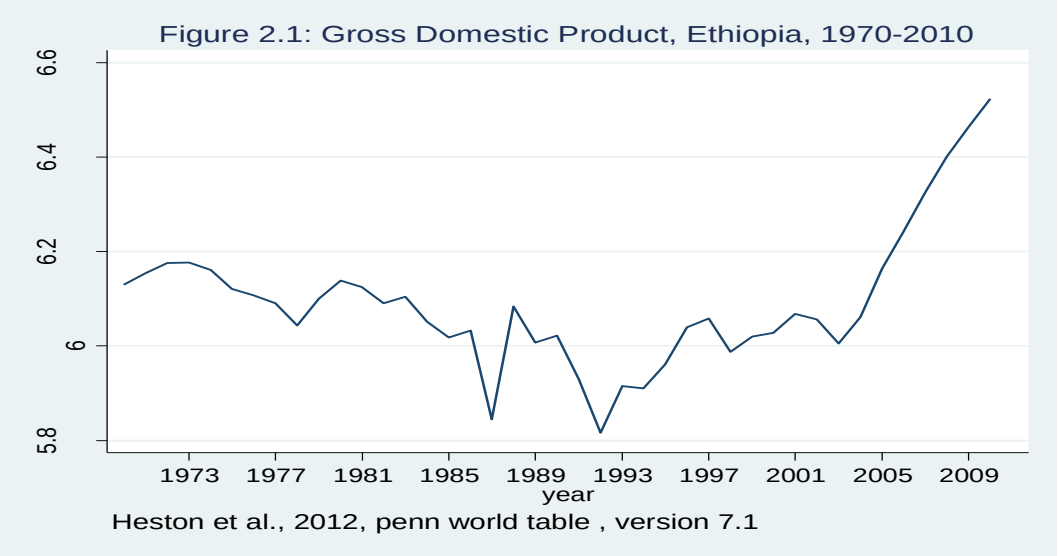
Background of the Study

2.1 Macroeconomic Conditions: 1970-2011

With a total population of 85 million, Ethiopia is the second most populous country in Africa and it is characterized by a high annual population growth rate of 2.6 %. The sub-Saharan African nation is one of the least urbanized with only 17% of the population living in urban area and the majority are agriculture based rural dwellers (CSA, 2010).

The Ethiopian economy is dominated by agriculture and related activities which employ about 85 percent of the population and generate more than 40 percent of the country's GDP (MOFED, 2012). Mixed subsistence farming combining crop and livestock is practiced on the fragmented lands. In Ethiopia, more than 40 % of households operate and survive on the very fragmented land size of 0.5 hectares or less (Gebreselassie, 2006). The agriculture sector is mainly rain fed and dictated by weather. Shortage and delay in rainfall had caused several droughts in the past, and affect the price of cereals which has an important implication to the welfare of the rural and urban households (Admassie, 2013).

The situation had been further exacerbated by a series of political crisis following the overthrow of the traditional monarch in the early 1970s. Figure 2.1 shows the trend of GDP over the period 1970-2011 and it clearly indicate that the economic conditions were deteriorating from the early 1970s up to the mid-1990s, which are mainly related to whether induced droughts and famines as well as political crisis in the country. The Value of Growth Domestic Product in 1992 was 43 percent lower than its value in 1972. Although the welfare of Ethiopians was highly deteriorated over these periods, the harshness of macroeconomic conditions has a great deal of variations across years. A sharp reduction in the GDP growth is recorded in the years 1978, 1987 and 1992 and short period of economic improvement were observed in the years 1979-1980, 1988 and 1983. After a period of positive GDP growth rate, a slump in GDP growth rate is observed in 1974 following the 1973/74 famine in the Northern Ethiopia and the outbreak of the popular political revolution which overthrow the 40 years rule of Emperor Haile Selassie I and it remained negative up to 1978 when it reached -4.68 percent. This was mainly due to the Somalian invasion in the eastern part of the country and droughts in the rural parts of Wollo and Tigray (Rahmato, 1994). A relatively stable political condition and good harvest seasons were followed in the 1979-1980 and the GDP growth rate was as high as 6 percent in 1979.

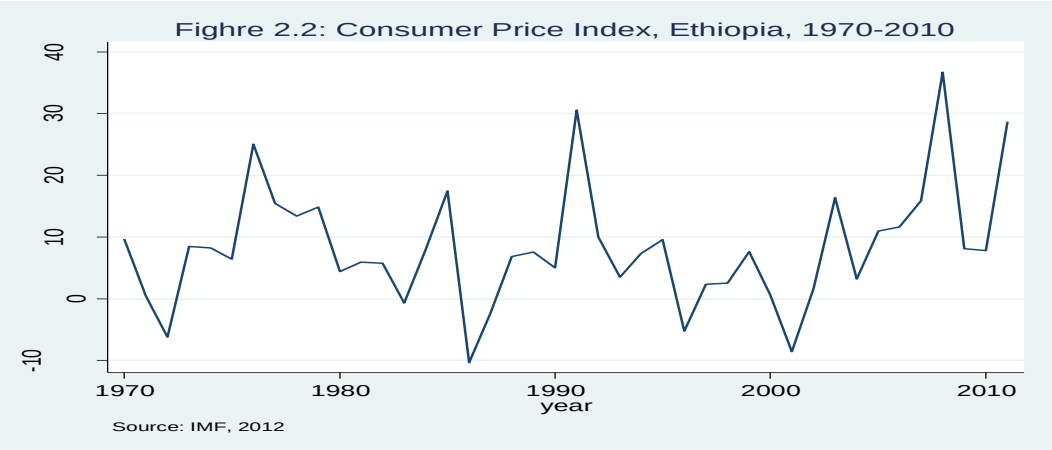


However, the decade of 1980s was even worse for Ethiopians when the war against rebels intensified and the major famine of 1984/85 outbreak. In 1980s the country continued to experience negativeGDP growth rate which reached -19 percent in 1987 following the famine which claimed the lives of a million people and caused serious food shortage to about 8 million people (Webb, 1992). As a recovery from the famine and the loose of military grounds, of the government, in Eritrea, the GDP growth rate in 1988 was historically high, 18% (Lindstron and Berhanu, 1999). However, in the following years (1989-1992), the war in Eritrea and Tigray expanded to the central parts of the country which affected the livelihood of almost all Ethiopians and, of course, it also affected the wellbeing of president Mengistu who flew to Zimbabwe as an asylum seeker in May 1991. The economy began to recover after the fall of the 'Derg' regime in 1991 and the GDP could resume its 1972 value in 2005. The double digit GDP growth rate of 10 percent is recorded in 1993. On the other hand, the outbreak of Ethio-Eritrean War (1998-2000) , the 2002/03 'Green Famine' in the southern region of Ethiopia and the 2005 political election disputes marked a decline in GDP growth and slows down the recovery. The last decade (2005-2013) is a Golden decade, in the recent history of the country, in which the sustainable high GDP growth rate of more than 7 percent is recorded.

2.2 Variations in Food Price, Ethiopia: 1972-2011

Historically, food price followed the trend of agricultural production and political situations that bad harvest seasons and war years coincided with high food price. As it is shown in figure 2.2, after the deflationary year of 1972, food price rose almost continuously up to 1976 in which it soared up to 25 percent. This is the period of famine and a war against the Somalian invasion was undergoing. The food price remained double digit until the 1979 when the level of government military attack against Somalian and rebel groups of Eritrea provinces declined and agricultural production improved (Lindstron and Berhanu, 1999). Food price rise up again, following the 1983-1985 famine which claim the lives of one million people. After successive years of economic decline, the country experienced a positive growth rate in 1986 and a deflationary situation is observed in 1986 and 1987. The worst food price crisis is occurred in 1991 (30 percent) when the civil war reached its peak. The relatively modest inflation is observed

from 1993-2004 except the two war years (1998-2000) and the crises following the 2002/03 famine.



Recently, Ethiopian households are living under a great deal of food price uncertainty, irrespective of the good harvest seasons. In the last decade, it has been the most colourful issue in the Ethiopian Medias. The period of 1998-2014 is a period of high food price fluctuation and Ethiopians experienced historically high food price inflation and some years of deflation. During the period 1998-2002, a period of Ethio-Eritrean war, relatively high food price is observed, mainly due to the war and drought in some parts of Oromia, Amhara, Somalia and Tigray regions (Admassie, 2013). Following the end of the war, deflationary situation is observed, between July 2000 and July 2002. However the following two years are marked by high food price inflation. In the year 2003 Ethiopians faced what is called, the 'Green-Famine' which forced 14 million people to food aid and food price inflation reached 15.5%. This drought was mainly in the SNNPR region (EEA, 2005). In 2002/03 total grain production has declined by 3 million tons compared to the production in 2000/01(CSA, 2010). Not surprisingly, the country recorded a negative GDP growth rate in these drought years of 2002 and 2003.

Food prices increased significantly in the period 2004–2011, ranging from 3.4 percent in 2004 to 92% in 2008 due to several supply- and demand-side factors. The rise in food price was strongly influenced by cereal price which increased by 172% between March and September, 2008 (CSA, 2010). The food price inflation of this sub-period coincides with agricultural production boom in which about 13 percent agricultural output growth rate is recorded (Loening et al .2009; Söderbom et al, 2010).Many studies show that expansionary monetary policy is mainly responsible to this inflation (World Bank, 2007). Following the ever worst inflationary year of 2008, the government has made a number of fiscal and monetary policy measures which reduced food price inflation to 6.1% in 2009. However, another inflationary monetary policy (20% devaluation of Ethiopian Birr) in 2010 results in a dramatic rise in food price to 40.7% in 2011.

The rate of this food price inflation and the degree of its welfare impact, however, was not similar across regional states. The World Bank (2007) study confirmed the existence of heterogeneity in annual price variation across different regions of the country. The study further explained that the limited regional market integration, due to poor infrastructure, hinders trade between the food surplus and food deficit regions. Moreover, the different whether condition of different regions lead to the different performance of the agricultural sector and hence price

variation across regions. For instance, in the drought season of 2003, a deflationary situation is observed in Tigray (-1.1%) and Somalia (-1.8%) while Amhara (17.8%) and Benishangul-Gumuz (23.8%) were severely smashed by the drought driven food price inflation (IFPRI, 2009).

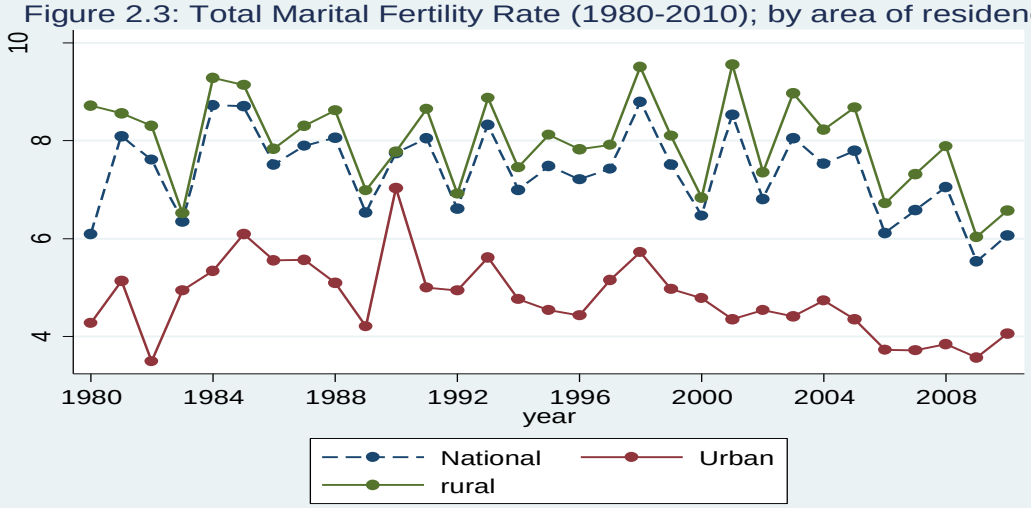
Since more than 50 percent of the household food budget are dominated by cereals, crisis in the price of cereals are expected to affect the welfare of households (IFPRI, 2009). Studies from pre-industrialized Europe and other developing countries show that food price crisis affect different groups differently. The impact depends on whether the household is a net producer or net consumer and its ability to smooth consumption in times of difficulties (Lee, 1990). In Ethiopia, even a modest crisis forced the urban poor and small scale farmers to sell some of their asset and reduce the consumption of high caloric foods and switched to less caloric cheaper foods (World Bank, 2007). IFPRI (2009) studied the welfare impact of a drought and driven food price crisis of 1999-2000. The study found that a 50 percent increase in grain price reduces the caloric intake of urban households by 16 percent and cut the caloric intake of rural households by 24 percent. The impact varies by regions; Households in Addis Ababa, Diredawa and Harari experienced a consumption loss far more than afar and SNNPR regions. Recently, Demeke and Rashid (2012) conducted the impact of recent food price crisis which is characterized by good harvest seasons on the welfare of rural households. It revealed that rural households were net beneficiaries in this period: rural families enjoyed a welfare gain of 10.5%. Furthermore, the high food price benefited not only net sellers but also net cereal buyers as they benefited from high price of non-cereal agricultural commodities. However, the impact varies across income groups progressively and poor farmers with less off-farm income experienced welfare loss.

However, well detailed empirical studies covering all regions of the country are not yet available. Thus, by measuring the fertility response of different socio-economic groups to food price crisis, this paper could give an insight about the living standard of Ethiopian households.

2.3 Short term Fluctuations of Marital Fertility in Ethiopia: 1980-2010

Like all the sub-Saharan African countries, the current fertility level of Ethiopia is more than double of the replacement level and one of the highest in the region. The 2011 Ethiopian Demographic and health survey result shows that Ethiopian woman would, on average, bear 4.8 children in her lifetime if fertility were to remain constant at the current age-specific fertility rates. This figure is ranked as one of the highest among African countries (the sub-Saharan Africa average is 4.9 children/women). However, it greatly varies by area of residence. In rural Ethiopia, the total fertility rate of 5.5 children/women is about 3 children higher than the level among urban residents. Though it is well-established fact that urban fertility is lower than rural fertility everywhere, the differential in Ethiopia is an extreme case. The gap is much larger than the African average rural-urban fertility differential of 2 children per women (Machiyama et al., 2011). Sibanda et al. (2003) studied the determinants of high rural-urban fertility differentials of Ethiopia. They conclude that the postponement of marriage due to high cost of living in urban areas has a primary importance. On the other hand, Brockerhoff and Yang (1994) relates the difference to spouse separation which is mainly caused by urbanization.

Figure 2.3: Total Marital Fertility Rate (1980-2010); by area of residence



Source: Own computation from the 2011 EDHS

Figure 2.3 presents trends in marital fertility rates, in Ethiopia, over the past 30 years. By any measure, the fertility rate of Ethiopia has been remained one of the highest in Africa and it declines very modestly over the last decades. The figure shows a very fluctuating annual trend in total fertility over the last three decades. The fluctuation is very high in the 1980s where the country was under civil war and experienced one of the disastrous famines in history. Following the improvement in political and economic conditions after the Ethio-Somalian war, total fertility rate shows an improvement between 1980 and 1984 in both urban and rural areas. However, after the famine seasons of 1984/85, fertility shows a remarkable reduction before it rebounds in 1988/89. It again shows a decline in the period 1991-1996 when the war ended and the country was in its political transition period and a decline in economic growth observed. In the 1990-2004, the rural-urban fertility gap widened and total fertility shows little improvement. In this period, urban marital fertility rate falls by 48 percent while rural fertility shows an increasing trend. thie is the period where the country experienced the Ethio-Eritrean war and the 2002/2003 drought that forced more than 14 million people for food aid and the GDP growth rate fall by 3.3% and food price inflation reached 15.5%(EEA, 2003). Perhaps surprisingly, the urban area shows a rising trend from 2005-2011 while the rural fertility drops considerably. In this period, the country experienced the highest inflation in history and good harvest periods.

2.4 Review of Related Literature

The demographic consequence of short term macroeconomic crisis has been studied by demographers, historians and economists from the pre industrialized European and contemporary developing countries. Studies in the late 20thc mainly employed a macro data analysis with distributed lag models, to understand responses of nupitality, fertility and mortality to macroeconomic crisis (see, for example, Galloway, 1988; Lee, 1981; Lee, 1990, Bengiston and ohlsson, 1985). Galloway (1988) studied the response of vital rates and nupitality to annual fluctuations in grain prices and made comparison across different pre-industrialized European countries. Strong preventive and positive checks were evidenced in the pre industrialized society. He founds fertility, particularly, more sensitive to short term macroeconomic crisis than mortality and nupitality. However, the fertility impact of crisis was identical across countries

under study. He rather found the differential response of mortality in different settings as an explanation for variation in the population growth rate of pre-industrialized Europeans. More urbanized and industrialized areas were less affected by positive cheeks while mortality was more responsive in the poorer and agricultural settings.

Lee (1981) analysed a very long monthly series of demographic and macroeconomic data (of three centauries) from a pre-industrialized England, to explore the response of vital rates to monthly fluctuations in food price. Similar to Galloway (1988), he also found a clear and strong negative response of births to short term economic stresses. However, Ronald Lee could identify the channels through which fertility might respond to food price fluctuations, by tracing the time pattern of the response in the monthly basis. Food price is found to have some impact after the three month of the crisis which, he explained, as a result of death of pregnant women or foetal loss. Another strong response was observed after the 9 months of the shock which is mainly due to fewer conceptions. He also found a rebound in births after 24 months of the food price crisis as compensation, by spouses, for the negative response in the previous months.

In today's developing countries, several studies have also been conducted to assess the demographic consequences of macroeconomic crisis. Lee (1990) shows a similarity in the pre-industrialized western societies and contemporary developing countries that short term economic stresses has a considerable consequence on demographic outcomes. Studies in Latin American countries observe a mixed result about the relationship between timing of birth and economic growth (see, for example; Palloni et al, 1996; Tapinos, Mason and Bravo 1997; Bravo, 1997). Palloni et al (1996) studied the effect of short term economic swings, measured as change in GDP, on nupitality, marital fertility and mortality from Latin American countries. Unlike the studies in pre-industrialized Europe, economic crisis had found to have a very heterogeneous impact among these countries. The estimation result of the distributed lag model shows a positive net response of fertility to short term change in GDP in only seven out of eleven countries.

In sub-Saharan Africa, one of the most detail and extensive study on the demographic consequence of macroeconomic fluctuations was conducted by National Council (1993). The study analysed the effect of changes in economic conditions, measured as GDP/capita, quantity of exports, terms of trade and commodity prices , on the annual probability of first marriage, first and second births, and infant and child mortality in seven sub-Saharan African countries using the data from the demographic and household surveys. The study found marriage, first birth and second birth respond positively to improved economic conditions measured as GDP/capita. However, the result is not uniform across countries. Other studies in sub-Saharan African countries also found evidences of crisis led fertility declines (see: Boserup, 1985; Lesthaeghe, 1989a; Lesthaeghe & Jolly, 1995; Lockwood, 1995).

Both the pre-industrialized western and contemporary developing countries societies are mainly agrarians and macroeconomic crisis mainly arises from whether induced harvest failure which caused both the rise in the food prices and a reduction in the agricultural outputs. Such crisis would not affect all segments of the society uniformly. Large land owners and net agricultural producers would be net beneficiaries if the price elasticity of demand for food prices is low. On the other hand, landless and non-agricultural labourers would be adversely affected by the food price crisis (Lee, 1990). In the countries where both manufacturing sector and agricultural sectors are important contributors of the economy, the distributions of the effect of a macroeconomics crisis depend on the relative change in food prices. That is, agricultural

households (even net producers) would suffer from shocks if the price agricultural products increase more than proportionately to the price of food. Conversely, the shock will hit industrial labourers severely if the price of manufactures goods remain stable or demand for their product decline with the food price shocks (Hill et al., 1993). Again, among the groups who are negatively affected by the macroeconomic stresses, the degree of the effect depends on several individual and community level characteristics. Households with a consumption smoothing possibilities such as assets and access to financial market are more likely to resist the shock. Similarly, social bondage, age, educational attainment and other characteristics are also important mitigates of a shock. Bengtsson and Dribe (2002) explained that the welfare impacts of such kind of macroeconomic crisis are well reflected by their demographic consequences. How it affects the birth and marriage plan of the family, how it causes mortality and migration are important indicators of the family's living standards.

However, with aggregated data, like the above macro level studies, it is difficult to examine the differential impact of crisis by different socio-economic status (Bengiston and Dribe, 2006). Thus, recently, demographers and economists are employing a more effective micro analysis by combining micro demographic data with macroeconomic variables. This enables them to examine the fertility response by different socio-economic groups and to trace the timing of responses in greater detail. Most of the studies show that families had been adjusting the number of children and birth timing following macroeconomic shocks and it greatly varies with their socio-economic status. Bengtsson and Dribe (2006) explored the effect of temporary food price crisis on timing of births by combining individual longitudinal demographic data with community data on food prices, from the pre-industrialized societies of different parts of Europe and Asia. They also analysed the degree and direction of effect by different socio economic groups and identify the mechanisms through which short term economic stress affect fertility. This duration analysis found a strong response of second and higher order births to food price crisis in almost all study areas. The effect is mainly strong and significant in the second year of the crisis. However, in some areas like Scania region of Sweden an immediate and strong response of shocks are observed. In some other areas, there is a tendency of births to rebound in the next year after the crises. The result also shows that the childbearing of different group of the society affected differently, by the crisis. In the areas where labor is more integrated, landowners and net producers of grain had been benefiting from food price changes. In the areas where market is disintegrated and trade is very limited, harvest failure has a negative fertility consequence for the producers. Similarly, landless agricultural labourers were also highly vulnerable to shocks. The researchers found evidence of both deliberate birth controls and passive responses in different regions. For example, in Scania there was a strong evidence of planned response of births to short term economic crisis while in some other study areas they found a delayed negative response which is mainly due to malnutrition, following economic stresses.

Studies in Latin American countries observe a pro-cyclical relationship between timing of birth and economic conditions (see: Adsera, 2009: Bravo, 1997; Ortega and Reher, 1997). Adsera (2009) combine individual characteristics and demographic data with macroeconomic variables (unemployment and GDP growth rate) from a pool of South American countries to examine the response of fertility in time of economic uncertainties. She founds a strong negative response of fertility to economic decline, particularly with the higher unemployment rate. The urban dweller,

younger and most recent cohort women are less responsive to economic conditions. The more educated women are more likely to postpone births in the periods of high unemployment.

In Ethiopia the most extensive study which combines micro demographic data with aggregate variables is conducted by Lindstron and Berhanu (1999). They investigate the marital fertility effect of war, famine and political crisis that Ethiopians had been experiencing in the 1970s and 1980s. The logistic regression result evidenced a strong adverse effect of economic reversals and political crisis on the annual probability of conceptions. They found that medium birth orders (3-4) are more likely to be affected than the other parties. Conception probabilities were considerably low in the second year of famine and it rebounds in the later years. Marital fertility was more responsive to military attacks than food price changes. They explained separation of spouses due to military conscription as an important mechanism that short term economic crisis affect marital fertility. However, they didn't examine the role of socio-economic status of the women in moderating or attenuating the effect of the crisis.

A number of other studies were also conducted to investigate the relative impact of economic crisis on the welfare of rural and urban households in Ethiopia. For example, Soderborn and Alem (2010) employed a survey data to study the impact of the 2004-2008 food price crises on the welfare of urban households. They found households with low asset level and causal workers as adversely affected by shocks. Education had little significant in the response of households to food price crisis.

2.5 The Conceptual Framework

In analysing the relationship between short term macroeconomic crisis and marital fertility, the conceptual framework, used in this study, was adopted from Bengtsson and Dribe (2002) who extends the basic framework developed by Bongaarts (1978).

In the Bongaarts model, all important changes in fertility are the direct consequence of changes in what he is called 'proximate determinates': marriage, postpartum infecundability, contraception and abortion. This proximate determinates are actually mediating the influences of social, economic and cultural factors1. The marriage factors represent the length of period a women is exposed to the risk of sexual intercourse which is defined by age at marriage and the time spent with in marriage. Contraception and abortion are purposive actions which have direct biological consequences. On the other hand, postpartum amenorrhea and induced abortion are physiological factors.

As figure 2.3 (adopted from Bengtsson and Dribe, 2002) shows, households are exposed to various kind of short term macroeconomic crisis (mainly from whether induced harvest failure and political crisis) which are usually reflected by food price crisis. This exposure deteriorate the welfare (living standard) of the family: consumption, children education, health and other indicators of living standard would be affected by the shock. However, the degree of vulnerability to the crisis depends on the individual characteristics and socio-economic status of the women and her family. That is, individuals varies by age, wealth, asset ownership, source of livelihood, education level , family size , sex and survival status of the previous births and many other factors. These variations are responsible for the variations in vulnerability levels.

[1] This idea was originally explained by Davis and Blake (1956) . John Bongaarts formalized it in to a conceptual framework in 1978.

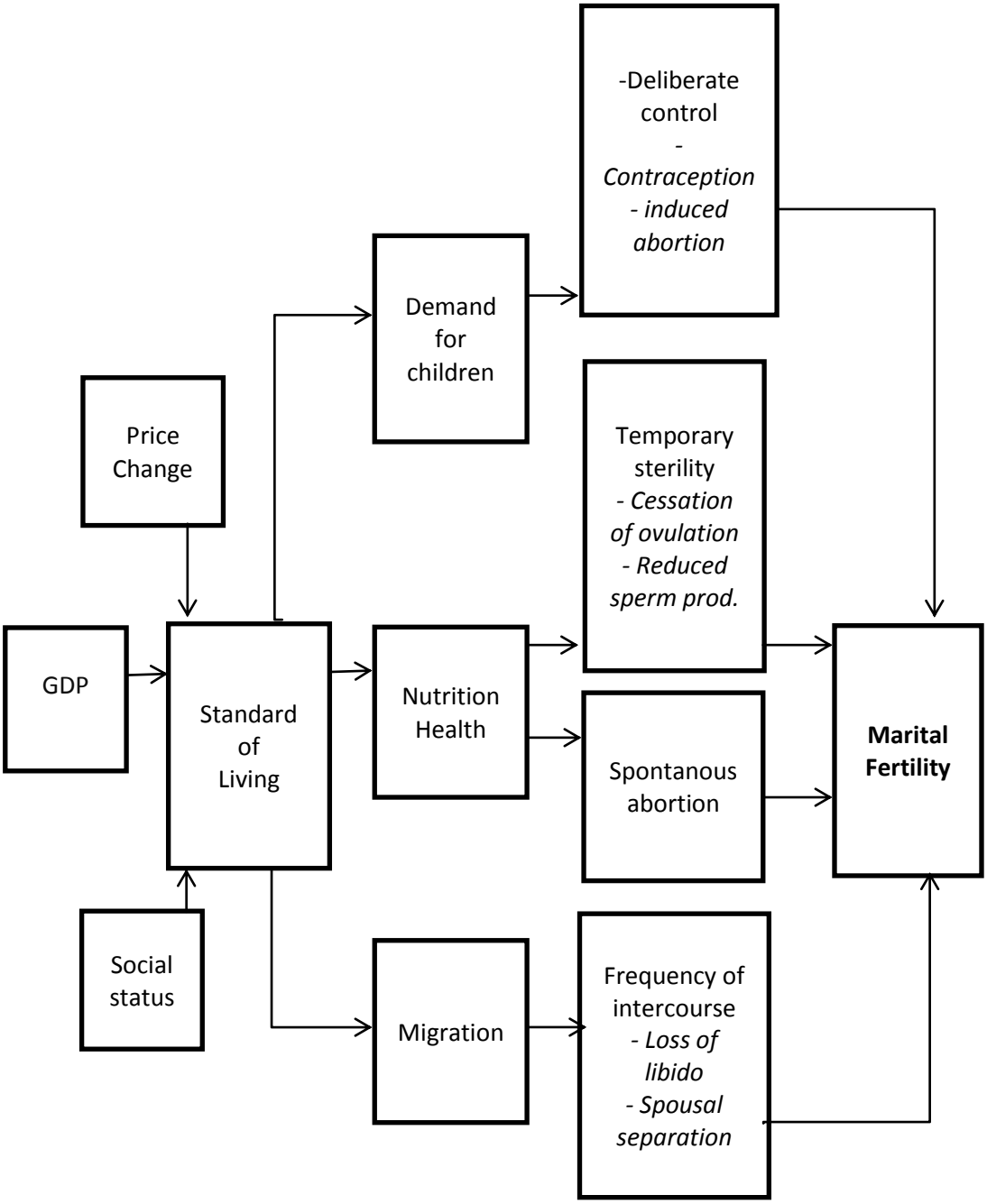


Figure 2.4: Conceptual Framework
Source: Bengtsson and Dribe, 2006

In the extended framework, there are three main channels that marital fertility is affected by short term economic crisis. First: a family may deliberately postponed births in time of economic difficulties as the incoming babies require additional caloric intake by the mother and/or the mother need to work harder to cope the shock. Such responses would result in a considerable decline in marital fertility in the year following the crisis. However, there are many reasons not to expect deliberate birth control as a main mechanism to maintain the welfare of the family in Ethiopia: i) Contraception and other family planning service are very recent phenomena in Ethiopia. The 1990 national family and fertility survey result shows that only 4 percent of Ethiopian women of age 15-49 had been using contraceptive methods before 1990. ii) In this very religious and traditional society, induced abortion is not only illegal but also against their religious belief. iii). Harvest failure is unlikely to predict if it is caused by excess rainfall or shortage of rainfall that may occur soon before harvest collection. Moreover, military attacks and other political crises used to cause sudden price changes.

Second: short term economic crisis may force members of a family to migrate temporarily and cause separation of spouses. In Ethiopia, temporary migration of family members to nearby town and cities or to cash crop producer rural areas is one of the coping mechanisms to climate shocks. "In years of little or off-timing rainfall or when there are extended dry-seasons, crop production can suffer; individual family members migrate as a temporary and strategic adaptation to diversify a household's income and livelihood sources" (Hunnes, 2012). Thus, macroeconomic declines would have a delayed impact on marital fertility.
Third: In the times of famine, partners would be malnourished which reduced sexual intercourse and lowered fecundity. In addition, psychic stress may reduce coitus or lead to amenorrhea. Both are well documented facts in Ethiopia where recurrent famine had been causing hunger and death of millions (Rahmato, 1994).

Chapter 3

Data and Methodology

3.1 Data Sources and Data Type

In analysing the response of marital fertility to short term macroeconomic shocks, two types of data were employed. The cross sectional micro data of the demographic history and other socio-economic characteristics of women and her partner were used from the 2011 Ethiopian demographic and health survey (EDHS), which is conducted by the central statistics authority of Ethiopia. This is the latest of the three DHSs in the country. The survey covered all the nine regional states and the two city administrations of the country and it employed two stage stratified cluster sampling method to select the representative sample units (households, women and men). As the first stage of sampling, 624 census enumeration areas (Primary sampling units) are selected from both rural and urban areas. At the second stage, 17,817 Sample households were selected from 187 urban and 437 rural enumeration areas, using probability systematic sampling method. The 2011 EDHS used three types of questioners (women, household and men questionnaires) to collect complete birth history and large amount of socio-economic and demographic information of each sample men, women and their household. The women questioner was used to collect data on birth history, marital status, infant and child mortality, maternal mortality, occupation of the respondent and her partner, knowledge and use of contraception, exposure to mass media, and other background characteristics of respondents. The survey interviewed 16,155 women of reproductive age (15-49) and both from rural and urban households of all regions in the country. Since our interest variables are births with in marriages, the never married women are excluded from the analysis. This paper further excluded women who had been married more than once (including married Women who were divorced or separated). Thus, the analysis is based on durations of births from 9,472 ever married women and who had never been in more than one union. In the case of multiple births, the data for only one of these births is considered. This resulted in the final sample of 21,499 second and higher order births.

Similarly, the macroeconomic data on GDP/capita and CPI are also employed from the pin world table and the World Bank data base. Since the objective is to examine how contemporary and lagged short term macroeconomic crisis would affect birth timing, the annual

series of inflation (annual change in CPI) and growth rate (computed from GDP/capita series) data are employed for the period 1970-2011[2].

3.2 Limitation of the Data

The 2011 EDHS was the most successful survey of all demographic surveys conducted in the country, in terms of its coverage and details of data as well as with its nearly complete responserate. The data, however, has some limitations, concerning this study. First: though the survey covers all regions of the country, it failed to interview sampling units in the 18 out of 65 enumeration areas of the Ethiopian Somalia region. Since the region is one of the most vulnerable regions to short term macroeconomic shocks, this study may underestimate the impacts of short term macroeconomic crisis on the timing of birth.

Second, the survey data lack some time-varying variables which would improve the analysis of this paper. For example, the survey collects data on education, occupation, land and asset ownership status of women and her household at the time of the interview. However, these are time variant variables and the child bearing decision of women could change with improvements in educational attainment, income status and other time-variant variables. Thus, this study assumes current education level of the women as the planned education level of the women at the time of the j^{th} birth.

Third: the other limitations are emanated from the very nature of a retrospectively collected data. I). in such survey, self-selection bias is a common problem. That is, the survey would exclude those individuals who were out migrated or died before the survey year. This would result a bias as these individuals might die or out migrated as a response to the short term economic crisis, such as the 1984/85 famine. ii). Recall Bias: - retrospective data are 'recall data' and its quality would decline as the recall period lengthens. Individuals may report some of the earliest births as they have occurred instead in their middle reproductive years. Similarly, the year of death of the index child, age and income status are usually misreported. iii). respondents are selected based on their characteristics at the time of the survey. The survey considers only those women who were at their reproduction age (15-49) in 2011. Thus, the sample is biased towards more recent births. For example, the survey excluded all births occurred before 1990, if the mothers' age were thirty or more than thirty in the year 1990.

Similarly, the macroeconomic indicator data also have some shortcomings. Though the Ethiopian markets are highly disintegrated and there is a great deal of price heterogeneity (especially at the time of crisis), I could not find regional CPI and GDP data for the years prior to 2003. Thus, I have employed a national CPI and GDP, which is highly fluctuation over the study period, to identify the effect of macroeconomic shocks on birth timing.

3.3 Empirical Model Specification

Like any other event history data, the 2011 EDHS collected the birth history of women retrospectively and were recorded in longitudinal form. In the survey, to reduce recall errors,

[2]The birth year of the oldest child among all women is 1973 and the year of interview is 2011. Thus, I controlled three years lagged values for the macroeconomic series that starts from 1970 and ends 2011.

birth times are recorded to the nearest month or year and, hence, the durations of births are interval censored. Thus, I preferred to employ a discrete time event history model as it assumes a discrete time measurement of events. The second consideration while specifying the appropriate model was the way covariates are assumed to affect the timing of births. It is common for many researchers to assume a proportional effect of covariates for all birth time intervals and a cox proportional hazard model is specified. However, in the cox proportional and other continuous time model, it is not easy to relax the proportional hazard assumption. Unlike the continuous time hazard models, it is straightforward to allow non-proportional hazards in the discrete time models.

3.3.1Data Restructuring

In such repeated event history discrete time analysis, the first step before estimating a specified model is to expand the data set in to the person-period format. That is, the data set was reorganized so that the birth history data had two levels hierarchal structure. First, birth orders (j), with the corresponding birth intervals[3] , were nested with in individual (i). Here, birth intervals correspond to years to a birth from the most recent previous birth. Majority of the sample women have had at most 6 children and, hence, births of order seven and above are restricted in the final sample. Furthermore, first births are highly affected by age at first birth or marriage decision of women and are excluded from the analysis. Thus, birth orders of two through six are observed in the analysis (j=2,3…6). Similarly, the birth intervals of 6 and more years are censored and the duration of maximum 5 years is considered in the final analysis[4]. At the second level, each birth interval is expanded in to time interval of equal width (one year). Thus, I have carried out a two-level model for recurrent births with interval (t) of one-year width. The observation time (t) is set to be one year in order to make the size of the dataset manageable. In the final data, there was at most one birth in a given time interval (no tied events). In effect, a longitudinal data set of 64,214 observations was created.

Once the data is expanded in a way that there is a record for each time interval (t) in each birth order (j), a binary response variable (Y_{tij}) was constructed easily. The response variable (Y_{tij}) indicate whether a birth occur in year t of birth order j for the ith women. The dependent variable for each person-year was coded 1 if the person gave birth in that year; otherwise it was coded zero.

Let T_{ij} is the censoring time5. For each time interval (t) for birth order, j, the binary response variable Y_{tij} is coded as:

$$Y_{tij} = \begin{pmatrix} 0 & \text{if } t < T_{ij} \\ 1 & \text{if } t = T_{ij} \\ 0 \text{ if } t = T_{ij} & \text{and } \delta i = 1 \end{pmatrix}$$

[3] Birth interval is defined as the number of years between two consecutive births.

[4] The couples are considered as sterilized if they wait more than five years for the next birth.

[5] Censoring time is the time at which the observation of an event is ended. The observation of the j^{th} birth is ended when a new birth (j+1) is occurred or the interview year, in the case of the last birth. In between, the j^{th} birth can occur in any time interval t.

For example, if a women experienced her second birth (j=2) in the fourth time interval of the episode, the response variable for the four intervals will be $(Y_{1i2}, Y_{2i2}, Y_{3i2}, Y_{4i2}) = (0,0,0,1)$.

An individual is right censored ($\delta i = 1$) if she didn't experience the jth birth in a given birth interval. For example, while coding the response variable for the second birth (Y_{ti2}), 1,134 eligible women who have had no child at the interview year and 2,787 women who had bear only one child are right censored. The consideration of these right censored observations is another beauty of the discrete time event history model.

3.3.2 The Two-Level Discrete Time Model for Recurrent Events

Another common feature of the retrospectively collected 2011 EDHS is repeated events. Above 70 percent of interviewed women experienced more than one birth. When such repeated events are observed, the simplest and common way to handle is modelling the duration of each episode of births separately (see: Bengtsson and Dribe, 2006; Lindstron and Berhanu, 1999; Adsera, 2009). However, such approach of modelling repeated events independently is inefficient and misleading. This is mainly because some of the determinants of the duration of the first birth episode are likely to operate in the same way for the higher order births. Moreover, with the existence of unobserved heterogeneities, a separate modelling of birth timing is misleading (Steele, 2005; Kravdal, 2001).

Thus, the better way of modelling such repeated events is to model all birth intervals jointly. However, while pooling birth intervals, the correlation among duration of birth episodes is expected. This is mainly because of the unobserved individual specific factors that affect women's chance of having birth whatever the birth order is. Failure to control this unobserved heterogeneity will lead to a biased estimate with the possible correlation of episodes. Thus, in the model specified below, the effect of unobserved heterogeneity is controlled by incorporating the random effect (Ui) or shared frailty which is assumed to have a normal distribution. By doing so, one can assume the durations of separate episodes as independent.

Therefore, once the data is expanded in to person-period form, a two level discrete time random effect logit model is specified to estimate the timing of births jointly. The log odds of giving j^{th} birth in the interval t for women, i, is estimated from:

$$\text{Logit}(h_{tij}) = \log\left(\frac{h_{tij}}{1-h_{tij}}\right) = \alpha(t) + \beta' X_{tij} + \rho' Z_{ij} + \gamma' W_{ij} + U_i$$

Where:h_{tij} is the discrete time hazard-the probability of giving the j^{th} birth during interval t for the women i, given that no birth has occurred in the previous interval of the episode j.

$$\text{i.e. } h_{tij} = \text{pr}(Y_{tij} = 1/Y_{sij} = 0, s < t)$$

Where,$\alpha(t)$ is the baseline hazard which needs to be specified by ocular inspection of the hazard function. In this paper, it is specified as a step function by treating intervals (t) as a categorical variable.

$$\alpha(t) = \alpha_1 D_1 + \alpha_2 D_2 + \ldots\ldots + \alpha_g D_g$$

Since the maximum birth survival time, in the data set, is restricted to 5 years, I have created 5 dummy variables of the interval time (g=5). In this specification the hazard is assumed constant within each of the g categories (piecewise-constant hazard model)6.

The correlation among the birth intervals of women is allowed by incorporating the individual unobservable (U_i). This is interpreted as residual variance: the variance among individuals due to unobservable fixed characteristics.

3.4 Variables

The dependent variable is a dichotomous indicator of whether or not a women had the j^{th} birth in the birth interval, t. In the specified model, three types of explanatory variables are controlled. First: Internal covariates (X_{tij}) are controlled to represent the individual specific characteristics which are both time-invariant and episode level variables. Sex of the household head, Age at first marriage, birth cohort of the women, place of residence, religion and the marriage union of the women are some of the time –invariant individual specific covariates. For above 90 percent of the respondents, the place of birth of the women and her partner, and their living place at the time of the interview are similar. Thus, only the place of residence of the women at the time of the interview is considered. The socio-economic status of the women and her partner such as education level, occupation, land and other asset ownership are also controlled. Educational attainment of the woman is entered into the regression as categorical dummy variables: non-educated, some level of primary education, secondary education and tertiary level. Land ownership status is also categorized as landless (who have no land), semi landless (who are mainly sharecroppers) and landowners (who own lands both individually and jointly). The 2011 EDHS collected the wealth status of households in to 5 quintiles from the poorest (first quantile) to the richest (5th quantile). Since majority of women are housewives, partners are the main breadwinners. Partners' occupation is classified in to five sectors: agriculture, managerial/professional, sales and service, unskilled manual and unemployed. In Ethiopia, the use of contraceptive and exposure to mass media are highly collinear with education and income status of the women (USAID, 2011). Thus, these two variables are not controlled for the regression analysis.

Episode level covariates include age of women, survival and sex status of the previous child, number of sons and daughter already in the family, are measured at each time interval (t). The age of the mother is a categorical variable of six age groups as described in table 3.1. These categories are chosen to reflect the likely decline in fecundity with age.

Second: External covariates (Zt_{ij}) which measure the short term macro-economic crisis are also included in the model. In order to gauge short term macroeconomic fluctuations, the first difference of logarithm of GDP/capita (growth rate) and the first difference of logarithm of CPI (inflation) are considered in this study. This is mainly because GDP and CPI are non-stationary variables while inflation and growth are stationary variables which fluctuate around their own mean. The 5 years moving averages of inflation and growth rates are, then, computed and the difference between the MA value and the actually value of the two variables are estimated. In addition, to reflect the delayed effect of macroeconomic crisis on birth decision of

[6] To allow and test non-proportional hazards, some of key covariates are interacted with t as additional explanatory variables in the model.

women, two years lagged values of these indicators are employed. This is also believed to reduce concerns about endoginity. Thus, information on changes in CPI and GDP per capita growth rates in the immediate past years of the beginning of each time interval were collected.

Third: In this joint modelling, dummy variable for birth parity (W_{ij}) are incorporated and how the effect of the macroeconomic crisis is differ by the birth order is tested by examining the interaction term of the birth parity andZ_{tij}. For example, the effects of food price crisis might differ for the second and third birth orders.

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Chapter 4

Results and Discussion

4.1 Descriptive Analysis

A total of 21,499 second and higher order births were extracted from fertility history of 9,472 eligible women of the reproductive age, for about four decades preceding the 2011 EDHS. About one-third of these births are second order, one-fourth is third order births and only one-tenth is order six. About 5% of the births followed the death of the previous child within 2 years and for majority of the births (85%), the index child survived. Table 3.1 clearly shows that majority of the births (58%) followed a female index birth. It may indicate the preference to son in the Ethiopian society. At the birth of the index child, 12 percent of the women were younger than 20 years, only 5 percent were older than 35, and the majority (69 percent) were in their 20s and a sizable portion (15%) were between age 30 and 35. Thus, women in the medium age category gave more next births than younger and old women.

The table also describe women by their socio-economic and other basic characteristics. The mean age at first marriage is 17 years old, which is very low, even compared to the pre-industrialized Europeans. Majority of the women (80%) are rural dwellers and Christianity (56.4%) is the dominate religion in Ethiopia. The survey data shows that Ethiopian women have a very low educational attainment with more than 60 percent of them have no formal education while only 4.6% of them have some secondary education and about 31 percent have primary education. Furthermore, the table shows that, half of the women were basically house wives and mainly responsible for child caring and other household level activities. Half of those engaged in some formal occupation were working in family enterprises mainly with no payment either in cash or in kind. On the other hand, only two percent of partners are unemployed. Majority of the partners (64%) are engaged in the agricultural sector while service and sales sector are the second most important sources of livelihood. May be related to this, Ethiopian households are dominantly male headed. Land is the most important asset in this agrarian society. Agriculture is mainly practiced in the very fragmented lands of the densely populated highland areas. In the sample, about 54% of the women and her family own land while 13% of the women own a land only jointly with others.

4.1.1Life Table Analysis

To get a quick glance at birth timing of women in Ethiopia, the cumulative birth probability for every year from the birth of the index child were computed using life tables for the joint births and separate life table for each birth order (see table 4.1). The duration of interest is the number

of years between two consecutive births. In the data, the shortest duration in which the women were at risk of birth was one year and the maximum duration is 5 years. From the retrospectively collected data, the median duration, of birth of orders two and above, is three years. That is, about 50 percent of Ethiopian mothers were at risk of birth for three years before the birth of the j^{th} child and after the birth the index (j-1) child.

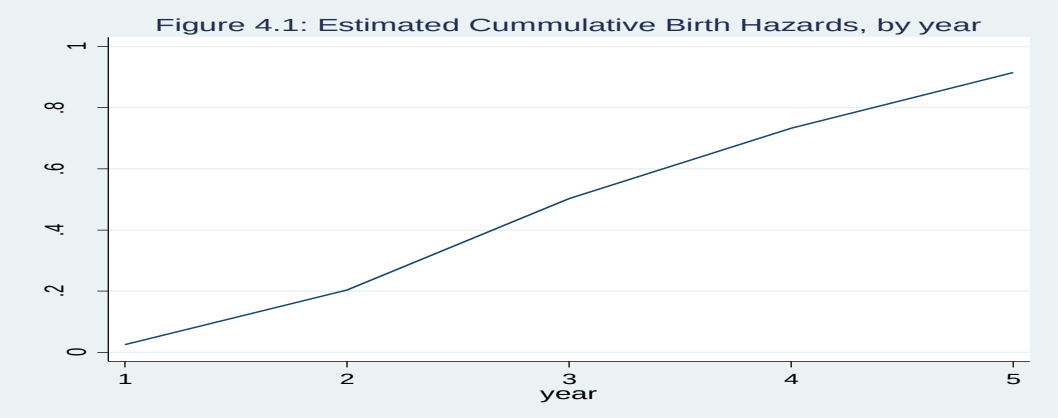


Figure 4.1 shows that the cumulative birth probability increases rapidly, in the first five years. Within the first year of the birth of the previous child, only 2.5 % of the women have had another child. After 2 years, more than 20% of women, under risk of birth, gave an additional child and about 92% of women already had had another birth at the fifth year of the index child. However, this is less informative as the cumulative probability always increases with time. Similarly, the estimated hazard rate of childbirth at the midpoint of each interval (column 3 of table 4.1.) increased with time, reaching 46% at the 3.5 years of the birth of the index child, before it rises dramatically to 99 percent at the fifth year. Thus, the probability of giving birth, among Ethiopian women, increases with years in which the women are a t risk of birth.

The duration that a woman was at risk of birth varies by socio economic characteristics of the woman. Table 4.2 presents a summary of the life table median birth intervals and the corresponding cumulative hazard rate and probability of giving birth. The median birth interval among rural women is about two years longer than the median duration among urban women. Moreover, the probability of giving birth among rural women is higher in all birth intervals and the difference is the same across all intervals (see figure 4.3 in the appendix).

The median duration of birth interval is similar (3 years) among illiterate women and those with only primary education. However, the birth hazard, at the median birth interval, is higher mong the former (42%) than the later (32%). Women with some secondary education have a very high median birth space of more than five years and their birth hazard at the 3^{rd} year is about 30% lower than those with only primary education. Birth spacing is found to vary less across birth cohorts that median duration is three years irrespective of the birth decade of the woman. Similarly, women in the lowest and medium wealth quantile have equal birth spacing while women in the highest wealth quantile have longer birth duration, between successive births, of five years. Another remarkable difference in the median length of birth interval is found by the source of livelihood of the partner. The duration of birth interval is higher and the hazard rate is lower if the partner is engaged in managerial and other professional jobs. A woman whose partner is working in the agricultural sector has a shorter time at risk of birth and higher

probability of giving birth in each birth interval. Interestingly, landless women have a wider birth interval than women who own land. However, there is little difference in birth spacing among the land owners and the semi-landless population.

A mother had shorter birth interval if the index child died (two years) than if it survives (three years). Among those women whose previous child was died, the birth space is wider if the index child died in less than two years. This may indicate the replacement effect. The median duration of birth interval is progressively increasing with the age of the mother at the birth of the previous child. Younger women had a shorter birth interval. The sex status of the previous child is little to do with the length of birth interval. The parity specific differential in the median duration of birth interval is also examined from the life table. The median birth interval is three years irrespective of the number of children the woman already have.

In the panel of figures 4.2 to 4.5, the hazard rate for selected socio-economic groups, over all birth intervals, is computed to examine if the duration dependence of birth hazard varies by socio-economic status of the women[7]. The figures show that, the effect of socio-economic variations, on birth hazard, is not constant across time intervals. For example, Figure 4.2 shows the hazard function by birth parity and the birth hazard is little affected by the birth order of the child in the first three years of risk of birth. The parity specific effect is clear in the third through fifth year of birth interval that hazard is higher for the higher birth orders (except the third order birth for which the hazard is higher in all time intervals). At the fourth year, the probability of birth for second order births is 54% while it is 65% for the six order births. However, this differential is not large enough to infer the parity specific effect of birth hazard over time. In figure 4.3, the life table analysis had found a clear rural-urban differential in the birth probability across time interval. The hazard ratio in the second year was 1.25 which rises rapidly over time and reached 1.72 in the fourth year and falls to 1.5 in the fifth year. Figure 4.3 indicate that the rural women have a higher probability in all time intervals. But, the effect of the area of residence of the women is disproportionately distributed over time intervals.

Figure 4.4 exhibit the effect of education on the birth hazards over time intervals of births. The probability was clearly lower for the better educated women and the differential increases with time interval. For example, in the first year of the birth of the index child, the difference, in the probability of giving the next child, between those women with primary education and secondary education is only 16 percent. The relative difference however rise over time and at the fourth years after the index birth, it reached 40 percent.

The hazard differential over the specified time intervals was also assessed by the characteristics of the index child in figure 4.5. The survival status of the index child has a disproportionate effect on birth hazard. The hazard is quite high if the index child was died than if it was survived and the relative difference remained constant up to the third year. However, as the duration of birth interval lengthened this differential impact on birth hazard diminished.

From the above life table analysis, one can understand the non-constant effect of time intervals on birth hazards and the disproportional effect of socio-economic variables on the likelihood of births.

[7]In this analysis the hazard rate is assumed to remain constant for the birth durations of more than 5 years and the duration is censored at the fifth year.

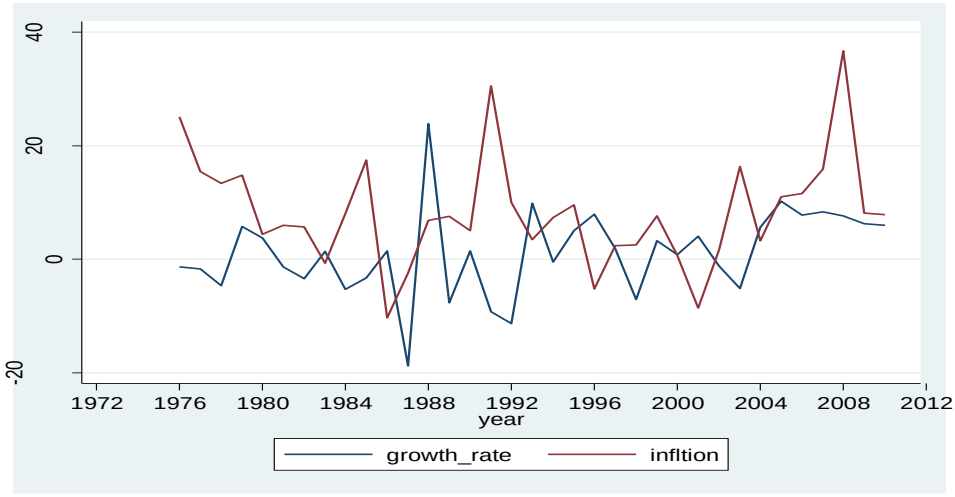
Figure 4.6 shows the differential impact of short term macroeconomic stress on the birth hazard of different socio-economic groups. It indicates the change in birth hazard among different occupational groups with a change in the economic situation. The birth hazard is generally high in the normal growth years (GDP growth rate between 0 to 5 percent) and it is low in the economic declines (negative growth rate of below 10 percent). It is computed at third year of birth of the index child, for all groups. Clearly a women whose partner is not working and women whose partner is in the agricultural sector are highly affected by economic stress. With the macroeconomic pressure, the birth hazards, for these groups, decrease by 27 percent and 15 percent respectively. On the other hand, the macroeconomic shock has little impact on those working in the service sector and managerial jobs.

4.1.2 The Linkage between Macroeconomic Conditions and Birth Rate, Ethiopia, 1970-2011

In order to have a an insight of the linkage between macroeconomic crisis and birth timing over the study period, the trends of macroeconomic indicators (GDP growth rates and inflation rates) that are discussed in section two are summarized below. As it is mentioned in section three, annual GDP growth rate and food price inflation rate are the two indices used to measure the macroeconomic conditions of Ethiopia in the study period, 1973-2011. Figure 4.7.presents the very fluctuating macroeconomic crisis in the last four decades.

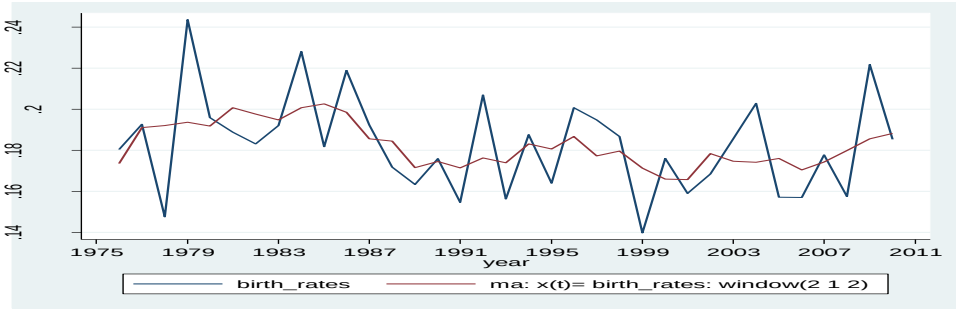
The figures shows that, the economic conditions were deteriorating from the early 1970s up to the mid-1990s, which are mainly related to whether induced droughts and famines as well as political crisis in the country. The Value of Growth Domestic Product in 1992 was 43 percent lower than its value in 1972. Although the welfare of Ethiopians was highly deteriorated over these periods, the harshness of macroeconomic conditions has a great deal of variations across years. A sharp reduction in the GDP growth is recorded in the years 1978, 1987 and 1992 and short period of economic improvement were observed in the years 1979-1980, 1988 and 1983. After a period of positive GDP growth rate, a slump in GDP growth rate is observed in 1974 following the 1973/74 famine in the Northern Ethiopia. It remained negative up to 1978 when it reached -4.68 percent following the Ethio-Somalian war. A relatively stable political condition and good harvest seasons were followed in the 1979-1980 and the GDP growth rate was as high as 6 percent in 1979. However, the decade of 1980s was even worse for Ethiopians when the war against rebels intensified and the major famine of 1984/85 outbreak. As a recovery from the famine and the loose of military grounds, of the government, in Eritrea, the GDP growth rate in 1988 was historically high, 18% (Lindstron and Berhanu, 1999). However, in the following years (1989-1992), the war in Eritrea and Tigray expanded to the central parts of the country which affected the livelihood of almost all Ethiopians. The economy began to recover after the fall of the 'Derg' regime in 1991 and the GDP could resume its 1972 value in 2005.

Figure 4.7: Gross Domestic Product and CPI, Ethiopia, 1976-2010



Source: Heston et al,2012:Penn World Table Version 7.1 ; IMF,2012

Figure 4.8 Birth Rates, Ethiopia, 1975-2011



Source: own computation from the 2011 EDHS

4.1.2.1 The Consumer Price Index, 1970-2011

As it is shown in the above figure, the food price index follows very closely to the trend of GDP growth rates over the period 1970-20004. That is, in good harvest and politically stable years, the data exhibits a low inflationary periods. On the other hand, inflation was very high in the drought seasons and periods of war and political difficulties. After the deflationary year of 1972, food price rose almost continuously up to 1976 in which it soared up to 25 percent. As mentioned above, this is the period of famine and the war against the Somalia invaders was intensified. The food price remained double digit until the 1979 when the level of government military attack against Somalian and rebel groups of Eritrea provinces declined and agricultural production improved (Lindstron and Berhanu, 1999). As shown in the above figure, food price rise up again with the 1983-1985 famine.

After successive years of economic decline, the country experienced a positive growth rate in 1986 and a deflationary situation is observed in 1986 and 1987. The worst food price crisis is occurred in 1991 (30 percent) when the civil war reached its peak and the EPRDF controlled Addis Ababa. The relatively modest inflation is observed from 1993-2004 except the two war years (1998-2000) and the crises following the 2002/03 famine. However, after 2004, the story has been changed that good harvest periods were coincided with very high food price inflations. Over the period 2004-2008, the inflation rate was rapidly rising from about 3 percent in 2004 to 92 percent in 2008. On the other hand, the country experienced agricultural production boom of up to 13 percent over the same period. Though a dramatic reduction of food price inflation to 6 percent is shown in 2009, the 2010 devaluation of Ethiopian currency, in terms of dollar, contributed to another dramatic rise in food price of 40.7% in 2011. Imprudent fiscal and monetary policy measures were responsible for the recent food price inflations which threating the welfare of Ethiopians (Assefa, 2013).

4.1.2.2. Comparison of changes in Birth Rates and Macroeconomic Crisis: 1970-2011

In figure 4.8 the five years moving average of birth rates is fitted to the annual birth rates. Like the macroeconomic indicators, the birth trend over the study period is very fluctuating. Interestingly, it is well consistent with the trends of GDP and food price. Between 1976 and 1978, the years after the 1975 famine and the war in the eastern part of the country was undergoing, birth rates were very low which reached as low as 14 percent in 1978. However, the following two years of good harvest and low inflation came up with a baby boom, when birth rate was 24 percent in 1979 which is never reached then. After the disastrous famine of 1984/85, birth rate remain low throughout the second half of the 1980s and it was very low in 1991 when the civil war heightened and food price inflation reached at the historically high level of 30 percent. Another sharp reduction in birth rate was occurred in 1999, the second year of Ethio-Eritrean war. This might be a response to the psychological and economic stress following the war which pushed GDP growth rate to -8% in 1998 or it might be due to the separation of spouses as husbands went to the war front. Moreover, Birth rates remain low in the post-war years of 2001 to 2003 which is even exacerbated by the 2002/03 famine.

After successive years of political and economic strains, another baby boom is occurred in the relatively low inflationary and agricultural production boom season of 2004. In the year 2004, inflation was a slow as 3 percent and GDP growth rate surpassed 5 percent. It is not surprised to observe high birth rates in the year following the 2003 famine as it affected only few regions of the country (SNNPR, Benishangu--Gumuz and Amhara regions) (IFPRI,2009).

Recently, 2005-2011, the birth rate is more responsive to food price fluctuations than the GDP growth rate. Over this period, the country experienced constantly high and harsh food price crisis and one of the fastest economic growths in the region, at the same time. As figure 4.8 evidenced, the trend of birth rate followed the trend of food price than the GDP growth.

These data suggest a clear linkage between macroeconomic conditions and birth timing in the last four decades. In the case of modest crisis, births were more responsive in the second year of the crisis. On the other hand, births were instantly low in the harsh famine and war periods of the like of 1978, 1984/85, 1991, and 2008.

4.2 Econometrics Result

The descriptive analysis in the previous section has already clarified the linkage between macroeconomic shocks and birth timing in Ethiopia. It also uncovers how birth timing varies by different socio-economic characteristics of the women and their household. However, careful investigation of these correlations calls for a multivariate analysis, considering all possible determinants together. The explanatory variables controlled in this event history analysis of birth intervals are summarized in table 3.1(see the appendix). The event of interest is the birth of next child, at time t.

Before we look at these correlations, in addressing the research questions, it is important to examine the validity of the two-level random effect logit model specified in section three: the piecewise specification of the baseline hazard, the importance of the unobserved heterogeneity and the assumption of proportional effect of covariates on the birth hazard. In doing so, four different models were specified and estimated, for a comparison, below. The first model is specified in the way that the hazard rate is to depend on explanatory variables only. This specification assumes that the birth hazard of each woman does not change separately over time and any change that may occur is, solely, in response to changes in the explanatory variables. Four types of explanatory variables are considered. First: indicators of macroeconomic crisis (GDP growth rate[8]). Second: measures of the women and her partner socio-economic status; educational attainment, asset ownership, occupation, residential area and others. Third: basic characteristics of the women such as Age, religion and birth cohort. Fourth: characteristics of the index child such as sex and survival status are controlled. Fifth: to minimize the effect of outliers, a dummy variable for major peaks and troughs in annul trend of GDP growth rate is controlled.

As shown in table 4.3, the estimated coefficients of all the individual and macro level covariates are at their expected sign and most of the variables have a statistically significant effect on the woman's likelihood of giving birth in interval t. Years of economic fortune and the previous years of good harvest seasons increase the probability of giving birth at time t. A woman with more number of daughters in the family , more educated and Christian is less likely to give the j^{th} birth in year t. Sex and survival status of the previous child have also a significant impact. Land ownership and occupational status of the women have less impact on the birth decision of women in a given year.

The second model is specified in the way that the hazard rate is allowed to vary across the five (years) birth time intervals, after controlling the other explanatory variables[9]. Thus, in model-II, dummies of the g-1(4) time intervals are estimated in addition to the explanatory variables that are controlled in model-I. The logistic regression result shows that the birth hazard increases with the number of years the women is at risk of birth and the coefficients for the intervals are significant. It is worth to note that, the addition of time intervals in the estimation affect the significance and effect of the other explanatory variables. The effect of residential

[8] I have employed only one of the macroeconomic indicators ,for the model selection purpose

[9] In this piecewise specification , the baseline hazard is specified as a step function which is fitted by including dummies of for grouped birth interval durations of 5 categories, g=1,2,3,4 and 5. By doing so, the hazard s is assumed to be constant within each year.

status, wealth status and household headship turned out statistically significant. On the other hand, Macroeconomic crises, now, have only a delayed effect.

Following Allison (1982), the validly of model-II (duration effects) is examined by comparing the LR chi-square statistics of the two models[10]. Accordingly, the difference in the LR chi-square statistics is 13843.24 with 4 degree of freedom. The test statistics is significant at the 5 percent level of significance and there is a strong evidence to reject the null hypothesis that the duration effects are insignificant. Thus, I chose model –II over Model-I.

Model three test the assumption of time independent effect of covariates by estimating the coefficients for interaction terms: interaction of selected covariates with time intervals (years). I have constructed (separately) the interaction tem of all significant explanatory variables (from model-II) with intervals and compared each model with model-II, using similar logic applied above. And, the test result supports the time independent effect of main explanatory variables (i.e. growth and inflation) and the assumption of proportionality is considered in the study. Model-III of table 4.3 presents the estimated interaction term of one of the main variable of interests, GDP growth rate, with time intervals. The estimation results for the other interaction terms are not reported.

Finally, Model I through III ignore the unobserved heterogeneity and therefore threat inter-birth intervals for the same women as independent (conditional on covariates). However, in such event history analysis, omission of relevant but unobserved factors which affect the birth tendency of women is possible and it may leads to a biased estimates. The positive (negative) estimates from Model-III, underestimate (overestimate) the true coefficients from Model-IV. Moreover, since repeated events are pooled in this analysis, the existence of the unobserved heterogeneity means the correlation of inter-birth intervals. Thus, to make sure that intervals durations of different births of the same woman are independent and to minimize the potential endoginity problem, I added random effects (also called shared frailty) to control for unobserved heterogeneity between women and a multilevel random effect logit model is estimated in model-IV. The estimated between- women residual variance is statistically significant and the likelihood ratio test statistics of 86.74 (Prob >= chibar2=0.00) provide evidence of residual heterogeneity.Thus, the two-level random effect logit model (model-IV) is employed for the rest of the analysis in this study.

[10] Under the null hypothesis that the second model is 'similar' to model-I, the difference in the LR chi-square statistics of the two models, with the associated differenced degree of freedom, has a chi-square distribution

Table 4.3. Logistic Regressions of the Odds of Giving Birth, by Birth Interval: Model Selection

	Model-I		Model-II		Model-III		Model-IV	
	Odd ratio	Sd.Err	Odd ratio	Sd.Err	Odd ratio	Sd.Err	Odd ratio	Sd.Err
Macroeconomic indicator								
$Growt_t$	1.012*	0.001	1.000	0.001	1.000	0.001	1.001	0.001
$Growth_{t-1}$	1.018 *	0.001	1.006*	0.001	0.992***	0.004	1.014*	0.001
$Growth_{t-2}$	1.018*	0.001	1.009*	0.001	1.009*	0.001	1.015*	0.001
Age at the interval (Ref= 15-19)								
20-24	1.001	0.025	1.092*	0.031	1.092*	0.031	1.148*	0.035
25-29	.978	0.034	1.118*	0.044	1.118*	0.044	1.282*	0.058
30-34	0.970	0.049	1.227*	0.070	1.227*	0.070	1.540*	0.105
35-39	0.969	0.094	1.234**	0.135	1.234**	0.650	1.733*	0.215
40-49	1.146	0.351	1.872***	0.651	1.869***	0.031	2.621*	0.980
Survival status of index child (Ref= survive)	0.907*	0.022	0.864*	0.023	0.864*	0.023	1.148*	0.024
Survival status of index child								
Died within 2 years	1.456*	0.042	2.120*	0.072	2.118*	0.072	2.184*	0.079
Died after 2 years	1.326*	0.046	1.718*	0.068	1.717*	0.068	1.765*	0.074
Head of the Household								
Male	1.032	0.027	1.071**	0.031	1.071**	0.031	1.079**	0.036
Place of residence(ref=urban)								
Rural	1.041	0.042	1.078***	0.048	1.079***	0.048	1.091***	0.056
Education Level(ref=no-education)								
Primary	0.936*	0.022	0.895*	0.024	0.895*	0.024	0.884*	0.027
Secondary	0.734*	0.053	0.615*	0.048	0.616*	0.048	0.598*	0.052
Land ownership(ref=landless)								
Semi-landless	1.038	0.025	1.044	0.028	1.043	0.028	1.054***	0.033
Own land	1.014	0.035	1.003	0.039	1.004	0.039	1.016	0.046
Wealth Status(ref=first quantile)								
Second	0.980	0.026	0.960	0.029	0.960	0.029	0.958	0.033
Third	0.992	0.027	0.978	0.030	0.978	0.030	0.981	0.035
Fourth	1.038	0.029	1.062**	0.034	1.062***	0.034	1.071***	0.040
Fifth	.977	0.040	0.948	0.044	0.948	0.044	0.944	0.051
Religion(ref=Christian)								
Muslim	1.080*	0.028	1.149*	0.331	1.149*	0.033	1.177*	0.039
Traditional and others	1.060	0.061	1.131**	0.073	1.128***	0.073	1.135***	0.086
$\boldsymbol{Parteners' soccupation(ref = agricultur)}$								
$Managerial/professional$	0.945	0.036	0.917**	0.039	0.917**	0.039	0.909**	0.044
$Sales/serivce$	0.984	0.032	0.972	0.036	0.973	0.036	0.971	0.041
Not working	1.113	0.074	1.239*	0.094	1.238*	0.094	1.267*	0.110
Unskilled manual	0.840**	0.087	0.768**	0.088	0.768**	0.088	0.745**	0.095
Interval(years) (Ref= fifth)								
First			0.046*	0.261	0.048*	0.259	0.035*	0.287
Second			0.604*	0.721	0.611*	0.723	0.543*	0.928
Third			0.987*	0.990	0.995*	0.992	0.944*	1.452
Fourth			1.034*	1.083	1.036*	1.106	1.018*	1.694
$\boldsymbol{Growt_{t\_1}}$***×Interval(ref=fifth)***								
First					1.015*	0.004		
Second					1.013*	0.004		
Third					1.019*	0.005		
Fourth					1.022*	0.007		
Constant	0.416	0.037	0.7375566	0.003	0.720	0.003	0.995	0.969
Random effect variance ($\delta^2{}_u$)							0.394	0.025
Model Summary								
Number of observations	62,405		62,405		62,405	62,405		
LR chi2	1047.48		14890.7		14906.3			
Degree of Freedom	65		69		73			
LR statistics for rho								86.74

*, **, ***. Denote significant at 1%, 5% and 10% respectively

Some of the variables such as birth orders, number of daughters and sons in the family, region dummies, house ownership, age at marriage, partner education are controlled in the estimation but not reported, here.

Note: Coefficients are presented as odds ratios. Hence, it shows a negative relationship whenever an odds ratio is less than unity.

4.2.1 Marital Fertility and Economic Crisis

The response of birth timing to short term macroeconomic shocks, after controlling other individual and socio-economic determinates are estimated and presented in table 4.4. Estimated Coefficients are reported as marginal effects and it indicate the percentage change in risk of giving birth for a one percent change in the covariate (relative to the reference group in the case of the categorical variables) while the other covariates are at their mean.

As it is indicated in the descriptive analysis, the changes of CPI and GDP were quite linked. Thus, in this logistic regression model, the two macroeconomic indicators are included separately. In the first model, inflation is appeared as the sole macroeconomic indicator while only GDP growth rate is controlled in the second model. To allow the delayed effect of macroeconomic crisis, the two years differenced series of inflation and GDP growth rate are considered in the models. The effect of acute years of inflation and severe decline and major peaks of growth are also controlled.

Before we discuss, the role of economic crises in birth timing, some remarks are made, below, about the role of individual and socio-economic characteristics of the women on marital fertility from table 4.4. The estimated result indicates that the birth hazard differs significantly by the socio-economic status of the woman, after controlling the effect of economic stresses. As expected, the likelihood of giving birth is higher among rural women than their urban counterpart. A family who own a land is 5.27 percentage points more vulnerable to a birth than a landless family. However, no significant difference is found between the semi landless and landless groups. Wealth status of the family has a U-shaped effect. The result indicates that middle income groups have a significantly lower risk of birth than the poorest groups of the society. However, as one climbed to the highest wealth quantile, the birth hazard rises together. Another important difference in marital fertility is found by the job sector of the partner. Women whose partners are working in the agriculture related jobs are exposed to a relatively higher risk of birth than those in the service sector and managerial /professional jobs. A more educated woman is less likely to bear the next child than uneducated woman. This differential is stronger among the uneducated women and women with secondary education than with women who attended college education. Each increase in age category of the women (in each time interval) caused a marked and highly significant increase in the risk of giving birth. Similarly, religion, birth cohort and gender of the head of the family are another important determinates of marital fertility in Ethiopia. The multivariate analysis found a strong and clear differential in the risk of birth of the women by the sex and survival status of the previous child. The death of the previous child would increases the probability of the birth of the j^{th} child by 56 percent. The effect is even stronger (80 percent) if the index child had died before celebrating its first birth day. This is consistent with replacement effect hypothesis that infant mortality is positively related to fertility (Schultz, 1996). It is also in line with the breast feeding hypothesis that the death of the index child would cause shorter period of lactation amenorrhea. Similarly the birth hazard is lower if the index child is a female. Probability of giving birth is generally higher for the higher order births, as compared to the second birth. However, no consistent relationship between marital fertility and birth order is found.

Table 4.4: Event History Analysis of Birth timing, Ethiopia, 1970-2011

- **Marginal Effects after Random Effect Logistic Regression-**

	Model-I		Model-II		Model-III	
Variable	Coefficient	Std.Err	Coefficient	Std.Err	Coefficient	Std.Err
$Price_t$	-0.002	0.001			-0.0022	0.001
$Price_{t-1}$	-0.012*	0.001			-	-
$Price_{t-2}$	-0.0006	0.001			-0.0007	0.001
$Growt_t$			-0.0026	0.0016		
$Growth_{t-1}$			0.0038**	0.0015		
$Growth_{t-2}$			0.0068*	0.0015		
Age at the interval(t) (Ref= 15-19)						
20-24	0.131*	0.030	0.016	0.033	0.131*	0.030
25-29	0.233*	0.045	0.015	0.051	0.233*	0.045
30-34	0.412*	0.067	0.065	0.077	0.412*	0.067
35-39	0.507*	0.123	0.056	0.134	0.507*	0.123
40-49	0.954*	0.372	0.346	0.383	0.957*	0.010
Sex of Index child(Male)	-0.165*	0.029	-0.163*	0.029	-0.164*	0.029
Survival status of index child (Ref= survive)						
Died within 2 years	0.779*	0.036	0.807*	0.036	0.779*	0.036
Died after 2 years	0.564*	0.042	0.601*	0.042	0.564*	0.042
Head of the Household (Ref= female)						
Male	0.080**	0.033	0.080**	0.034	0.080**	0.033
Place of residence (Ref=urban)						
Rural	0.088***	0.051	0.082	0.053	0.087***	0.051
Education Level (Ref= None)						
Primary	-0.123*	0.031	0.133*	0.032	-0.123*	0.031
Secondary	-0.514*	0.087	-0.543*	0.089	-0.514*	0.087
tertiary	-0.309*	0.121	-0.298*	0.125	-0.310**	0.121
Land ownership (Ref= Landless)						
Own land	0.052***	0.031	0.067**	0.032	0.052***	0.031
Semi-landless	0.014	0.045	0.022	0.046	0.014	0.045
Wealth Status (First)						
Second	-0.043	0.035	-0.040	0.036	-0.044	0.035
Third	-0.020	0.036	-0.011	0.037	-0.020	0.036
Fourth	0.069***	0.371	0.084**	0.038	0.069***	0.037
Fifth	-0.053	0.053	0.040	0.055	-0.053	0.053
Birth Order (Ref= second)						
Third	0 .191*	0.033	0.165*	0.034	0.191*	0.033
Fourth	0.110**	0.045	0.055	0.046	0.109 *	0.045
Fifth	0.126***	0.056	0.040	0.059	0.126*	0.056
>=6	0.001	0.075	-0.109	0.079	0.0004	0.075
$\boldsymbol{Parteners' soccupation\ (Ref=Agriculture)}$						
$Managerial/professional$	-0.092***	0.048	-0.099**	0.050	-0.092	0.048
$Sales/serivce$	-0.024	0.042	-0.033	0.043	-0.024	0.042
Not working	0.238*	0.086	0.250*	0.089	0 .238	0.086
Unskilled manual	-0.285**	0.128	-0.312**	0.131	-0.285	0.128
Interval(years) (Ref= first)						
second	2.129*	0.034	2.108*	0.034	2.129 *	0.034
third	3.159*	0.038	3.139*	0.038	3.159 *	0.038
fourth	3.398*	0.047	3.364*	0.047	3.397 *	0.047
fifth	3.315*	0.059	3.263*	0.059	3.316 *	0.059
Parity x Price_t_1						
Second birth					-0.010*	0.0022
third birth					-0.011*	0.0025
Fourth birth					-0.014*	0.0027
fifth birth					-0.011*	0.0031
>=6 birth					-0.012*	0.0036
Constant						

,,*** significant at 1%, 5% and 10% respectively*

Note: Variables such as number of daughters, religion, region dummies, house ownership, age at marriage, partner education are controlled in the estimation but not reported, here

The hazard is 20 percentage points higher if the child is the third child. But, this relative risk is only 12 percentage point for the fourth and fifth order births. Moreover, statically significant evidence was not found for the higher relative risk (relative to the second birth) of the 6th and above order births. Thus, there is no clear evidence of parity specific birth adjustments in time of difficulties.

4.2.2 The Role of Economic Crises

In the above models, table 4.4., no statistically significant response of births to macroeconomic shocks, within the first 12 months after the crisis is found. However, there is evidence of delayed impact of shocks on the birth hazard of women, considering socio-economic characteristics of the women. In the first model, births respond negatively and significantly in the second year of the food price crisis. A 10 percent change in food price reduces the birth hazard by about 12 percentage points, in the second year of the crisis. This result is consistent with what Bengtsson and Dribe (2006) had found for the pre-industrialized Scania county of Sweden and for Liaodong province of china. However, the response is much stronger among the contemporary Ethiopian women. Similarly, Lindstron and Berhanu (1999) also found that a significant reduction on fertility in the second year of famine, in Ethiopia. However, a significant rebound in birth is not found, in this study, atleast in the first three years after crisis.

As shown in the second model, GDP growth rate had a longer delayed effect, on the risk of births timing, than the impact of food price crisis. That is, fertility responds to growth shocks within 12-36 months after the growth shock. However, the response is weaker as compared to its response to food prices. A ten percent change in GDP growth rate caused the probability of giving birth, in the second year, to increase only by 3.8percentage point. The stronger fertility response to food price is, partially, due to imprudent policy measures and world price changes, in some years, that caused inflation even in a good harvest seasons which negatively affected net-consumers. Moreover, majority of Ethiopian farmers are not net producers and are also affected by inflations of good harvest seasons. In order to strengthen this explanation, the second model was re-estimated for the sub-period 2004-2011 (a period of agricultural production boom and high inflation) and for the period 1970-2003 (a period where food price is mainly dictated by level of agricultural production) and compared. As it is presented in table 4.5 fertility responds negatively to the GDP growth rate in the sub-period 2004-2011. On the other hand, GDP growth rate had had a positive and significant effect on fertility over the sub-period 1970-2003. In addition, the model for the sub period 2004-2011 is also estimated after controlling both growth and the food price indicators. The result clearly shows that, the effect of GDP growth rate is strong and positive, once I have controlled the effect of cost of living.

Was the Effect of Economic Stress Parity Specific?

Studies in sub-Saharan Africa (example; Boserup, 1985; Lesthaeghe & Jolly, 1995) observed crisis led fertility reduction in this high fertility environment. The main explanation behind is large families have been less affordable to bear additional child as real income eroded due to recurrent macroeconomic crisis and civil war. The larger number of children in the family tends to reduce the household future consumption, thereby increasing household vulnerability in time of shocks (Haroon, 2009). Thus, the effect of crisis is expected to be stronger on the higher order births. Similarly, the marginal utility and marginal future economic benefit (to the parents) of an

additional child declines, with parity. Thus, households with more number of children would respond to economic stresses by having longer birth interval in the higher parities.

On the other hand, under the plausible assumption of higher economic scale advantage of large families, the effect of food price shocks is likely to be lower to higher order births. That is, additional cost of children decreases with parity. Moreover, when household income declines following economic hardships, the first and most important response is to mobilize additional labor in to the labor market or migration. This advantage of additional labor could help larger family to adopt shocks more effectively.

Under model-III of table 4.4, the parity specific effect of economic crisis is examined by estimating the interaction of the one year lagged value of prices with the five birth orders. The result shows no clear relationship between the fertility impact of economic crisis and birth orders. The effect first increase with parity up to the fourth birth and lower effect is observed at the fifth birth. Then the effect is higher for 6 and above order births. However, the between-parity birth hazard differential is small. The fertility effect of a 10 percent change in food price is 11 percentage points for the second birth while the impact is 12.5 percentage points for the six and above birth order. Thus, I didn't find significant evidence that show a parity specific effect of economic stress in Ethiopia.

4.2.3 Socio-Economic Differences in the Response to Macroeconomic Shocks

The Previous models have shown that macroeconomic crisis have a significant impact on the timing of birth among Ethiopian women and the risk of birth varies by the individual characteristics of the women. In the economic demography literatures, economic crisis affect different group of the society differently. For example, Bengtsson al (20004) explained that landless and semi-landless groups are more vulnerable to such kind of shocks than farmers, as they are net buyers of food. To examine the effect of socio-economic differences in the response of fertility to economic stress, the interaction effects between selected socio-economic characteristics of women and inflation, along with the covariates controlled above, are estimated. The estimates of the interaction of socio-economic status covariates with one year lagged price values are presented[1112] in table 4.6. Figures in the table indicate that Economic stresses stall the welfare of all Ethiopian households disregarding their difference in socio-economic status. However, the degree of the effect is significantly varied across groups.

Economic declines may affect the rural and urban groups differently. The economic benefits of children, access to family planning service and the basis of livelihood are different in the two settings. Söderbom et al, 2010 indicate that food price crises would affect the welfare of urban Ethiopians more severely than their rural counterparts, given the fact that the share of household expenditure spent on food by urban dwellers is larger than by rural households, who are relatively net producers. On the other hand, Barrett et al, 2013, argues that Ethiopian farmers have fragmented land and are net consumers. Moreover, rural households would be more severely affected by such shocks due to the absence of formal insurance mechanisms to smooth consumption in time of economic difficulties. The multilevel logistic regression result

[11] I have also estimated the interaction of socio economic covariates with the current and two years lagged price level and all the estimates are insignificant and not reported.

supports the later argument that rural households are more vulnerable to food price shocks in Ethiopia. The result shows that a 10 percentage increase in food price raises the risk of birth, among rural women, by 13.14 percentage point while the effect is only 5.4 percentage point among the urban women. This result is in contrast to studies found in Latin American countries (see; Marichal, 1989; Adsera, 2009).

The table also present the effect of economic crisis by occupational status of the partner. Since majority of Ethiopian women are house wives, partners are the sole breadwinners and the occupational status of the husband determines the living standard of the family. A family is highly prone to food price shocks if the husband is engaging in the agricultural sector and the effect is even severe if the husband is unemployed. The risk of birth falls by 23 percentage point, to this group of the society, for a 10 percent increase in food price. The high price effect against agrarians demonstrates that Ethiopian farmers do not produce enough to store foods to smooth consumptions and are net buyers, since they are working on the very fragmented land. The average farm size can generate only about 50% of the minimum income required for the average farm household to lead a life out of poverty (Gebreselassie, 2006). Moreover, in many regions of Ethiopia, agrarians are not grain producers. Rather, livestock are their main source of livelihood which is highly vulnerable even to moderate droughts. On the other hand, families whose breadwinner are in the sales and service sector are more resistant to food price shocks. There is no statistically significant evidence that this group are affected by food price shocks in the past. However, this group constitute only fifteen percent of the population.

To the extent that, education is highly correlated with income, the effect of food price crisis, which reduce the real income of the family, is predicted to be stronger among the less educated women. By the same argument, for educated women, the rational choice model predicts that, food price inflation would negatively affect them by reducing the real income (return of education) earned from the job market. On the other hand, the reduction in real income would reduce the opportunity cost of child bearing and marital fertility is predicted to be higher, in time of economic hardships, among them. The result confirms the differential impact of economic stresses by the education level of the women. It clearly shows that the impact of crises is stronger among the less educated than among the more educated. For women with no education and with only first level education, a ten percent rise in food price caused the risk of birth to fall by 13 percentage point and 11 percentage points a year after the crisis, respectively. These groups constitute 92 percent of the women in the society. For the rest 8 percent of the women, the fertility effect of economic crisis is insignificant.

A seemingly surprising result found from the differential response by land ownership that land owners are as responsive as landless households. However, majority of landless households are urban dwellers who are less affected by food price crisis, as mentioned above, and landowners are generally rural households who are working on a fragmented land and are highly prone to shocks. Equally surprising is semi landless households are much less affected by the crisis. Semi-landless households are those who own resources and energy to plough and rent land (either in the form of fixed rent or sharecropping) from landowners who are too poor to buy seeds and farm equipment. Moreover, they engaged on rural trading activities and diversify their income.

Table 4.6: The effect of a 10 percent increase in CPI on marital fertility, by socio-economic groups

Socio-Economic Group	Percentage	Z-Value
Place of Residence		
Urban	-5.41	-1.77**
Rural	-13.14	-8.70*
Land-Ownership		
Landless	-13.35	-4.37*
Semi-landless	-0.90	1.30
Landowners	-15.70	-6.61*
Source of livelihood		
Agriculture(ref)	-13.22	-8.43*
Professional/managerial	-10.11	-2.67*
Sales and service	-3.00	-0.85
Not working	-22.90	-2.64*
Unskilled manual	-13.57	-1.02
Wealth Status		
Poorest	-18.05	-6.55*
Poor	-14.92	-6.17*
Lower middle	-12.53	-4.17*
Upper middle	-10.80	-3.56*
Wealthiest	-6.40	-2.16**
Education		
No education	-12.76	-8.11*
Primary	-10.47	-4.06*
Secondary	-1.87	-0.23
Tertiary	-2.81	0.25

Note: a) Results are obtained from marginal effects of the random effect multi-level logistic regression.
b) All the individual covariates that are controlled in table 4.4 were also controlled here, but the estimated coefficients are not reported.Separate models were estimated to each interaction of the covariates with the price change.
c) *,**,***, significant at 1%,5% and 10%, respectively.

4.2.4 Passive Response or Deliberate Control of Births?

The above random effect logistic regression results provide a clear and strong response of births to short term crisis in the past four decades, in Ethiopia. And, the macroeconomic crisis affected all segments of the society at different degree. Now, the immediate question is the way these economic hardships affected birth timing: Deliberate control of births or passive response to shocks?

As it is mentioned in section two, the mechanism that economic stress would affect birth timing can be identified by examining the time pattern of the responses. A quick response (with in the year of the crisis) is an indication of deliberate control of births. That is, families could forecast future economic misfortunes and planned births, accordingly, by using contraception, by abstinence or by induced abortion. However, precise determination of the mechanism requires tracing the responses in quarterly basis (Bengtsson and Dribe, 2006). On the other hand, a delayed response (in the following years after the crisis) is an evidence of passive response to economic difficulties either due to temporary migration and separation of spouses or due to malnutrition which would lowered fecundity and increased spontaneous abortions.

In the above event history analysis, no evidence is found that Ethiopians could foresee bad economic years and planned births accordingly. The result shows that marital fertility respond to food price crisis after 12 months of economic stress and the effect die out after 24 months. This timing of the response is too late to be explained as deliberate adjustment of birth timing with economic stresses. Rather, it is consistent with the malnutrition and temporary migration hypothesis. The response could be due to separation of spouses following the temporary migration of a partner in search of job somewhere else or lower fecundity due to malnutrition. Both are plausible mechanisms in the Ethiopian context.

In Ethiopia, temporary migration of family members to nearby town and cities or to cash crop producer rural areas is one of the coping mechanisms to climate shocks (Dercon, 2002; IFPRI, 2010). In the time of economic difficulties, members of the drought affected family migrate to nearby cities with the hope of a labor wage, which would enable them to remit back to the families and purchase seeds and farm equipment for the next production season. Ezra,2001 indicate that farmers and rural poor of the northern highlands send family members (usually the bread winner) , in search of job, to the sugar and cotton growing rift valley lowlands, where the job is available throughout the year as they practice irrigation and not dependent on the annual rainfall. Similarly, temporary migration to coffee producing south and south-east provinces of the country, following the harvest failure in the crop producing areas, is also common. In Ethiopia, Land is a state owned asset and the family could lose it if all the members migrate for an extended period of time. In addition, the land would also be overtaken by the government if it is not cultivated in the next season. Thus, some members of the family (usually the wife and kids) stay behind. The migrated member would return back to his/her village once he earned enough money to buy seeds and other farm equipment for the next production season.Thus, spouse separation is only temporary and fertility is expected to get normal a year after the partner return back home. The insignificant effect of food price crisis after 24 months is in line with this explanation. Similarly, temporary separation of spouses in time of war and political difficulties was also common in the 1970s and 1980s. For example, during the Somalian invasion in 1977/78, when food price hiked, younger peasants went to war front, temporarily, until the end of the war in the same year.

The differential impact of economic crisis by socioeconomic status can be explained by the selective nature of migration. For example, landowners are found to be more vulnerable to economic stresses than semi-landless. As we have mentioned, semi landless families do not have risk of losing their land tenancy by the government, as they are mainly sharecroppers. Thus, spouses are more likely to migrate together.

The delayed impact of crisis is also in line with malnutrition hypothesis. There is a well-documented evidence that whether induced famines had caused serious temporary food shortage in Ethiopia which malnourished and caused for the death of considerable proportion of the society. For example, the 1984/85 famine claimed the lives of 1 million people while the 2003 famine caused serious food shortage for 14 million people. This would force partners to reduce sexual intercourse, reduction of sperm production, loss of libido and hence lower fecundity. Interestingly, the malnutrition effect of economic crisis is not similar across all segment of the society. For instance, in the modest economic decline year of 199/2000, a percentage increase in food price caused rural households to reduce about 25 Kcal/day while urban households loss only 8-16 kilo calorie per day (IFPRI, 2009). This is consistent with our result that the delayed impact of economic stress is stronger in urban area.

Chapter 5

Conclusion and Policy Implication

Based on the 2011 Ethiopian Demographic and health survey data, this study analysed the response of marital fertility to short term macroeconomic crisis that Ethiopian has been facing in the last forty years. By doing so, the study could quantify and compare the living standards of various socio-economic groups of the country. Variations in food price and GDP growth rate were used as a proxy for short term economic stresses.

The multivariate regression estimate found a clear response of marital fertility to economic stresses. Periods of economic declines and high food prices have been causing lower risk of births. However, evidence of immediate response of fertility, to shocks, is not found. Marital fertility has shown a significant reduction within 12-36 months after the crises. The influences of short term economic hardships were found considerably different across various socio-economic groups. Rural, less educated and landed family are more vulnerable to short term economic crisis. Landless women, they are mainly urban dwellers, are less responsive to shocks. The delayed impact of the crisis is higher if the partner is engaging in the agricultural sector or if he is unemployed. The study also found the characteristics of the index child as an important modifier of the impact. The woman is more responsive if the index child survived and if the index child is male.

A Careful examination of the time pattern of the responses shows that Ethiopian households were not able to foresee crisis and plan births accordingly. The strong and delayed impact of the economic stresses evidenced passive response of marital fertility in Ethiopia. Marital fertility was declined due to separation of spouses as a partner temporarily migrates in search of work elsewhere. The diversified topography of the country allowed a member of the family to migrate temporarily to the less affected areas or to nearby cite and towns. Similarly, temporary separation of couples for military service following political crisis were also common. Moreover, droughts and famines had caused spouses malnourished and lowered fecundity.

Though, this thesis was able to give a good insight about the relationship between marital fertility and economic hardships in the Eastern African nation, and hence a provide a proxy measure for the living standard of the various socio-economic groups, further studies in the area is required to improve the study in several ways. First: the channels by which short term economic stresses are affecting births can be more effectively identified from a continuous time event history analysis. That is, by following the time pattern of responses in monthly basis, it is possible to identify the mechanisms more precisely. Second: in-depth analysis of the response among sub-segments of the society is more interesting. For instance, in this study, the same model and similar covariates were employed to examine the response of rural and urban households. By doing so, it was more interested to see the differential impact pf shocks by area

of residence. However, it might be important for policy makers to identify how differently the agrarian and pastoralist rural women respond to economic shocks. This cannot be captured when we have the same model for both rural and urban households. Another indication of this limitation is, I have found a smaller impact of shocks on landless households than landowners. This is due to the fact that majority of the landless groups are urban households who have better living standard than the landowner rural dwellers. However, the result might be different if a comparison was made between landless and landed rural households only.

One of the most important lesson drawn from this thesis is the poverty reduction strategy of the country should focus more on the rural households in improving the productivity of the small scale farmers, creating off-farm income sources , expanding education among the agrarians. The differential impact of the crisis across regions also indicates the high disintegration of markets in Ethiopia which require efforts to improve infrastructures and other policy measure in integrating regional markets. The other implication is towards population and health policy. In an effort to foster the fertility transition of the country, attentions should be put on fighting the high infant and child mortality which is found as a key driving force behind the high marital fertility of the country, even under economic uncertainties.

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Appendices

APPENDIX I: Supplementary Figures and Tables

Table 3.1. Distribution of women/Birth-Interval by Covariates (partial)

Woman-level Variables	Number of Women	Percentage of women	Description
Birth cohort			
Cohort 1	813	8.58	=1, if the mother was born in the 1950s, 0 otherwise
Cohort 2	2,377	24.6	=1, if the mother was born in the 1960s, 0 otherwise
Cohort 3	4,061	42.72	=1, if the mother was born in the 1970s, 0 otherwise
Cohort 4	2,221	23.5	=1, if the mother was born in the 1980s, 0 otherwise
Head of the Household(Male)	7,340	82.13	=1, if sex of the head is male, 0, otherwise
Age at first marriage	9472	17	Age of mother at first marriage
polygamy	2,332	21.13	=1, if the women is in the polygamous marriage union
Education			
None	2,768	60.12	=1, if she has no formal education, 0 otherwise
Primary	596	31.26	=1, if she got some primary education, 0 otherwise
Secondary	413	4.6	=1, if she got some secondary education
Tertiary	2,768	3.6	=1, if she is college graduate
Women occupation			
Not working	4,786	51.04	=1, she was not working, 0 otherwise
Professional	1,060	10.49	=1, if the women had been in some professional(technical, managerial)
Service and sales	1,707	18.5	=1, if she was involved in the service sector
Agriculture	1,748	26.7	=1, if the women had been in the agriculture related work
Unskilled manual	76	0.71	=1, the women was working some unskilled manual job,
Term of employment			
Not working	4,791	50.58	=1, if she hadn't work, 0 otherwise
Family	3,795	49.92	=1, the women was working in the family enterprise /self-employed
Employed	886	6.81	=1, if the women was employee of a non-family enterprise
Land ownership			
Landless	4,148	43.84	=1,If the household has no land, 0 otherwise
Own land	4,100	54.1	=1, if the family own land jointly with another family
Semi landless	1,214	12.48	=1, if the family own land both jointly and individually
House ownership	1,520	14.15	=1, the women live in her own house, otherwise
Wealth			
First	2,503	26.43	=1, if the women is from the lowest wealth quantile, 0 - otherwise
Second	1,460	19.76	1, if the women is from the second lowest wealth quantile,
Third	1,347	19.53	=1, if the women is from the middle wealth quantile,0 - otherwise
Fourth	1,426	18.92	=1, if the women is from the high wealth quantile,0 - otherwise
Fifth	2,736	22.37	=1, if the women is from the highest wealth quantile,0 –otherwise

Religion			
Christian	5,270	56.4	=1, if she is Christian, 0-otherwise
Muslim	4,027	31.65	=1, if the women is Muslim, 0-otherwise
Traditional and others	175	2.07	=1, if the women is member of a traditional religion, 0-otherwise
Place of residence (Rural)	6,919	80.0	=1, if she is living in rural area and 0, if she is living in urban area
Interval-level Variables	Number of	Percentage	
Sex of index child	11,749	42.92	Sex of the previous child, 1-if it is male, 0-otherwise
Survival status of index child			
Survive for < 2years	2,559	11.9	=1, Dummy variable=1 if the previous child died within 2 years of birth
Survive for >= 2years	832	3.80	Dummy variable=1 if the previous child died after 2 years of birth
Age at time intervals(years)			The age of the mother at the beginning of the episode
< =19(years)	2,819	12.56	=1, if she was <20 years old
20-25(years)	8,163	37.81	=2, if she was [20,24] years old
25-29(years)	7,000	31.02	=3, if she was [25,29] years old
30-34(years)	3,289	14.18	4, if she was [30,34] years old
35-39(years)	1,023	4.26	5, if she was [35,39] years old
40-49(years)	146	0.57	6, if she was [40,49] years old
Birth parity	Frequency	percentage	Order of the jth birth
Second	6,685	31.00	
Third	5,269	24.3	
Fourth	4,176	19.3	
Fifth	3,160	14.6	
>=6	2,336	10.8	
Inter-birth Interval			Number of years a women was a risk of next birth starting from the last birth
[1,2)	3,694	18.22	
[2,3)	8,283	40.86	
[3,4)	5,287	20.08	
[4,5)	960	4.7	
>=5	2,043	10.08	
Macro Variables			
GDP Growth Rate_t	21,499	2.74	GDP growth rate at the birth year of the jth child
GDP Growth Rate_t_1	21,499	2.31	
GDP Growth Rate_t_2	21,499	1.93	
Price _t	21,499	8.41	Inflation rate at the birth year of the jth child
price_t_1	21,499	7.66	
price_t_2	21,499	7.01	

Source: 2011 Ethiopian Demographic and Health Survey

Table 4.1: The Probability Distribution of inter-birth interval

Year	Cumulative Failure	Hazard rate	Survival
[1,2)	.0245	0.0248	0.9775
[2,3)	.2038	0.2025	0.7962
[3,4)	.5026	0.4619	0.4974
[4,5)	.7327	0.6019	0.2673
[5,6)	.9152	0.9983	0.0848

Source: Computed from the 2011 EDHS

Table 4.2: Life Table Estimates of Median Length

Variables	Median Interval (years)	Cumulative Hazard (at the median birth interval)	Hazard rate (at the median birth interval)
Place of residence			
Rural	3.5	0.5772	0.4517
Urban	5.5	0.5421	0.1775
Birth cohort			
Cohort 1	3.5	0.5042	0.3409
Cohort 2	3.5	0.5080	0.3459
Cohort 3	3.5	0.5561	0.4322
Cohort 4	2.5	0.3708	0.4320
Head of the Household			
Male	3.5	0.5425	0.4054
Female	3.5	0.4730	0.3027
Education			
None	3	***0.5740***	***0.4365***
Primary	3	***0.4642***	***0.3284***
Secondary	5	0.5574	0.1679
Tertiary	5	0.4871	0.143
Partner occupation			
Not working	3	0.5263	0.2944
Professional	5	***0.5486***	***0.1725***
Service and sales	4	0.5679	0.2484
Agriculture	3	0.5796	0.4601
Unskilled manual	5	0.5408	0.1374
Land ownership			
Landless	4	0.5597	0.2348
Semi-landless	3	0.5876	0.4768
Own land	3	0.5132	0.3633
Wealth			
First	3	0.5793	0.4387
Second	3	0.5756	0.4630
Third	3	0.5747	0.4675
Fourth	3	0.5895	0.4661
Fifth	5	0.5538	0.1834
Religion			
Christian	2-3	0.4795	0.3606
Muslim	3	0.5887	0.4155
Traditional and others	3	0.5890	0.4291
Sex of index child			
Male	3	***0.5347***	***0.3752***
Female	3	***0.5331***	***0.3875***
Survival status of index child			
Survive	3	0.5132	0.4473
Survive for <= 2years	2	.5126	0.5053
Died after 2 years	3	0.5827	0.4076
Age at index birth (years)			
< =19(years)	2	0.5994	0.6901
20-25(years)	2.5	0.6228	0.5026
25-29(years)	3	0.4791	0.3442
30-34(years)	4	0.5304	0.2390
35-39(years)	5	0.4807	0.1166
40-49(years)	5	0.5085	0.1296

Source: Source: Computed from the 2011 EDHS

Table 4.5: Logistic Regressions of the Odds of Giving Birth, by Birth Interval: By Sub-Period

	1970-2003		2004-2011	
Variable	Odds Ratio	**St.Error**	Odds Ratio	**St.Error**
$Growt_t$	**1.000**	0.001	**0.920**	0.017
$Growth_{t-1}$	**1.006***	0.001	**0.969***	0.003
$Growth_{t-2}$	**1.009***	0.001	**1.030***	0.004
Age at Index birth (Ref=15-19)				
20-24	1.092*	0.031	1.144**	0.061
25-29	1.118 *	0.044	1.352*	0.101
30-34	1.228 *	0.070	1.540*	0.169
35-39	1.234***	0.135	1.452***	0.287
40-49	1.873***	0.651	2.572*	1.195
Sex of Index child(Male)	0.864*	0.023	0.659*	0.030
Survival status of index child (Ref=survive)				
Died within 2 years	2.120*	0.072	2.544*	0.170
Died after 2 years	1.718*	0.068	1.649*	0.147
Head of the Household				
Male	1.071**	0.031	1.157*	0.054
Place of residence (Ref= urban)				
Rural	1.078***	0.048	1.221*	0.089
Education Level (Ref= none)				
P*rimary*	0.895*	0.024	0 .842*	0.035
Secondary	0 .615*	0.048	0.686*	0.083
tertiary	0 .751*	0.082	0.759	0.147
Land ownership (Ref= Landless)				
Own land	1.011	0.028	0.998	0.042
Semi-landless	1.003	0.039	1.014	0.067
Wealth Status (Ref= First)				
Second	0.960	0.029	1.051	0.050
Third	0.978	0.030	0.972	0.049
Fourth	1.062	0.034	1.094***	0.058
Fifth	0.948	0.044	0.955	0.072
Religion (Ref= Christian)				
Muslim	1.149	0.033	1.212*	0.059
Traditional and others	1.131	0.073	1.165	0.126
Birth Order (Ref= second)				
Third	1.252*	0.0401	1.306*	0.080
Fourth	1.199*	0.049	1.377*	0.108
Fifth	1.279*	0.064	1.578*	0.149
>=6	1.170*	0.078	1.471*	0.168
$\boldsymbol{Parteners' soccupation}$ **(Ref=Agriculture)**				
$Managerial/professional$	0.917*	0.039	0.906	0.061
$Sales/serivce$	0.972	0.036	1.051	0.06
Not working	1.239*	0.094	1.250***	0.154
Unskilled manual	0.768**	0.088	0.909	0.151
Duration(years) (Ref= duration1)				
Duration2	7.898*	0.261	8.141*	0.471
Duration3	20.801*	0.721	24.355*	1.475
Duration4	24.688*	0.99	30.555*	2.096
Duration5	21.595*	1.083	31.608*	2.637
Constant	0.034*	0.003	0.041*	0.014
Model summary				
Number of observations	62405		22774	
LR chi2	14890.73			
Degree of Freedom	70		68	
Log likelihood	-31384.531		6045.72	
Prob >chi2	0.000		0.000	

*, **, ***. Denote significant at 1%, 5% and 10% respectively

Figure 4.2: Estimated Hazard Rates by Birth Orders (in years after the birth of the index child)

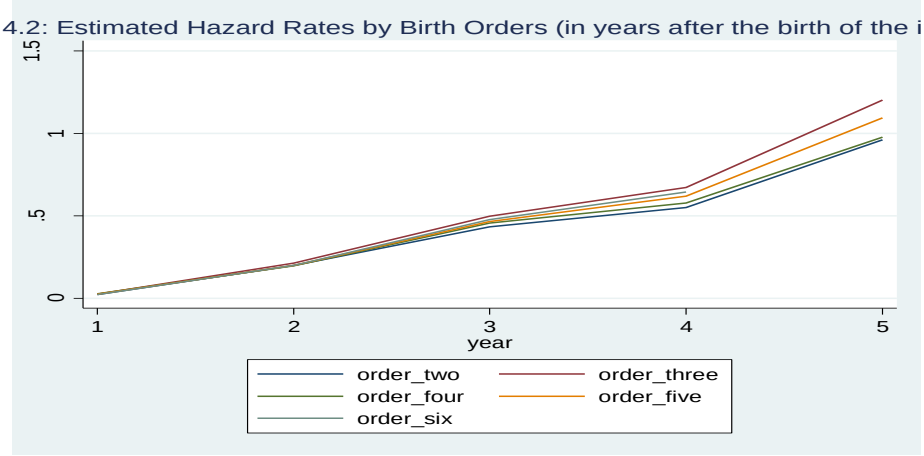


Figure 4.3: Estimated Hazard Rates by area of residence (in years after the birth of the index child)

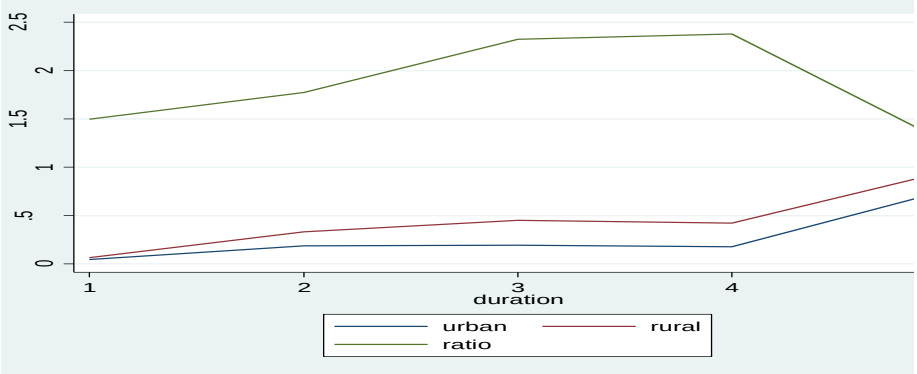


Figure 4.4: Estimated Hazard Rates by educational attainment of women (in years after the birth of the index child)

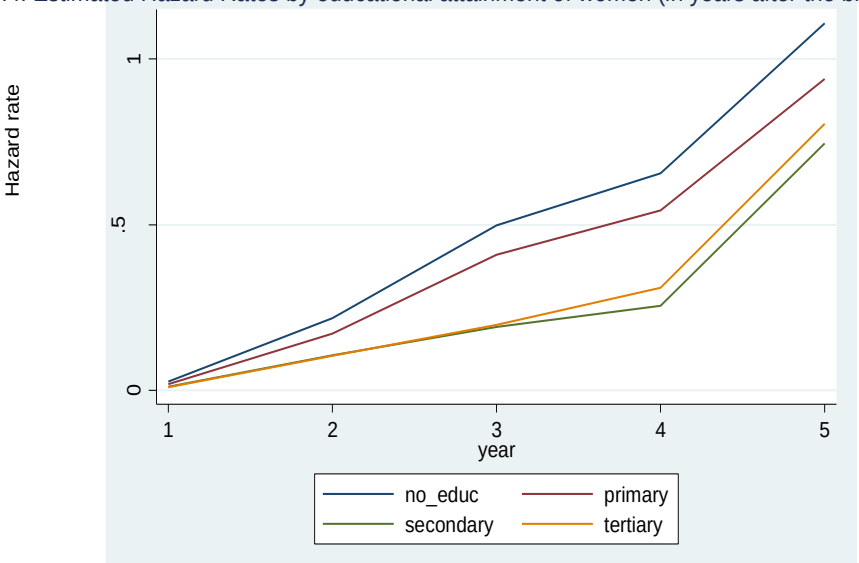
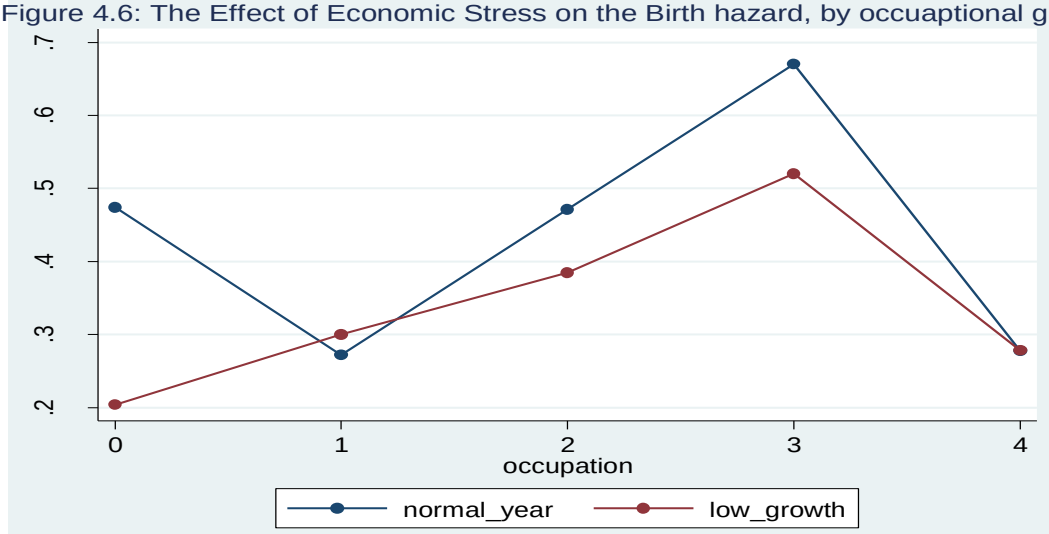


Figure 4.5: Estimated Hazard Rates by survival status of the index child (in years after the birth of the index child)

Figure 4.6: The Effect of Economic Stress on the Birth hazard, by occuaptional groups



0= agriculture, 1= managerial, 2= service and sales, 3= not working, 4= uskilled manual