ADDIS ABABA UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENT OF ECONOMICS

THE EFFECT OF AGGREGATE ECONOMIC SHOCKS ON CHILD HEALTH OUTCOMES: THE CASE OF 20 SENTINEL SITES IN ETHIOPIA

By

Kahsu Hindeya

February, 2022

Addis Ababa, Ethiopia

ADDIS ABABA UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENT OF ECONOMICS

THE EFFECT OF AGGREGATE ECONOMIC SHOCKS ON CHILD HEALTH OUTCOMES: THE CASE OF 20 SENTINEL SITES IN ETHIOPIA

A Thesis Submitted to the College of Business and Economics of Addis Ababa University in Partial Fulfillment for the Degree of Master of Science in Economics (Natural Resource and Environmental Economics)

By

Kahsu Hindeya

Advisor: Adane Tuffa (PhD)

February, 2022

Addis Ababa, Ethiopia

DECLARATION

I, Kahsu Hindeya, do hereby declare that this thesis is my original work. It has not been submitted partially or in whole by any other person for an award of a degree in any other university/institution. All the sources I used or quoted have been indicated and acknowledged by complete references.

Full Name ______________________

Signature ______________________

Date __________________________

This Thesis has been submitted for examination with my approval as College supervisor.

Name of Advisor______________________

Signature ____________________________

Date ________________________________

ADDIS ABABA UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENT OF ECONOMICS

This is to certify that the thesis prepared by Kahsu Hindeya entitled: The Effect of Aggregate Economic Shocks on Child Health Outcomes: The case of 20 Sentinel sites in Ethiopia, and submitted in partial fulfilment of the requirements for the Degree of Master of Science in Economics (Natural Resource and Environmental Economics) complies with the regulations of the University and meets the accepted standards concerning originality and quality.

Signed by the Examining Committee

______________________	____________	________
External Examine	**Signature**	**Date**
______________________	____________	________
Internal Examiner	**Signature**	**Date**
______________________	____________	________
Advisor	**Signature**	**Date**

ACKNOWLEDGMENTS

First and for most, I would like thanks to the almighty God for everything. Next, I would like to express my gratitude to the commitment of my advisor Dr. Adane Tuffa of Addis Ababa University for his advising throughout my work on the thesis.

I would like to extend my deepest appreciation to my colleagues Dr. Aregawi G/Medihin and Mr. Asefa Belay for his priceless assistance, patience, and guidance during this work. Thank you for not giving up on me and encouraging me through this endeavor.

And then, I would like to thank the main Department of Education, Ministry of National Defense and all staff members of Economics Department of Addis Ababa University.

Last, but not least, I would like to thank my family and friends for their encouragement, financial support and invaluable comments.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

CC	Child's Characteristics
CE	Consumptions and Expenditure
DHS	Demographic Health Survey
ECCD	Early Childhood Care and Development
ECD	Early Childhood and Development
EDHS	Ethiopia Demographic and Health Survey
EMDHS	Ethiopia Mini Demographic and Health Survey
EPHI	Ethiopian Public Health Institution
ESH	Economic Shocks
FAO	Food and Agricultural Organization
FE	Fixed Effects
GDP	Gross Domestic Product
HC	Household Characteristics
HH	Households
HHI	Household Incomes
HIN	Health Inputs
HIV	Human Immunodeficiency Virus
Ho	Initial Health
HQC	Health Quality of Child
HSTP	Health sector development program
IFAD	International Fund for Agriculture Development
LMIC	Low and Middle Income Countries

MDG	Millennium Development Goals
MOFED	Ministry Of Finance and Economic Development
MoWUD	Ministry of Works and Urban Development
OC	Old Cohort
OECD	Organization for Economic Co-operation Development
PCCE	per capita consumption and expenditure
PCV	Pneumococcal Conjugate Vaccine
RE	Random Effect
RMNCAYH	Reproductive, Maternal, Neonatal, Child, Adolescent and Youth Health
RMNCH	Reproductive, Maternal, Neonatal, Child, Health
SDG	Sustainable Development Goals
SNNPR	South Notion National People Region
TB	Tuberculosis
USAID	United States Agency for International Development
WFP	World Food Program
WHO	World Health Organization
YC	Young Cohort
YL	Young Live

ABSTRACT

Ethiopia has suffered from different aggregate economic shocks such as droughts, crop failure, famines, death of livestock, epidemics, floods, landslides, civil wars, and mass displacement, as well as rapid declines in major export commodity prices and it presents a compelling context in which to desire a better understanding of its history of recurring natural and economic shocks. The two covariate shocks, that is, economic and natural shocks are more likely to aggravate reductions in savings and in food consumption. In this study, we used young lives' longitudinal data survey of UK project in Ethiopia. Fixed effect and random effect estimators in parallel with quantitative are used. This study adds to a limited literature and analyzes the effect of aggregate economic shocks on children's health outcomes i.e. anthropometric measurements particularly, height-for-age and body mass index- for-age taken within the young cohort age group. The mean value of zhfa (zbfa) score of these YL children employed in this study was -1.59 (-1.39) respectively and 46.63% (46.53%) of these YL children were below this mean value and lie in the interval -8.50 (-9.90) and -1.323 (-1.536) zhfa (zbfa) of the normal curve respectively and 53.37% (53.47%) of these YL children were above this mean value and lay between -1.323 (-1.536) and 10.5 (5.50) zhfa (zbfa) of the normal curve respectively. The effect of crop failure on these young live children is estimated to be about 0.31cm (0.03 standard deviation) lower in height-for-age z-score, 7.51% of these children are severely stunted and 7.46% of these children are severely thinness. The impact of family-shocks on these YL children can be approximately; 0.39cm (0.03 standard deviation) higher in height-for-age z-score; 30.95% of these children were stunted and 0.03 standard deviation lower in body mass index-for-age z-score and 32.27% of these children were thin. In addition, these YL children affected by small shocks have probably about 0.28cm (0.01 standard deviation) lower in height-for-age z-score; 30.72% of these children were stunted and 28.12% of these children were thin and about 0.01 standard deviation higher in body mass index-for-age z-score; all of them have significant effect on child's health outcomes. All of these aggregate economic shocks used in this study could not have the same effect on child health outcomes in its magnitude. Hence, our results highlight the importance of early understanding the problems of different aggregate economic shocks affect multiple child development domains during early period.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Developing countries are vulnerable for a combination of shocks, including weather related shocks, loss of income, sharp increases in food and fuel prices and a global economic slowdown that drastically affect households' welfare. Ethiopia is one of the developing countries in Africa, which has a long history of natural disasters; such as, droughts, floods, crop pests, and localized rain failures that at times have turned into humanitarian crises with long term social and economic problems (Dercon & Porter, 2014). From this result, the effects of drought on early childhood can have permanently affecting children's physical growth and cognitive development and their health status.

In Ethiopia during 1995-1996 the effect of shocks and food aid on the growth of children aged six to fifty four months report stated that crop failure reduced child growth substantially-reducing child growth by about 0.9cm growth over a six month interval when half of their crop area is damaged-while food aid was found to have positive effects on child growth (Yamano et al., 2005) The welfare effects of drought shock on poor rural households are often exacerbated by economic stresses subsequent to the humanitarian crises, including food price inflation (Durevall et al., 2013)and distress sales of assets (Berhane et al., 2011).

Households in Ethiopia are exposed to different types of covariate and idiosyncratic economic shocks mainly the illness of household members, and in urban and rural areas, drought (MoWUD, 2009). Approximately, 9.6 percent were acute malnutrition (wasting) and about 56.7 percent were chronic malnutrition (stunting) in children aged six to fifty-nine month from 1999-2000 national dada. In addition, it states that child malnutrition in Ethiopia constitutes a particularly daunting challenge as the country had a 17 % under-five mortality rate in 2001, of which an estimated 57 % was linked to severe and mild to moderate malnutrition (MOFED, 2002).

From the Ethiopia demographic and health survey 2001, reported that there were about 51.5 % of children under five were stunted (low height compared to standard heights for their age), 10.5 % were wasted (low weight for their height) and 47.2 % were underweight (low weight for their age) (CSA, 2001).

In developing countries there were about 220 million pre-school-age children fail to reach their development potential because of four major factors: stunting, iron deficiency, iodine deficiency and lack of cognitive and social-emotional stimulation(Grantham-McGregor et al., 2007).

The early childhood conditions including the in utero period have a long lasting impact on life expectancy, adult earnings, adult health, and cognition development which are well ducumented by (Douglas et al., 2009); (Banerjee & Research, 2007); (Maccini & Yang, 2009); (Neelsen & Stratmann, 2011) found that the in utero exposure to adverse environments may negatively affect the health and educational attainment later in life.

Various recent studies have seriously differentiated the human capital effects for prenatal and early childhood conditions, showing that both extreme and subtle shocks in utero and during early childhood can have lasting effects on later educational attainment, test scores, and child health (Almond & Almond, 2017; (R. Brown, 2018); (B. I. Cook et al., 2019). These negative shocks can affect children through both biological and social pathways that determine educational and cognitive outcomes. Long- term human capital development is critical issue for prenatal and early childhood conditions(Almond & Currie, 2011; (Georgiadis et al., 2016).

Improving children nutrition has become a critical and detrimental agenda for most developing worlds' governments given its long-term effects for health, human capital formation, productivity and income during adulthood, and economic development (World Bank, 2006); (Victora et al., 2008). In developing world's malnutrition is recognized as a basic and core issue among low-income households (Black et al., 2008;(Food and Agriculture Organization of the United Nations, 2011); (OECD, 2012); and (Overview Of & Ratings, 2012). Tanzania is one of the ten worst affected countries in the world in which about 42% of children under age five are stunted because of low malnutrition (WHO, 2012).

There is some studies showing that the risk of poor developmental outcomes remains extremely high, affecting an estimated 250 million (43%) children under five in low-income and middle-income countries, and rising to over $\frac{2}{3}$ of children in sub-Saharan Africa (Kerac & McGrath, 2017).

In developing countries, a higher prevalence of malnutrition has a strong association between household income or socioeconomic status and health, which is well documented in the literature (Deaton & Paxson, 1998); (Chen et al., 2006). Wealth and a wide range of aggregate and idiosyncratic shocks affects nutrition and hence health outcomes; specifically, those poor families live rural areas faces such problems the recovering process for such shocks may be long lasting and involve long term consequences on labor market and health outcomes in adult age.

Covariate shocks those community level shocks, are typically natural disasters like floods, cyclones, droughts or epidemics and economic or political crisis. All these can potentially contribute to high income volatility of households. the role of external shocks experienced by individuals, households and communities, especially those caused by exposures to environmental and societal (Brown et al., 2020). The primary causes acting independently and in interaction of crises such as famines resulting in prevalence spikes in the rate of acute malnutrition on children are disasters such as climate extremes (e.g., drought) and violent conflict (e.g., civil war) are regularly attributed.

In developing countries, especially African countries, economic shocks or crises have been shown to negatively impact child health (Paxson & Schady, 2005); and (Pongou, Salomon, et al., 2006). Few other studies have indicated that some economic shocks have short-term effect on child health (Dercon, 2002)and at household level (Alderman et al., 2004); (Smith et al., 2003).

A one-time economic shock should not have a long-term impact on children’s nutritional achievements and growth development but as long as social assistance programs are in place and effective, they have short-term effects on child growth (Yamano et al., 2005).

Health and income are coherently integrated across countries and, within countries, across individuals. In the United States, the life expectancy of people in the lowest level of the income distribution was about 25% lower than that of people in the highest level of income in 1980 (Rogot et al., 1992).

In developing countries, different studies have been reported that people with higher incomes have better health status and lower mortality, i.e. the health of the poor is notably worse than that of the better-off (Gwatkin et al., 2007). As countries become richer or more wealthier, life expectancy rises, although many other factors are important in explaining mortality declines (Preston, 1980).

Even if, the extent to which improvements in income have a causal effect on health status remains controversial. The main concern is the existence of feedbacks from health to income as such, improvements in health status would increase rates of economic growth (Gallup & Sachs, 2001) and the (Ort, 2001). Countries those which have higher income levels lead to have higher education levels, better functioning health systems, and better institutions, all of which are likely to improve health outcomes independent of income. The effect of aggregate shocks due to the Mexican Peso crises in the 1990's on Mexico has had significant effect on child human capital outcomes, such as health and schooling (D. Cutler et al., 2006).

A food and economic crisis may have a negative impact on human development in four ways: by increasing poverty and inequality; worsening nutrition; reducing utilization of education and health services; and depletion of the productive assets of the poor (Ferreira & Schady, 2009). The food and economic crises in the poor countries of Asia and Africa can lead to decreased school enrolment, poor nutrition outcomes and an increase in infant mortality and their evidence suggests that aggregate shocks experienced during early life stage have a tremendous impact on child nutritional status, mortality, and schooling. Deterioration in any of these areas is difficult to reverse and may have implications for years, and in some cases generations, to come (FAO, 2008).

Modernizing children nutrition has become an important goal for most developing countries' governments given its long-term implications for health, human capital formation, productivity and income during adulthood, and economic development (World Bank, 2006); (Victora et al., 2008). Malnutrition is recognized as a major issue among low-income households in developing countries ((Black et al., 2008); (Food and Agriculture Organization of the United Nations, 2011); (OECD, 2012); and (Overview Of & Ratings, 2012). Infant mortality is pervasive in the developing world; in lower income countries, approximately 30% of all deaths occur to children under the age of five, compared to less than 1% in rich countries (D. Cutler et al., 2006). Infant mortality is also much less likely than adult mortality to be affected by reverse causality from health to income.

In this regard, there are some studies so far conducted in Ethiopia regarding the long-term consequences of aggregate economic shocks on children health outcomes, specifically on anthropometric measures.

1.2 Statement of the Problem

In recent years Ethiopia has only had limited success in reducing the prevalence of child malnutrition. The rate of wasting increased slightly from 9.2 percent to 9.6 percent between 1995 and 2000. But, the proportion of severely wasted children declined by 47.1 percent.

The rural population in Ethiopia remains vulnerable to shocks and the vicious circle of poverty. Some argue that much of this poverty can be explained by recurring shocks (Chuta 2014). In Ethiopia poor rural households face both covariate shocks, such as drought, death of livestock and crop failure, and idiosyncratic household-level shocks, such as the illness, the death of household members, or divorce (Woldehanna, 2010). All such shocks are of significant concern for poor households, with their children being among the worst affected. Shocks can cause child poverty to persist, with negative future consequences.

Rising food prices have direct adverse impacts on poor households, since food constitutes a relatively large share of the consumption basket of poor households. Among households defined as poor in Ethiopia, only 8 percent were found to be net-sellers of food in 2000/01. Ethiopia is identified as being particularly vulnerable country to the effects of global food price shocks (World Bank, 2008). Ethiopia experienced sharp food prices increases in 2008. Food price inflation in Ethiopia was 81 percent, one of the highest rates in the world. Some studies suggested that 60 percent of households in Ethiopia were under chronic food insecurity during this period. The prevalence of stunted and wasted children in Ethiopia were at their highest during the peak of the food price hikes (Uraguchi 2009). An average household in Ethiopia spends more than two-thirds of its income on food (Berhane et al., 2012).

The Ethiopia Demographic and Health Survey (EDHS) for 2011 reports that only four percent of children age 6-23 months are fed according to recommended practices. Childhood illness is rampant. The combined effect of these problems results in Ethiopia having among the highest stunting (44 percent), underweight (29 percent) and wasting (10 percent) prevalence rates globally among children under five years of age as observed in 2011 (EDHS, 2011)).

The effectiveness of social assistance programmes on reducing vulnerability of household to covariant shocks such as drought is much more important, providing additional focus on idiosyncratic shocks will also help reduce the malnutrition of children in Ethiopia, especially in rural areas (Woldehanna, 2010). He recommended that government and NGOs in Ethiopia revise their social assistance programmes to make them inclusive of the idiosyncratic shocks that frequently affect households and, consequently, children.

Early childhood development (ECD) is now a worldwide agenda, especially in low-income and middle-income African countries where the majority of young children face adversity in early life. ECD is a process of continuous maturation in terms of physical, cognitive, linguistic and executive functions, as well as mental, emotional and behavioral development in early childhood. Early childhood represents the period from conception to six years of age (here after referred as ‘young children’) and is critical for brain development.

There are three malnutrition categories: under-nutrition, over-nutrition, and micronutrient-related malnutrition. The different forms of under-nutrition; are wasting (low weight for height), stunting (low height for age), and underweight (low body mass index for age). Children are the most at risk for under-nutrition. High mortality and lower growth progress of child are the adverse repercussions of under-nutrition (Victora et al., 2008).

Children development studies in developing countries; indicate that about 200 million children under five are not reaching their full developmental potential due to multiple factors including poverty, a lack of stimulation and responsive care, poor health and nutrition (malnutrition), lack of basic services and limited scope for a nurturing environment and nearly half of children in LMICs are lagging behind in their full development potential (FMOH, 2015). In developing countries, negative economic shocks reduce household consumption of nutritious foods and lower expenditures on other inputs into child health and they may seriously disrupt public health services; all of these would tend to increase infant mortality and child health crises.

Investment in children and human capital development are critical in a nation's pursuit of economic growth and development. Nutritional status of children and under-five mortality rate are among the core indicators of sustainable development with which national governments used to measure progress on the Millennium Development Goals (MDGs) (Thornberry, 2012). One of the Millennium Development Goals is Goal 4 i.e. Reduce child mortality. Under nutrition is estimated to be a determinant cause in more than one-third of all deaths in children under five. FAO programs assist poor households and communities to secure access to nutritionally adequate diets and reduce child under nutrition and improve household food security and nutrition information increase children's chances of growing to adulthood. Adequate nutrition is critical to children's growth and development and it is one of the prerequisites for national development.

As confirmed by consecutive EDHS results, there is a decline in stunting, underweight and thinness in children under-five years of age. However, a stunting rate of 40% remains a great concern with the subsequent life course impact of malnutrition on the long-term health of individuals and the socioeconomic development of the nation. There is also a regional variation ranging in malnutrition. The achievements in child health are mostly attributable to large scale implementation of promotion, preventive and curative primary health care interventions alongside a positive trend of socioeconomic changes.

Whatever there are long-term improvements in infant mortality are caused primarily by improvements in medical technology rather than directly by economic growth, short-term shocks to GDP could have important consequences for child health. However, the effect of income shocks on infant mortality is hard to sign ex ante.

1.3 Research Questions

This study aims to address the following issues:

- ✓ Which economic shock has more effect on child health outcomes?
- ✓ How does aggregate economic shocks impact on child's health outcome vary across gender?
- ✓ What is the relative impact of aggregate economic shocks on child health outcomes for rural and urban residence child?

1.4 Objectives of the Study

1.4.1 General Objectives

The main objective of this study is to investigate the effect of aggregate economic shocks on child health outcomes, specifically anthropometry measures, with respect to the following economic shocks such as; drought, crop failure and pest infestation, the death of livestock and the death or illness of members of a household. All these shocks affect the intensity of children's health outcomes.

1.4.2 Specific Objectives

The specific the objectives of this study are: -

i) to explore the effect of aggregate economic shocks on child health outcome

ii) to examine how the impact of aggregate economic shocks vary across gender

iii) to identify the relative impact of aggregate economic shocks on child health outcomes for rural and urban households.

1.5 Hypothesis of the Study

The hypotheses of this study are:-

Economic theory predicts that adverse shocks during early childhood have detrimental long-run consequences for children's development. We investigate this hypothesis by analyzing the effects on children's health outcomes of a specific aggregate economic shock: covariant and idiosyncratic shocks. There is also strong evidence from developing countries confirming the above hypothesis that rapid increase in food prices and food insecurity lead to increases in maternal and child malnutrition levels. This is in the spirit of the impact of income shocks on savings decisions in rural Thailand (Deaton & Paxson, 1998). This is because the welfare implications of income volatility on physical health outcomes are more directly interpretable than, say, variation in spending on clothing or other semi-durable goods in the face of income volatility.

1.6 Significance of the Study

The significance and benefits of this study are to investigate the effect of aggregate economic shocks on child health outcomes and to what extent this effect influence the indicators of child health outcome such as increased survival rates, reduction in morbidity, improvement or reduction (in height-for-age, short height-for-age, and body mass index), faster psychosocial development, improvements in cognitive development, social development, emotional development and language skills at any age, improved attendance and performance (timely enrolment in school, in primary school, fewer children dropping out of school, better performance in school and more continual attendance). In addition, to identify coping strategies or mechanisms which are remedial actions undertaken by people whose survival and livelihood are compromised or threatened and intended to minimize impact of aggregate economic shocks on child health outcomes and wellbeing.

A large number of African countries, including Ethiopia, experienced economic shocks that led to sharp reductions in incomes and living standards and they have adverse effects on health outcomes. To the extent that economic shocks lead to declines in health outcomes, it is important to identify the specific mechanisms that are responsible, with evidence toward developing policies that can ameliorate adverse health effects in the future.

1.7 Scope and Limitation of the Study

This study mainly focuses on the effect of aggregate economic shocks on child health outcome in Ethiopia in selected areas-(YL children living in five regions and one city administration of

Ethiopia). Moreover, concepts and measurements related with economic shocks and child health outcomes, and theories and models related to child health outcomes are discussed in this paper.

1.8 Organization of the Study

The remaining part of this paper is organized as follows. In the second chapter, we provide an overview of the literature on the determinants of aggregate economic shocks. In chapter three, we describe the methodology of the study as how to collect and analyze our data. In chapter four, we discuss the estimation strategy. Chapter five contains the empirical results and further discussion of econometric identification and Chapter six presents a conclusion.

CHAPTER TWO

LITERATURE REVIEW

In this chapter, we review the theoretical and empirical literatures related with aggregate economic shocks and child health outcome in Ethiopia.

2.1 Theoretical Literature Review

The extent to which individual children or groups of children those who are able or enabled to (a) develop and realize their potential, (b) satisfy their needs, and (c) develop the capacities that allow them to interact successfully with their biological, physical, and social environments should be defined as Children's health (Committee on Evaluation of Children's Health & Board of Children Youth and Families, 2004)

Health Economics is concerned with the allocation of resources between various health promoting activities, the quantity of resources used in health services delivery; the organization and funding of health service institutions, the efficiency with which resources are allocated and used for health purposes, and the effects of preventive, curative and rehabilitative health services on individuals and society (Narayan & Handra, 2007).

Health economics is the study of how scarce resources are allocated among alternative uses for the care of sickness and the promotion, maintenance and improvement of health, including the study of how health care and health-related services, their costs and benefits, and health itself are distributed among individuals and groups in society.

The Convention on the Right of the Child (art. 6); the right to life survival and development, states that the deprivation of liberty has very negative consequences for the child's harmonious development and seriously hampers his/her reintegration in society, so that the child's right to development is fully respected and ensured (Cook, 2020).

The economic framework used in this study is adopted from (Maccini & Yang, 2009),which is an extension of the health production function model developed by (Grossman, 1972). As Grossman (1972) defines health as a capital stock that can depreciate or varies over time and that produces an output of healthy time. Health is both a production and consumption good. Variation in the health stock is justified by investments in health that increase the capital stock and by depreciation of the stock as the individual ages.

Moreover, this economic perspective based on a household utility maximization framework follows the tradition established by (Becker, 1965), which views a household as maximizing a utility function which depends on leisure, market-purchased goods and home-produced goods; that affect child nutrition. Child nutrition is important at every age. Nutrition for children can help establish a foundation for healthy eating habits and nutritional knowledge that your child can apply throughout life. The maximization is done subject to a budget constraint, a time constraint and a (biological) nutrition production function. The production of nutrition depends on a set of inputs-such as food (or nutrients), caring practices and the accessibility of health services and its utilization; a series of exogenous individual characteristics including those of children and a vector of household characteristics such as the education of the parents and community characteristics. A reduced form of demand equation for status of child health (H) is derived from the solution of the constrained household utility maximization problem.

Grossman's model assumes that the health stock at time t, HS_t is a function of an initial health condition H_0, vector of other health inputs such as early taking medical vaccination HIN_{it} = (HIN_1,...,HIN_t), time-invariant child characteristics CC_t (gender, birth order), parent's (household's) characteristics PC_t such as, economic status, availability and access to residence (type site) infrastructures R_{it} = (R_0,..........,R_t), and the environmental problems faced by the individuals in the community EPit = (EP_0,.............,EP_t). The health production model can be described as follows:

$$HS_t = h(H_0; HIN_{it}; CC_t ; PC_t; R_{it} ; EP_{it}) \quad (1)$$

The result of a complex set of variables ranging from the source of income of child, child age, wealth index, low parent education, mother and household demographic and place of residence to the presence of diseases are among the main critical factors of children health outcomes (Akombi et al., 2017).

From the above baseline health production function; we start to derive a linear model that links aggregate economic shocks and child health outcomes. The evidences from the following researchers, (Alderman & Behrman, 2019), (Foster, 2016) and (Hoddinott & Kinsey, 2001) investigates the relationship between child growth, maternal health and household resources with economic shocks.

Households are assumed to maximize inter-temporal expected utility. Utility (U_t) in each period is a function of consumption of goods (CE_t), household size (the number of children in HH) (NCh_t) and a vector indicating the current health status of each child (HQc_t) and may also be affected by household characteristics (HHC) such as incomes, its life style and the education of household members that act as preference shifters. Depending on the literatures the demand for child health, the conceptual framework employed in this study relies on a model of child health production function in which child health is embedded in a household utility function. Households are assumed to maximize a utility function at time t given as:

$$Ut = ft\ (CE_t, NCh_t, HQc_t, HHC_t) \text{--} (2)$$

Households face two constraints in the production of commodities:- i) technological constraint is a constraint imposed by the technology through which it combines goods to produce commodities available for consumption and ii) an income constraint which determines the bundle of goods it can afford. Thus, the maximization problem facing households is subject to a budget constraint, households' technology and a child health production function. The child health production function can be described as a function of a set of inputs which can be combined to produce child health. These inputs such as food nutrients, time and resources invested in caring for the child are demanded by parents because they affect parents' utility indirectly through their impact on child health outcomes.

In this study, child Height-for-age z-score (zhfa) and Body mass index z-score (zbmi) are used as an indicator of child health outcomes. A height-for-age z-score (zhfa) is defined as the number of standard deviations of the actual height of a child from the median height of the children of his/her age as determined from the standard sample. Body mass index z-scores (bmi standard deviation s.d) are measures of relative weight adjusted for child height, age, and sex. Hence, it is the ratio of weight to height square.

Z-scores of anthropometry are statistical tools to help assess child growth and nutritional status, relative to a reference or standard population. Child nutritional status is described as a function of a set of materials and environmental inputs which affect child health status:

$$H_t = h\ (CC_t, CE_t, HIN_t, PC_t, HHC_t, \mu_{iht}) \text{ ---(3)}$$

Where H_t is the child's health outcome Z-scores, CC_t is a vector of observable child characteristics such as age and gender which may affect growth rate, CE_t is household consumption and expenditure on food nutrients which captures food nutrient input, HIN_t is a vector of non-material and health inputs such as time invested in caring for the child, PC_t is a vector of parental characteristics such as education and age which may affect the technology through which health inputs are combined, HHC_t is a vector of household characteristics capturing the health environment facing each child such as household size, households educational level, geographical location, good sanitation and availability of safe drinking water, and μ_{iht} captures time-invariant unobserved child characteristics such as genetic predispositions which are uninfluenced by parental behaviors' or preferences but which may affect child health and are unobserved time-invariant household and community characteristics, respectively, which could also affect child health.

Aggregate economic shocks are often associated with economic and welfare losses, particularly in poor households already facing huge budget constraints and limited abilities to smooth consumption. This may in turn affect child's nutritional and health outcome status through a reduction in household food consumption and expenditure. Household food consumption and expenditure, CE, is described as follows:

$$CE_t = f\ (SH_t, HHI_t, HIN_t, HSt, £z) \text{ ---(4)}$$

Where SH_{t-1} represents households' exposure to aggregate economic shocks between time periods t and t -1, HHI_t is household income (total PCCE on all food and non-food goods) and £z are unobserved time-invariant household and community characteristics that could affect household food consumption and expenditure CEt, and HIN_t is a vector of non-material inputs such as time invested in caring for the child and health stocks (HSt). Substituting equation (4) into equation (3), yields a child health production function that includes households' exposure to aggregate economic shocks:

$$H_t = h\ (CC_t, SH_{t-1}, HHI_t, HIN_t, PC_t, HHC_t, HSt, £_t) \text{ ---(5)}$$

2.2 Empirical Literature

Current empirical evidence on effects of aggregate economic shocks on child health outcome with nutritional status and mortality in the developing world particularly in Africa suggests outcomes are pro-cyclical i.e., child mortality and malnutrition increase during periods of aggregate shock (Yamano et al., 2005) for Ethiopia; (Alderman et al., 2006) for Zimbabwe; (Pongou, Ezzati, et al., 2006) for Cameroon; (Cogneau & Jedwab, 2012) for Ivory Coast. (Jensen, 2000) in Ivory Coast by his analyses show that malnutrition increased for all groups but there is a large increase for those in economic shock areas. Exposure to drought is associated with more than two standard deviations below the reference median.

For middle-income nations of South America, health outcomes are mixed i.e. pro-cyclical (Maluccio, 2005) and countercyclical ((Miller & Urdinola, 2010). The evidence derived from developing nations contrast with those of developed nations like the United States of America, where health outcomes are generally counter-cyclical but infant mortality is generally pro-cyclical in the United States. During the early childhood period aggregate shocks can have a tremendous impact on child nutritional status, mortality, and schooling (Ferreira & Schady, 2009).

Household income shocks induced by variations in tea prices are key drivers of child health outcomes (Kazibwe, 2019) that is a one percentage increase in tea price in the early life stage improves child nutrition with a 32.67 standard deviation increase in height-for-age Z scores and reduces under-five mortality rate by 1.74 percentage points among children born in tea producing zones relative to those born in non-tea growing zones in Kenya.

Different transmission mechanisms have been proposed to explain why economic recessions lead to improved child health, including reductions in air pollution (Chay & Greenstone, 2003). Reductions in health-damaging behaviors such as smoking and drinking, and increases in the probability that mothers engage in time-intensive activities such as exercise and prenatal care (Ruhm, 2000).

In developing countries, the evidence on the relationship between economic downturns and infant mortality is more mixed (Ferreira & Schady, 2009). Sharp economic downturns have been associated with increases in infant mortality in Mexico (D. M. Cutler et al., 2002); Peru (Paxson & Schady, 2005), and India (Bhalotra, 2012). (Miller & Urdinola, 2010), however, find that arguably exogenous declines in the price of coffee, which resulted in declines in aggregate income in coffee-growing areas in Colombia, were associated with lower infant mortality and child health, echoing the results from the United States.

The impact of sharp fall in the administered producer price of cocoa in Ivory Coast during 1990, on investments among children of cocoa producing households (Cogneau & Jedwab, 2012). Four outcomes of interest are examined i.e., school enrolment, labor, height-for-age and morbidity and results show a strong causal effect across all four. Height-for-age declined significantly with a loss between 0.25 and 0.62 international standard deviations in height-for-age Z scores among children aged between 2 to 4 years old. There was increased morbidity by 3 to 4 percentage points among children from cocoa producing households in comparison to their counterparts in non-cocoa producing households. Furthermore, results on gender show that girls were more affected than boys, a result which contrasts findings by (Pongou, Salomon, et al., 2006).

The impact of a sudden reduction in the price of coffee between 2000-2002 on child health status in coffee growing areas; concluded that per capita consumption for households in the control group (those not assigned to the cash transfer program) fell on average by 10%. The reduction in consumption was larger in coffee growing areas by approximately 27%. Contemporaneous with these reductions in household per capita expenditure, height-for-age z scores of children aged 6 to 48 months declined by 0.148 percentage points (Maluccio, 2005).

The effects of the macroeconomic negative shock in Cameroon between 1991 and 1998. They indicate that a macroeconomic decline in Cameroon is similar to an increase in weight-for-age Z scores (a composite indicator of acute and/or chronic malnutrition) which increased by 9 percentage points for boys and 3 percentage points for girls. Increases in malnutrition were larger among children of mothers with no education than those with primary schooling and larger for mothers with primary schooling than those with secondary schooling; they were also larger in rural areas than in urban areas, and among households with few assets (Pongou, Ezzati, et al., 2006).

Child nutritional status determinants in Kenya on maternal education and gender of child was found that boys suffer more malnutrition than girls and children of multiple births are more likely to be malnourished than singletons (K. Mariara et al., 2008). It is also observed that maternal education and household wealth are vital determinants of child nutritional status in

Kenya. These results i.e. (Pongou, Salomon, et al., 2006), (K. Mariara et al., 2008) on gender of child contrasts the findings made by (Cogneau & Jedwab, 2012).

The impact of the 1994/95 drought on child health in rural areas using a panel data set. Children aged 12 to 24 months affected by the drought lose 1.5 - 2 cm (height-for-age) of growth in the aftermath of drought (Hoddinott & Kinsey, 2001). Four years after the drought, these children remained shorter than identically aged children who didn't experience the drought. Similarly, using three nationally representative surveys conducted during 1995–96 in Ethiopia, a 10-percentage point increase in the proportion of damaged plot areas within a community corresponds to a reduction in child growth by 0.12 cm (height-for age) over a six-month period (Yamano et al., 2005). All these studies explore the effects of drought on child investments during early childhood stages and conclude that a drought shock leads to a negative change in child nutritional status.

Among the 55 million under-fives living in the low and middle-income countries of East Asia, 35.3% are hampered, 3.6% are severely wasted and 20.7% are underweight (Black et al., 2008).

In Zambia during the drought of 2001–2002, mothers who experienced high maize prices while pregnant had reduced micro nutrient status and increased stunting among infants (Gitau et al., 2005). The long-term consequences of these short-term effects may be considerable. It has been recognized that boys who benefited from a nutritional intervention in their first two years of life subsequently earned wages as adults that were 50% higher than those of non-participants. Food price shocks had the reverse effects in terms of long-term impacts (Hoddinott & Kinsey, 2001).

2.2.1 Child Mortality Issues

A strand in infant mortality coincides with economic crisis; there is an increase in infant mortality from about 50 deaths per 1000 live births to 75 deaths (Paxson & Schady, 2005). They approximate a 2.5 percentage point increase in infant mortality rate for children born during the late 1980s, which implies that approximately 17,000 more children died than would have occurred in the absence of the crisis. Infant mortality peaked in 1990 when real wages were at their lowest.

Infant mortality is larger during economic crisis among children of less educated women than those with higher educated mothers. Baird in his study used DHS data consisting of 1.7 million births from 59 developing countries to investigate whether short-term fluctuations in aggregate income affect infant mortality. The results indicate that income shocks have large negative effects on infant mortality via a 1% decrease in per capita GDP is associated with a 0.24 to 0.40 percentage increase in infant mortality per 1,000 live births (Baird et al., 2011).

The results further show that mortality among infants born to less educated mothers is almost twice as high when compared to that of children born to mothers with higher education; children born to young mothers (15-19) and older mothers (35-39) are more likely to die than those born to prime mothers (20–34); that high-parity births (higher birth order) are more likely to die than low-parity births; and children born to mothers in rural areas are more likely to die than those born to mothers in urban areas. The results on mother's age, education and child birth order are analogous to findings by (Press, 1988) and (Finlay et al., 2011).

In their investigation of how cocoa price variations experienced during early life stage affect adult mental health, (Adhvaryu et al., 2016) also considers the magnitude at which cocoa price shocks affect infant mortality in Ghana's cocoa producing regions. This result indicates that increases in cocoa prices predict higher mortality.

There are three different coffee price shocks on infant mortality in coffee growing regions of Colombia and their result is similar to the main findings in the analysis of coffee price fluctuations and concluded that infant mortality increases when there are positive price shocks in Colombia, (Miller & Urdinola, 2010). They examined how child survival in Colombia responds to fluctuations in world Arabica coffee prices.

Children with low height for their age are considered stunted, an indicator of chronic malnutrition, and are likely to be on a different growth trajectory for the rest of their lives. On average, across households in all regions of Pakistan, children were more than two standard deviations below the average height-for-age of a reference child, and over 33% of children were severely malnourished with a z-score below-3 (Khan et al., 2019). Since height-for-age is generally accepted as a good indicator of the long-run nutritional status of children.

In developing countries in a non-shock environment, since height-for-age is a stock variable, reflecting current and past health investments, older children accumulate a larger deficit during their lives, resulting in lower height-for-age compared to younger children (Duflo, 2003). However, as the results show, the civil war exposed girls have lower height-for-age z-scores even when compared to girls from the same region but born in an earlier cohort, a finding that contradicts the expected height-age relationship. Civil war exposed boy's show a height-for-age z-score that is comparably low compared with boys from the same region born in an earlier cohort. The fact that both girls and boys exposed to armed conflict suffer negative health affects contrasts with the results for the crop failure exposed children.

As (Akresh et al., 2011), state that exposure to the crop failure, by negatively affecting girls' health, and the civil war, by negatively affecting all children's health, will reduce the future welfare levels of these exposed children. Exposure to different small-scale weather shocks in the previous year declined the child height-for-age Z-score (HAZ-score) by approximately 0.12-0.15 standard deviations; are also less likely to have full age-appropriate immunization coverage and increased the probability of reporting symptoms of acute illnesses by 9-18% (Datar et al., 2013).

2.3 The Ethiopian Case

In Ethiopia, 70% of the country's land is categorized as dry lands and the economy of Ethiopia is dependent on agriculture: almost half of GDP, 60% of exports, and 80% of total employment come from agriculture (Patz, 2005). By mid-1984, there was evident that show drought and resulting famine of major proportions had begun to affect large parts of northern Ethiopia. Just as evident was the government's inability to provide relief. The almost total failure of crops in the north was compounded by fighting in and around Eritrea, which hindered the passage of relief supplies. In 1986, locust plagues exacerbated the problem. The combined effects of famine and internal war had by then put the nation's economy into a state of collapse.

The short history of famine in Ethiopian the 1980s a wide spread famine affected Ethiopia from 1983 to 1985. During Derge regime there was the worst famine to hit the country in a century, it left 1.2 million dead, 400,000 refugees left the country, and 2.5 million people were internally displaced. Almost 200,000 children were orphaned. The droughts can vary in intensity, but the region is no stranger to devastating conditions brought on by natural disaster, weather, conflict, government neglect or a combination of each. Between 1900 and 2011, more than 18 famine periods were registered in the country's history. In 1985 a highly destructive drought in the area killed nearly 1 million people and in the last decade major droughts have occurred in 2001, 2003, 2005/06, 2008/09, 2011 and 2015/2016. Ethiopia is vulnerable to drought, with greater than a 40% annual probability of moderate to severe drought during the rainy season.

The Ethiopia demographic and health survey 2000 (Central Statistical Agency, 2001) reported that 51.5 percent of children under five were stunted (low height compared to standard heights for their age), 10.5 percent were wasted (low weight for their height) and 47.2 percent were underweight (low weight for their age).

Child malnutrition in Ethiopia constitutes a particularly daunting challenge as the country had a 17 percent under-five mortality rate in 2001, of which an estimated 57 percent was linked to severe and mild to moderate malnutrition. The National data (1999–2000) state that wasting (acute malnutrition) and stunting (chronic malnutrition) in children aged six to fifty-nine months were 9.6 and 56.7 percent respectively (MOFED, 2002).

Several studies were conducted to monitor the evolution of child malnutrition in Ethiopia, natural disasters such as, drought and crop failure that occurred after the child was born and in the early age, in both urban and rural areas, reduced children's z-score of height-for-age (Woldehanna, 2010). The first striking observation is the sheer magnitude of child malnutrition in Ethiopia; the incidence of underweight children has been consistently about 45 per cent, much larger than the average incidence of 33 per cent underweight children in sub-Saharan Africa in the 1990s (Christiaensen & Alderman, 2004). Similarly, surveys in Ethiopia have found more than half the children under 5 years old to be stunted, with stunting rates most often reaching more than 60 per cent, while the average prevalence of children stunted for 19 sub-Saharan African countries in the mid-1990s was 39 per cent (Christiaensen & Alderman, 2004).

There are several possible explanations for the high rate of child malnutrition in Ethiopia. Household resources, parental education and food prices are identified as key determinants of chronic child malnutrition in Ethiopia while maternal nutritional knowledge, and the community's diagnostic capability of growth faltering, also play an important role (Christiaensen & Alderman, 2004).

Shocks are also found to negatively affect health status in Ethiopia. Making particular use of evidence from Ethiopia on the impact of droughts and other serious shocks, (Dercon, 2002) found that health status, as measured by height and body mass, is affected by these shocks. Similarly (Yamano et al., 2005), showed that income shocks, measured by crop damage, reduce child growth substantially, especially among children aged 6 to 24 months and suggested that the average value of food aid received in a community has indeed a large positive effect on early child growth.

Gilligan et al. (2009) studied the impact of food aid programmes on household food security and welfare and nutrition. They found that food aid programmes such as general food distribution or food-for-work have at most a small impact on food consumption or nutrition and often only a short-term effect on aggregate consumption, while EGS (Employment Generation Scheme) programmes and receiving free food raises growth in food consumption but negatively impacts food security; they therefore suggest that food aid results in accumulated and persistent effects.

2.3.1 Child Health and Nutrition in Ethiopia

In 2019 Ethiopia Mini Demographic and Health Survey(EPHI and ICF, 2019), collected data on a number of key child health indicators, including vaccinations of young children, nutritional status as assessed by anthropometry, and infant feeding practices. Nutrition is one of the most important factors that influence a child's growth and development. Each stage of growth is slightly different. According to the 2019 EMDHS, which is the second EMDHS conducted in Ethiopia that investigates the following child health outcomes indicators.

A) Early Childhood Mortality

The overall picture shows that below-5, infant and neonatal mortality rates were 55, 43 and 30 deaths per 1,000 live births, respectively. Those trends pointed out that a continuous decline in below-5 and post neonatal childhood mortality rates over time. However, the trend of neonatal mortality rate remained relatively stagnant.

B) Child Immunization

Among children age 12-23 months, 43% have received all basic vaccinations and 19% have not received any vaccinations at all. On the average 61% of children received the recommended three doses of the pentavalent, 60%completedoses of polio, 60%completedoses of PCV, and 67% complete doses of the rotavirus vaccine. Penta3 increased from 32%to 61% in 2005 and 2019, respectively. Measles increased from 35%to 59% over the last 14-years. Moreover, the trend of all vaccines showed an increase from 20%to 43% over the same period.

C) Nutritional Status of Children

The number of malnourished children reduced over time. The prevalence of stunting decreased considerably, from 51% in 2005 to 37% in 2019. The prevalence of wasting decreased from 12% to 7%over the same time period. Moreover, the percentage of underweight children has consistently decreased from 33% to 21% over 14-yearsperiod.

D) Breastfeeding Practices

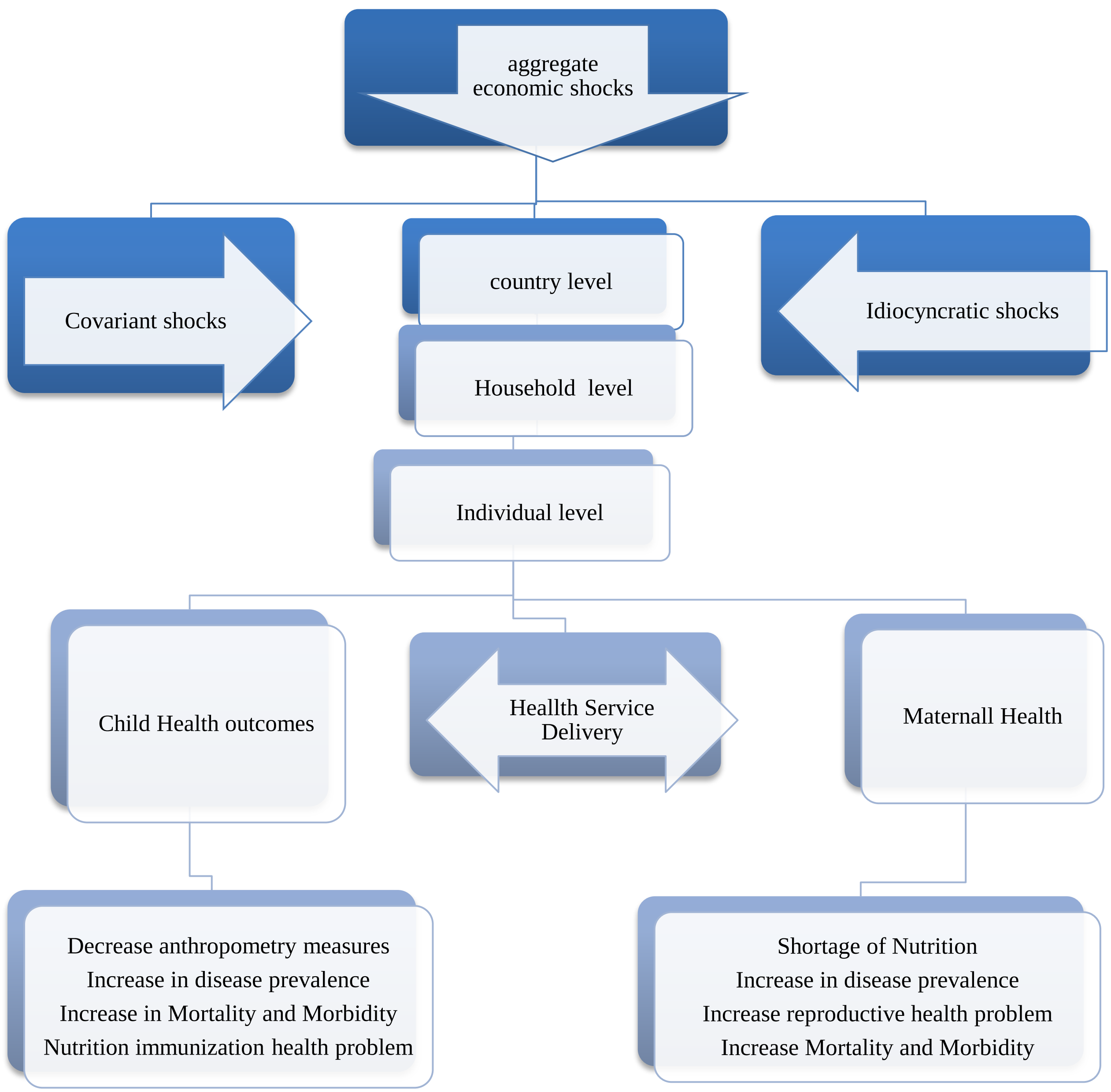
With age advancement, breastfeeding in children decreased from 85% to 76% among children aged 12-17 and 18 –25 months, respectively. Exclusive breastfeeding among children under age 6 months has consistently increased from 49% in 2005 to 59% in 2019.

2.4 Conceptual Framework

In Sub-Sahara African countries, any economic shocks that affect the economic situation of pregnant women or mothers can have devastating effects on the health of their children if they are forced to reduce their infant's food quality and food intakes or cease breastfeeding earlier than recommended (Serbesa et al., 2019). Economic shocks occurring in-utero or ECD (early in life) can be particularly damaging for infants whose mothers live in vulnerable environments with very limited resources. Indeed, mothers can find themselves trapped in critical situations in which the only way they can cope with the consequences of aggregate economic shocks is to adjust their diet or the ones of their newborns. This is especially true in regions of extreme poverty with non-existent or weak public safety nets. Households may report exposure to aggregate economic shocks depending on the extent to which they perceive a fall in household economic welfare, ex-post (Dercon, 2002).

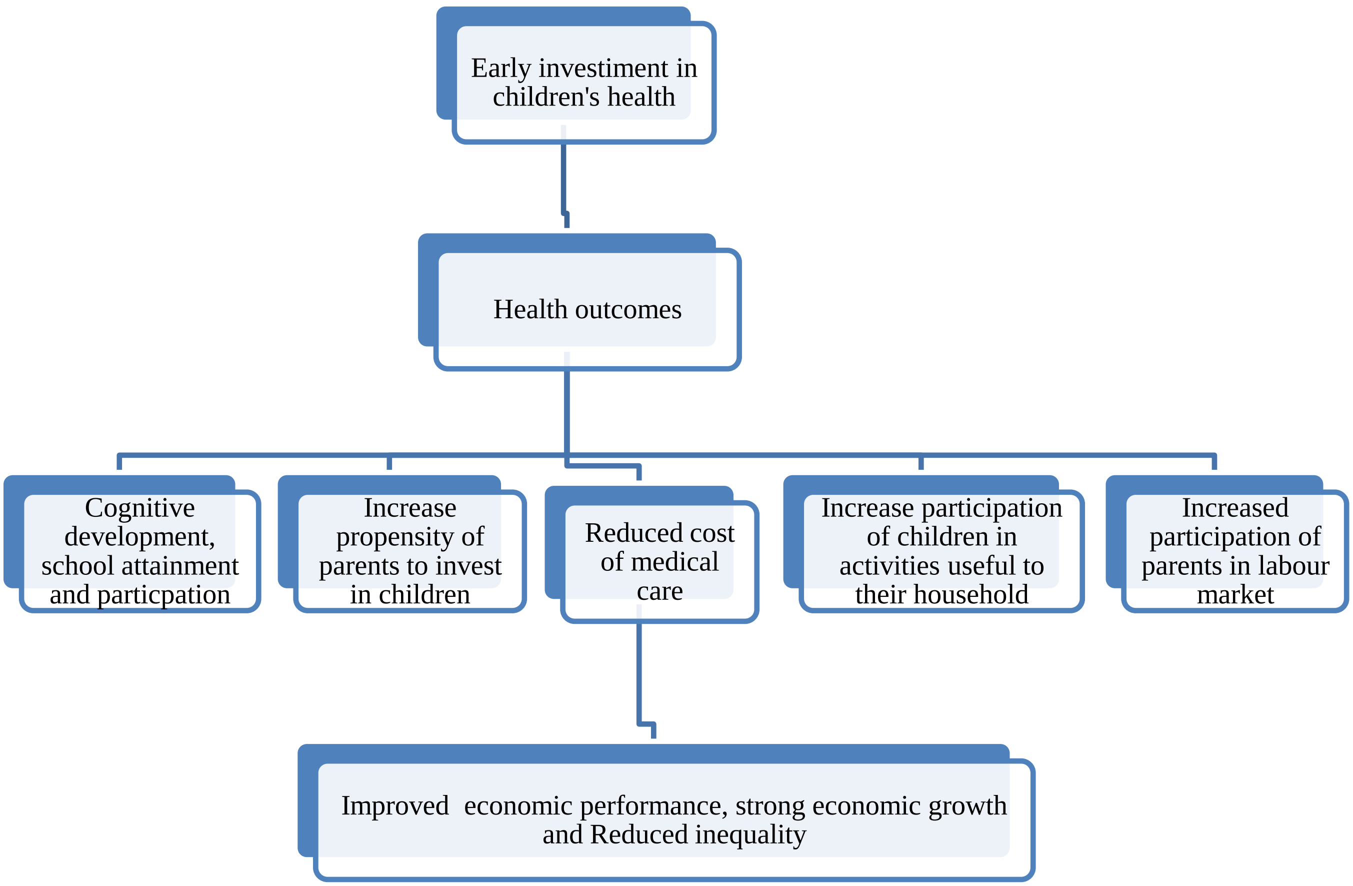
The effect of aggregate economic shocks within the wider context in Ethiopia that affect maternal and child health outcome indicators i.e. these indicators are variation in anthropometry measures, mortality and morbidity. Maternal health indicators are nutrition, disease prevalence, disability, immunization, reproductive health Mortality and morbidity education, health behavior and practices other vulnerabilities (e.g. food security, disability, living conditions).

Figure 1: The link how aggregate economic shocks affect maternal and child health



Source: Developed by the author

Figure 2: Channels through which child health interventions affect the future economy



Source: Bulletin of the World Health Organization (2005) Modified

CHAPTER THREE

METHODOLOGY

In this section, we discuss the research methodology that we employ in this study. This includes data source and type, description of study area, description of data, measurement tools of variables of interest, and finally, the specification of models and estimation strategies.

Quantitative methods are used in this analysis. The methods used for the quantitative analysis are descriptive statistics such as mean values, percentages and bi-variant and multivariate analysis. The bi-variant analysis relies on results from linear correlation among the four indicators of child health outcomes considered in this study, on the one hand, and their associates on the other. The multivariate analysis is based on the theoretical framework presented above we use both random effect and fixed effect estimator and vce(robust). Both those models are used when the dependent variables considered are z-scores (height-for-age, short height for age, body mass index z-scores and low body mass index for age).

The quantitative method was more suitable for this study and used a numerical and statistical data, which is a convenient approach to manage a large amount of data which can easily be presented in figures, tables and stats descriptions. Since everything can't be measured in a numerical way, the qualitative approach sometimes needs to be applied.

Young Lives project is a longitudinal cohort study that examining the changing nature of childhood poverty in four low and middle-income countries i.e. Ethiopia, India, Peru, and Vietnam. The project has had both household and child-level data to improve understanding of the causes and consequences of childhood aggregate economic shocks such as, crop failure, shock increase in input prices, shock decrease in output prices, shock increase in food prices, shock decrease in food availability, shock death of livestock, climate shocks, drought, rainfalls, poverty, conflict (war) and examine how those economic shocks affect children's health outcome (well-being), in order to inform the development of future policy and to target child welfare interventions more effectively(Young Lives 2017a). Together with the raw datasets, 'constructed files' are archived to support researchers using the Young Lives data. The constructed files are combined sub-sets of variables from rounds 1 to 5 of the Young Lives project Ethiopian's household and child surveys conducted from 2002 to 2016 young cohort only.

Young Lives (YL) obtained ethical clearance from the University of Oxford Ethics Committee (UK) and the Ethiopian Public Health Institute’s institutional review board. Collective consent from the communities and informed consent from children, parents and/or guardian was obtained before the actual data collection.

3.1 Types and Sources of Data

3.1.1 Types of Data

This study comprises one cohort survey in five rounds: the first carried out in 2002 and the last in 2016. In Ethiopia 20 sites were purposively sampled according to predetermined criteria, which differed from region to region; the selection criteria were regional and rural/urban diversity and poverty ranking and households with YL children in the right age group were randomly sampled which is children between 0 and 12 years old at the time of the survey.

The data was collected from 20 sentinel sites with 100 children from each site in each round. Eight sites are in urban areas and twelve are rural. They are mainly in food insecure areas Oromiya, Amhara, SNNP and Tigray regions and Addis Ababa city administration.

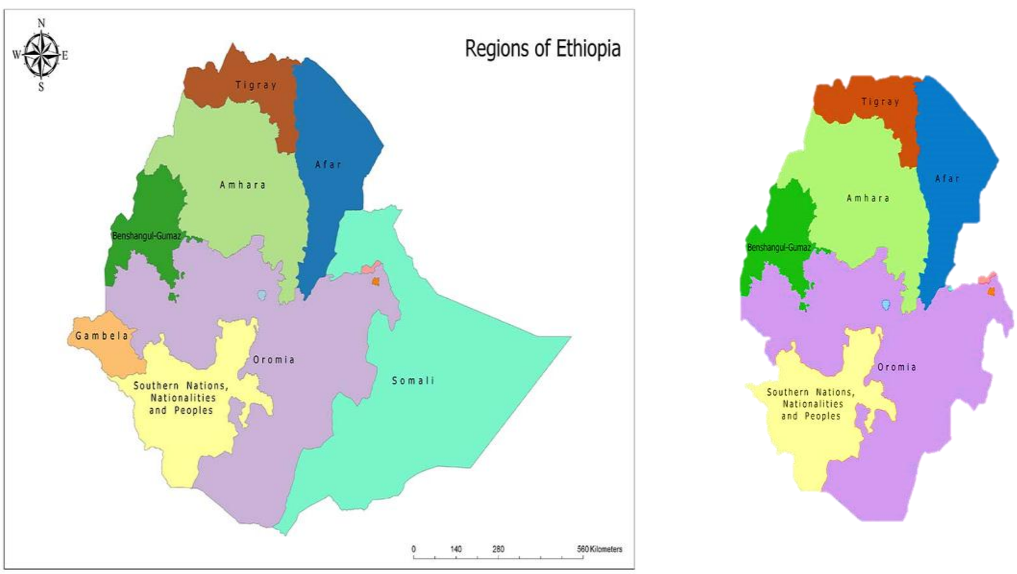
3.1.2 Sources of Secondary Data

In this paper we used secondary data obtained from five rounds of the Young Lives (YL) cohort study dataset in Ethiopia. This study was used five rounds (2002–2017a) of data from the Young Lives (YL) cohort study dataset (n=14,995) in Ethiopia. We used longitudinal survey data of Young Lives collected in 2002 (Round 1), 2006 (Round 2), 2009 (Round 3), 2013 (Round 4) and 2016 (Round 5) from the younger cohort when sample children were at the age of less than 12 years old. The aggregate economic shocks are collected from Round1 - Round 5 survey. For the outcome variable, we used anthropometric measure indicators, z-score of height-for-age, and body mass index to see the effect in which the dependent variables are normal, thinness, stunting and severe stunting.

3.2 Study Area Description

YL used a multistage sampling technique to collect data in Ethiopia 20 sentinel sites (used cluster sampling). In the first stage, four regional states Amhara, Oromia, SNNPR, and Tigray and one administrative city (Addis Ababa) were purposively selected. In the second stage, 3–5 Woredas (districts) were selected from each regional states and the administrative city. The sample represents diverse social, geographic and demographic groups. In the third stage, one or more Kebeles or the smallest administrative unit in Ethiopia was selected from each sample Woreda and data from a randomly selected sample of 14,995 YC children were gathered.

Figure 3: Scope of Study areas



Source: Developed by the author

3.3 Description of Data

We used longitudinal survey data of Young Lives collected in 2002 (Round 1) and 2016 (Round 5) from the younger cohort when sample children were at the age of 1 and 12 years, respectively. The quantitative data was analyzed using descriptive statistics like frequency, percentages/mean, tables, and the statistical analysis is chi-square test, F-test, T-test, standard deviation, correlation and regression model.

Panel (data) analysis is a statistical method, widely used in social science, epidemiology, and econometrics to analyze two-dimensional (typically time series and longitudinal) panel data. The data are usually collected over time and over the same individuals and then a regression is run over these two dimensions .i.e. fixed effect and random effect estimators.

Anthropometric information, Child's weight, child's height, child's age and child's body mass index (bmi) is available in the constructed files for those younger cohorts in the five rounds only. Using these two indicators, the height-for-age z-scores, and the BMI-for age z-scores were estimated using World Health Organization (WHO) reference tables and software. The indicators were estimated using the age of children in months which provides very close estimators.

For the children health outcome variable, we used z-score of height-for-age and body mass index to see the long-term effect of aggregate economic shocks. We ran two regressions to see the effects i.e. random effect and fixed effect models in which the dependent variables are stunting and severe stunting. Moreover, in order to see the impact of aggregate economic shocks on children health outcomes, we regress these model changes in height-for-age and body mass index and changes on z-score of aggregate economic shocks.

3.4 Empirical Model and Variables Description

The empirical analysis adopted in this study investigates the effect of aggregate economic shocks on child health outcomes. Finally, the analysis is extended to investigate possible differences in the effect of aggregate economic shocks between two groups of children defined by their household socioeconomic status: children living in households below and above the sample median household total PCCE.

To estimate the effect of aggregate economic shocks on child health outcomes i.e. Zhfa and Zbmi scores in detail substitute equation (1) in to equation (5) to yield an estimable version of equation (6) is specified to allow the comparison of Zhfa and Zbmi scores of these children exposed to aggregate economic shocks to these of unexposed children:

$$H_{ict} = H_o + HIN_{it} + EP_{it} + SH_{ict-1} + CC_{ict} + PC_{ict} + HHC_{ict} + R_{ict} + \mu_{ict} \quad \text{-----------------------------} (6)$$

Where H_{ict} is the Z-scores of the ith child living in community observed at time t, SH_{ict-1}indicates whether a child was exposed to any aggregate economic shock between time periods t and t-1, CC, PC and HHC are vectors of child, parent and household characteristics respectively, R child's current residence area or type site and μ_{ic} is the random error term.

The impact of aggregate economic shocks on child health outcome Z-scores captured by estimated from equation (6) will be valid if exposure to aggregate economic shocks is randomly assigned. However, communities with higher incidence of aggregate economic shocks are likely to experience less economic growth/development and wealthier households are more likely to migrate from these communities. In addition, households residing in high-risk communities may over time, adopt less risky work or labor strategies in order to minimize the potential impact of aggregate economic shocks. This may in turn result in lower average income or returns within these communities. Thus, households living within high-risk communities are likely to face greater constraints in investing in child health, resulting in lower child health outcomes. Failure to control for this will result in an overestimation of the impact of aggregate economic shocks on child health outcomes. A community fixed effect model is specified by decomposing the random error term in equation (6) into two components: This model controls for community time-invariant characteristics that may be associated with both child health and the probability of exposure to aggregate economic shocks:

Both FE and RE regression are the most common estimation methods for linear models and that's true for a good reason. The model satisfies the OLS assumptions for linear regression and we should use longitudinal panel data in order to get the best possible (FE and RE) estimators.

In this paper we use the following general model:

$$H_{ict} = H_0 + \beta_1 \sum_1^n SH_{ict} + \beta_2 CC_{ict} + \beta_3 PC_{ict} + \beta_4 HHC_{ict} + \beta_5 R_{ict} + \gamma Y_t + \mu_{ict} \text{ -------------------------- } (7)$$

Where is H_{ict} represents a health outcome for the i^{th} child living in community c, observed at time t, indicates whether a child was exposed to any aggregate economic shock ($\sum_1^n SH_{ict}$ = HIN + EP + SHt) between time periods t and t-1, CC, PC, R and HHC are vectors of child, parent, Residence and household characteristics (such as parents' marital status, child race, child gender, mother's education) respectively, Y is a vector of survey year dummies which captures general time trends in child HAZ-score, and γ is the random error term. $\boldsymbol{\alpha}_s$ is a vector of state fixed-effects, allowing us to control for unobserved differences across states, and β_i is a vector of age-month fixed effects, allowing us to control for changes over time in age-specific child health outcomes. SH_{ict} is the i^{th} type of aggregate economic shocks which occur in region c and in year t.

3.5 Anthropometric Indicators: zhfa, Stunting, zbmi, and Thinness

Commonly cited anthropometric indicators are the percentages of children who are zhfa, stunting, zbmi, and thinness. These four indicators also appear in "severe" versions as the percentage of children who are severely stunted, severely thinness etc. These binary indicators are calculated from the distributions of the zhfa, and zbmi, which in turn are calculated from the child's height, weight, age in months, and sex. The zhfa, and zbmi used here and in DHS reports are based on the WHO Child Growth Standards (WHO Multi-center Growth Reference Study Group 2006a).

The zhfa, for example, is a height-for-age "z score." The empirically based coefficients used to calculate the zhfa were constructed in such a way that, when the zhfa is calculated for all children in a healthy reference population, the mean will be approximately 0, the standard deviation will be approximately 1, and the distribution will be approximately normal.

For instance, in a heuristic or metaphorical sense, the zhfa is a ratio of height to age. Thus, among children who have the same day of age, a taller child will have a higher zhfa score, because the "numerator" is larger. Among children who have the same height, an older child will have a lower zhfa score, because the "denominator" is larger.

CHAPTER FOUR

DATA ANALYSIS AND PRESENTATION

In this chapter, we analyze and discuss the data using both descriptive and econometrics methods. In the descriptive analysis part, we discuss the demographic and socio-economic background of the sample households, the distribution of the data for the key interest variables (zhfa, stunting, zbmi and thinness) and the linear correlation between aggregate economic shocks and child health outcomes. In the econometric analysis part, before dealing with any panel data it is important to choose between the two estimators (i.e., FE and RE estimators) and the goodness of fit of models (FE and RE). The Housman test including sigma-more checking method is conducted where the null hypothesis is that the preferred model is RE versus the alternative FEs. It basically tests whether the unique errors (μi) are correlated with the regresses'; the null hypothesis is they are not.

From the Housman test result, we selected the fixed effect model which is conditional upon the value of αi used for the dependent variables (height for age z-score and short height for age) and we selected the random effect frame work seems appropriate for the dependent variables (body mass index z-score and low body mass index for age) and vce(robust) checker was used to check hetroscedasticity and multi-linearity between variables.

4.1. Descriptive Statistics

In this study, the sample population used for the analysis is all Young Cohort children from UK young live project in Ethiopia. Initially, a total of 9,995 Young cohort (YL) children were surveyed excluding old cohort; in which total of 6,106 rural young children and 3,383 young children from urban areas are used in this analysis in LY of Ethiopia project. However, in the data cleaning process, by using xtbalance command about 817 observations were deleted due to discontinuous or miss information on the relative variable and in addition 354 YL children died through time. We provide the summary statistics of all the variables in Table 4.1

Table 4.1: Descriptive statistics of all variables used in analysis

Variables	Observations	Mean	Standard deviation
Outcome Variables			
Child's health outcomes indicators			
Height for age z-score	8,824	-1.35998	1.084086
Short height for age	7,972	.3388108	.6056515
Body mass index for age z-score	8,824	-1.390633	1.123317
Low body mass index for age	7,959	.371906	.6290646
Key Independent Variables	Observations	Mean	Standard deviation
Regions(Type sites)			
Afar	8,824	.0002267	.0150542
Amhara	8,824	.1983228	.3987592
Oromiya	8,824	.2110154	.4080524
Benshangu..	8,824	.0001133	.0106455
SNNP	8,824	.2497733	.4329063
Addis Ababa City	8,824	.1351995	. 3419559
Type site	8,824	.3480281	.476372
Main Independent Variables	Observations	Mean	Standard deviation
Different main shocks			
Increase in input price	8,824	2311877	.421616
Decrease in output price	8,824	.0383046	.1919415
Shock in Crop failure	8,824	.2217815	.4154684
Shock pests in livestock	8,824	.0464642	.2105001
Shock death of livestock	8,824	.230961	.4214714
Drought shock	8,824	.2512466	.4337546
Shock loss of job	8,824	.0821623	.2746274
Shock death of father	8,824	.0231188	.1502892
Shock death of mother	8,824	.0081596	.0899661
Different family shocks	8,824	.4177244	.4932122
Different small shocks	8,824	.3977788	.489467
House's collapse shock	8,824	.0140526	.1177144
Different Crime shocks	8,824	.0915684	.2884321
Children's Characteristics			
Children's sex	8,824	.5376247	.4986106
Kids under 5 years	8,824	4.898799	1.993774
Child's serious injury	8,824	.0856754	.2799
Better Child's health			
Same	6,043	.514976	.499817
Worse	6,043	.0920073	.2890601
Mother's Characteristics			
Mother's age	8,824	38.45784	8.35394
Illiterate mother's			

Primary Education	8,824	.479261	.499598
Secondary and Tertiary Education	8,824	.1018812	.3025092
Mother live in the household			
Does not live in the household	8,824	.0674297	.250779
Mother has died	8,824	.0060063	.0772719
Father's Characteristics			
Father's age	8,824	46.5944	
Illiterate father			
Primary Education	8,824	.5906618	.4917396
Secondary and Tertiary	8,824	.1452856	.3524085
Father live in the household			
Does not live in the household	8,824	.0915684	.2884321
Father has died	8,824	.0157525	.1245235
Household's Head Characteristics			
Household's head sex	8,824	.793291	.4049679
Household's head age	8,824	45.91353	10.9403
Illiterate household's head			
Primary Education	8,824	.5888486	.4920705
Secondary and Tertiary	8,824	.1447189	.3518372
Household's head relation	8,824	1.238667	.9988868
Household's family size	8,824	6.043404	1.989043
Caregiver's head	7,649	1.77448	.5039045
Household's wealth index	8,824	.3685134	.186385

The following analysis is based on the above table 4.1:- the mean height for age z-scores of these Young Live (YL) children is -1.36, this result indicated that these young live children used in this study is grouped in the category of marginal stunt group and from these YL children used in this study about 33.88% of them are shorter in height than their peers. In addition to this, the average body mass index for age z-scores of these YL children is -1.39, which is included in the class interval of marginal thin and about 37.19% of these YL children have lower body mass index when compared with these YL children who are in the equal age range.

The average sample YL children contribution of these regions are, 20.54% Tigray, 19.83% Amhara, 21.10% Oromiya, 24.98% SNNP, 13.52% Addis Ababa city and 0.03% Afar and Benshangulgumuz regions. From the area of residence of these YL children perspective, 34.80% were live in urban and 65.20% were live in rural areas. The sex compositions of these YL children employed in this study were about 53.76% male child and 46.24% female child and the average age of these YL children included in this study was 4.99 years.

Depending on the back ground health status, from these YL children about 8.57% children have had series injury since last round (i.e. round-5) and about 91.43% children have no series injury since last round. The current health status of these YL children when compared with their peers were about 39.30% children were in better health status, about 51.50% children have the same health status with their peers and about 9.20% children were in the worse health status. The average mother's age and father's age of these YL children were 38 and 47 years old respectively.

Regarding the educational status, 39.88% of mothers and 26.40% of fathers are illiterate; 49.93% 0f mothers and 59.07% of fathers are completed first cycle (primary school i.e. grade1-grade8) and 10.19% of mothers and 14,53% of fathers are secondary school completed and above(i.e. grade-9 – PhDs holders). According to the presence of mother or father in household, about 92.66% and 89.26% 0f the young life children's mother (father) lives in the household respectively; about 6.74% and 9.16% 0f the young life children's mother (father) does not lives in the household respectively and about 0.60% and 1.58% 0f the young life children's mother (father) has died.

The sex proportionality of these YL children's household head, about 79.33% was male headed and only 20.67% being female headed. The average age of the household heads in the YL sample is 46 years old. Furthermore, in relation to households' educational status, about 26.65% of the households' heads are illiterate, about 58.88% of the households' heads have completed a primary cycle (grade 1- grade 8), and only about 14.47% of households' heads have completed secondary(high) school and above i.e., including PhD holders. The household's relation to YL children is almost biological parents (91.74%), secondly, 3.82% of YL children live with grandparents and 2.13% of YL children live with partner and non-biological parents. The average family size of the households is around six. i.e., on average, in each household there exist six members of the household/family.

The caregiver's relationship to household head is about 69.53% of the caregiver is partner of household head, about 26.51% of the caregiver is household head and about 3.96% of the caregiver is other communities. The YL household's wealth is in the category of poor household which is determined by the wealth index result that is 0,37unit.

Table 4.2: General Information of households Area of Residence of YL children

	Type site					
	Urban			Rural		
	Male	Female	Total	Male	Female	Total
Young	1777	1606	3383	3224	2882	6106
Old	904	941	1845	1534	1323	2857
Total	2681	2547	5228	4758	4205	8963

From a total of 8824 sample population young cohort 35.65% were urban and 64.35% were rural children. The sex composition in the area of residence were 18.73% male urban, 16.92% fimale urban, 33.98% male rural, and 30.37% female rural children involved in this study. The urban children were one-third and the rural children were two-third of the total sample population. The gender distrubution were almost equivalent.

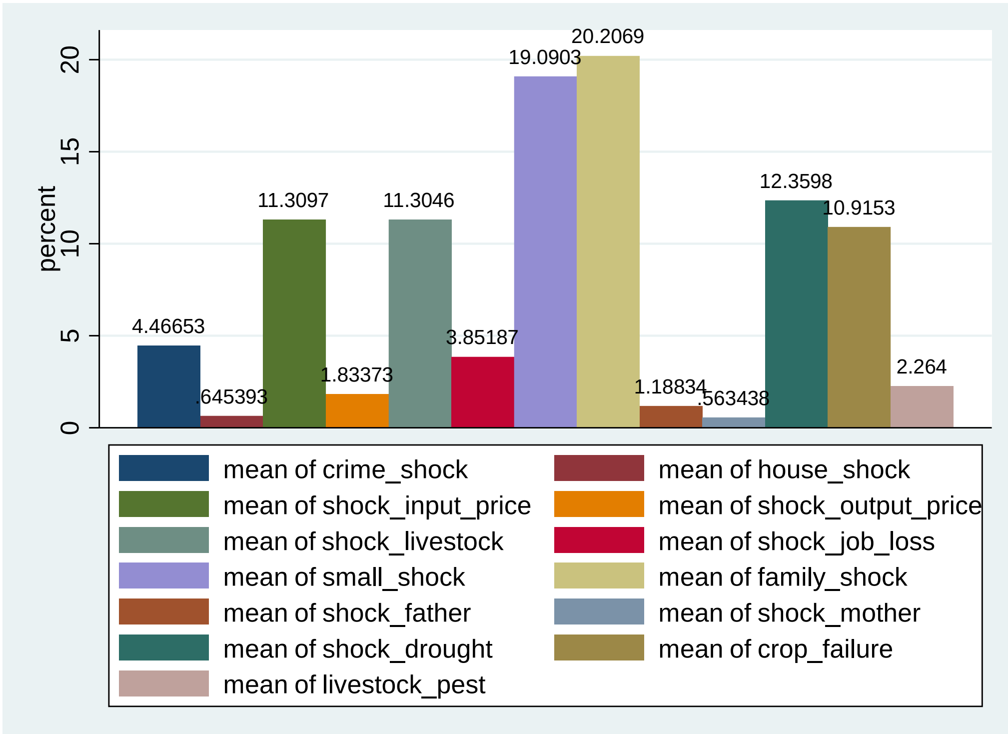
4.2. Econometric Analysis

We have estimated model (7) using Fe or Re model and the results are as follow.

4.3 Description of all Variables

-1.59 is the average zhfa, 0.42 is the average short_height-for-age, -1.39 is the average zbfa and -0.16 is the average low_body mass index of the YL children .

Figure 4: Specific impact of each shock on exposed children (in mean).



4.3.1 Presentation of Key Variables (Covariant and Idiosyncratic Shocks)

Table 4.3: Mixed-effect estimation result of aggregate economic shocks on child health outcomes

	(1) Zhfa	(2) short_height	(3) zbfa	(4) low_bmi
Increase in input price	.046	-.015	.08**	-.021
	(.03)	(.018)	(.034)	(.018)
Decrease in output price	.07	-.048	-.051	-.029
	(.061)	(.036)	(.067)	(.036)
Shock in crop failure	.06*	-.031*	-.031	.014
	(.032)	(.019)	(.036)	(.019)
Shock pests on storage	.049	-.03	-.121**	.012
	(.055)	(.032)	(.061)	(.033)
Shock death of livestock	.022	-.015	.053	-.015
	(.032)	(.019)	(.035)	(.019)
Drought shock	.018	-.022	.029	-.012
	(.032)	(.019)	(.035)	(.019)
Shock loss of job	-.064	.024	.025	-.003
	(.045)	(.026)	(.049)	(.026)

Shock death of father	-.064	.077	-.094	.03
	(.109)	(.065)	(.119)	(.063)
Shock death of mother	.182	.004	.163	-.192*
	(.169)	(.101)	(.188)	(.1)
Different family shocks	-.07***	.048***	.154***	-.06***
	(.026)	(.016)	(.029)	(.015)
Different small shocks	.145***	-.063***	-.255***	.046***
	(.023)	(.014)	(.027)	(.014)
House's collapse shock	.126	-.102*	-.074	-.032
	(.089)	(.053)	(.099)	(.053)
Different crime shocks	.012	-.013	.109**	-.065***
	(.043)	(.026)	(.047)	(.025)

Note*: zhfa stands for height-for-age z-score; short_height stands for short height for age and their results are derived from fixed effect regression estimator.*

Zbmi stands for body mass index for age z-score; low-bmi stands for low body mass index for age and their results comes from random effect regression estimator.

In all regression, standard errors are adjusted for 8824 young live children in Ethiopia. Asterisks p, p**, and p*** indicates statistically significance of coefficients at 10%, 5%, and 1% respectively.*

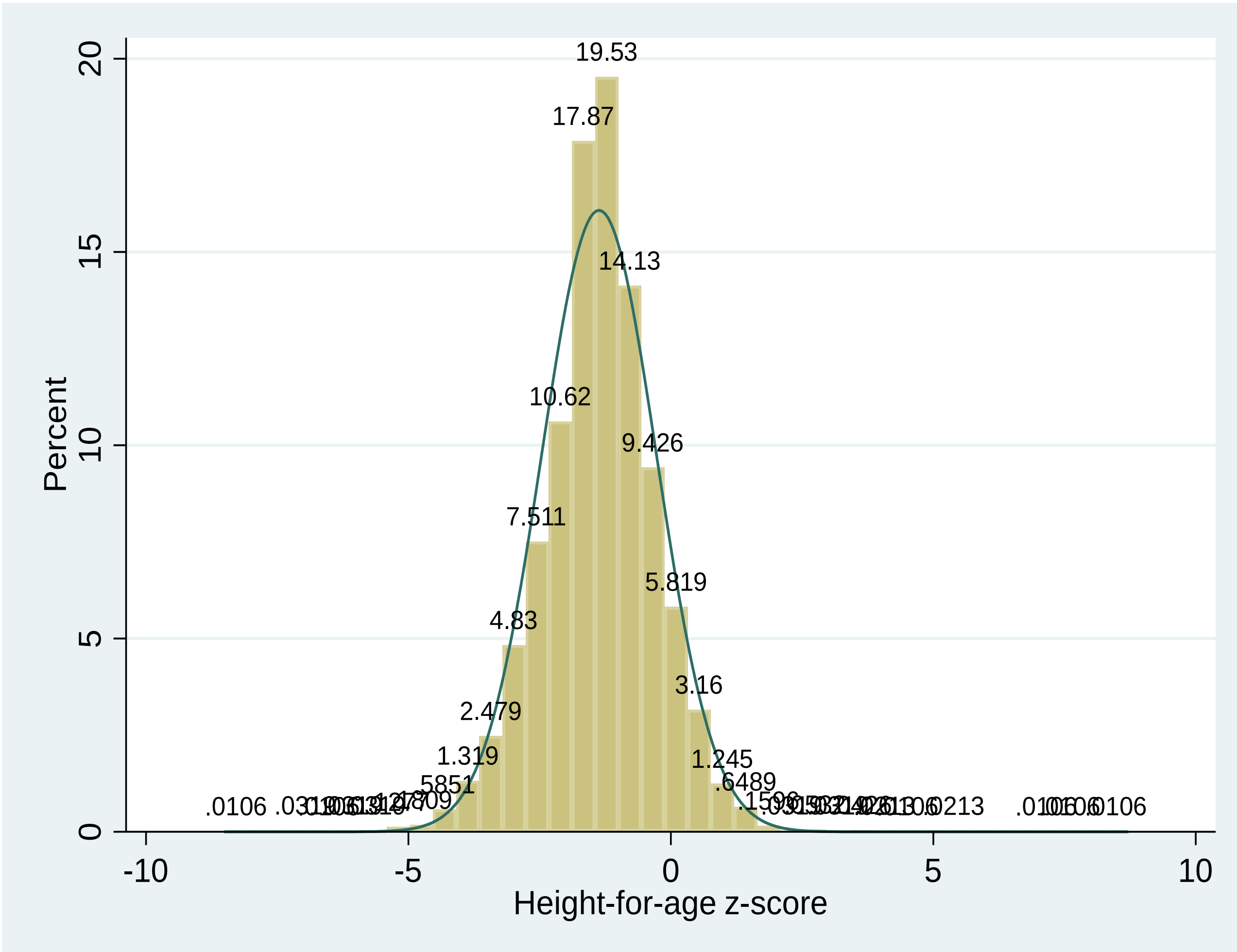
Table 4.3 indicates the result of the mixed-effects estimation strategy of our hierarchical model. Children health outcomes(the z-scores) are estimated on the covariantes. Regrression results of height-for-age z-scores, short-height-for-age, body mass indexs for age z-scores, and lower body mass index are in the first, second,, third, and fourth columns respectivelly.

i) Aggregate economic shocks dummy:

The data considers 13 main shocks which may occur in Ethiopia in which there are two groups of YL children i.e. these exposed YL children and that of these unexposed YL children to see the difference between them and to what extent these shocks affect these exposed YL children, in doing this these unexposed YL children is used as a reference for the analysis.

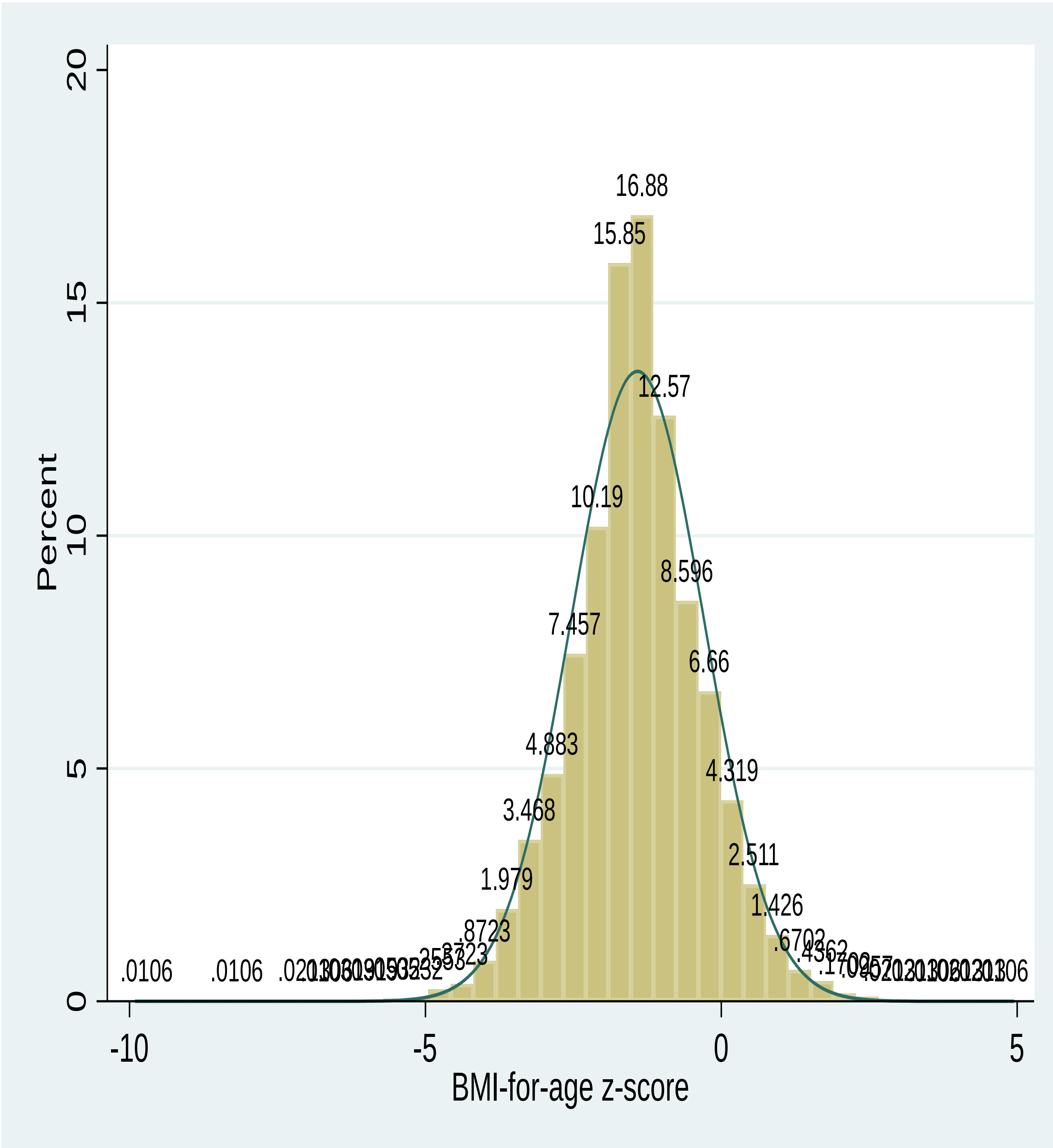
The percentage is the proportion of observations that fall in each bin per unit of outcome. The numerator gives you the proportion of observations that fall in a given bin, which is essentially the probability of observing an outcome in that bin. The height would fall in the bin from x to y zhfa scores has a z% of YL children were affected by shock increase in input price.

Figure 5: Specific impact of each shock from the total shock on exposed children zhfa (in %)



The graph is constructed by 39 bins, started from -8.5, having width 0.441 and its mean zhfa is -1.59.

Figure 6: Specific impact of each shock from the total shock on exposed children zbfa (in %)



The graph is constructed by 39 bins, started -9.9 and width 0.381.

Table 4.3.1: Specific intervals of z-score with in which each aggregate economic shocks lies

Type of Shocks	Effect of each shock in percent	Number Children affected by the specific shock in %	Variation in Height for age			Variation in Body mass index for age		
			From the total shock	Interval zhfa	Difference in height cm	From the total shock	Interval zbfa	Lower body-mass index for age
Family Shock	20.2069%	41.97%	19.53%	-1.322 to -0.881	0.39cm	16.88%	-1.523 to -1.142	0.31
Small Shock	19.0903%	39.65%	17.87%	-1.763 to -1.322	0.28	15.85%	-1.904 to -1.523	0.42
Drought Shock	12.3598%	25.67%	14.13%	-0.881 to -0.440	0.32	12.57%	-1.142 to -0.761	0.36
Increase in Input price Shock	11.3097%	23.49%	10.62%	-2.204 to -1.763	0.32	10.19%	-2.285 to -1.904	0.35
Livestock Shock	11.3046%	23.48%	9.43%	-0.440 to 0	0.32	8.59%	-0.762 to -0.380	0.35
Crop Failure Shock	10.9153%	22.67%	7.51%	-2.645 to -2.204	0.31	7.46%	-2.666 to -2.285	0.38
Crime Shock	4.46653%	9.28%	5.82%	0 to 0.440	0.33	6.66%	-0.380 to 0	0.30
Loss of Job	3.85187%	8.00%	4.83%	-3.086 to -2.645	0.36	4.88%	-3.047 to -2.666	0.36
Shock of pests on storage	2.264%	4.70%	3.16%	0.440 to 0.881	0.31	4.32%	0 to 0.380	0.38
Decrease in output price shock	1.83373%	3.81%	2.48%	-3.527 to -3.086	0.29	3.47%	-3.428 to -3.047	0.34
Fathers Shock	1.18834%	2.47%	1.32%	-3.968 to -3.527	0.42	2.51%	-3.800 to -3.428	0.40
House Shock	0.645393%	1.34%	1.24%	0.881 to 1.322	0.24	1.98%	0.380 to 0.761	0.34
Mothers Shock	0.563438%	1.17%	0.65%	1.322 to 1.763	0.35	1.43%	0.761 to 1.142	0.19

A) Shock-increase in input prices

From a total of children employed in this study these YL children who were exposed to increase in input prices were, 14% residence in urban area and 86% in rural area and from these YL children 55% were male and 45% were female in sex and from this approximately about 30.77% of rural male YL children were more affected by this shock. This shock is mostly related with those rural residence YL children and those are agricultural dependent. Hence, the input price for agrarians are: prices for fertilizers, prices for special seeds, prices for pesticides and the prices for insecticides.

Out of the total impact of aggregate economic shocks on children health outcomes, 11.31% of the effect covers by the impact of an increase in input prices and 23.49% of these YL children are suffered by this shock as indicated in the above bar graph and regressed table 3.4. As presented in Table 4.3, (row-1, column-1) the difference in mean of height for age z-score of these YL children who are affected by shocks of increase in input price is higher by 0.05 units as compared with the average height for age z-score of these non-affected YL children. In addition, as we have seen in the above histogram graph-(A), the area under the normal curve between -2.204 and -1.763 zhfa score is 0.1062 covered by this shock or 10.62% of YL children were lay in this interval and the height of these YL children under this area was lower by 0.02cm when compared to their peers.

According to Table 4.3, (row-1, column-2), the short_height-for-age analysis result indicates that those YL children who experienced the challenge of increase in input prices in the early child life (ECD) are, 17.19 percent severely stunting and the mean difference in short-height for age between with these severely stunting and these with not stunting is estimated to be -0.02 and these YL children who are suffered by shock of increase in input price is shorter by about 0.02cm. The shock increase in input price have indirect impact on child health outcomes as it follows, increase in input prices affects crop yields to decrease and this influence to decrease households consumption (nutrition) this directly affects zhfa of children.

As displayed in Table 4.3, (row-1, column-3) the average body mass index z-score of those YL children who are challenged by shock of increasing in input price is higher by about 0.08 units than an unaffected YL children. In addition, as we have seen in the above histogram graph-(B), the area under the normal curve between -2.285 and -1.904 zbfa score is 0.1019 covered by this shock or 10.19% of YL children were found in this interval and it is significant at 5 % level.

On the other side, depending on Table 4.3, (row-1, column-4), for low_BMI view, 17.33 percent severely thinness and the difference in mean for low-body mass index for age between those YL children who were severely thinness and those YL children who were not thinness is estimated to be -0.02 or those YL children who were suffered by shock of increase in input price is lower by about 0.02 unit (2%). As the input price increase by one percent the height of these YL children decease by about 0.02cm and the body mass of the also decrease by 0.02 units. From the above analysis, as the input price increase by one percent the height of the children decease by about

0.02cm and the body mass of the also decrease by 0.02 units. This result indicates that the increment of the input price of commodities or goods have direct impact the child health outcome. This result was similar with that of (Baird et al., 2011) 25% of the population is directly affected by fluctuation in price of coca and children living in coca household have relatively lost between 0.25 and 0.62 international standard deviation in height for age. In addition to this these male children who is living in the rural area was more vulnerable to this shock. (Agricultural product sellers) fertilizer special seeds).

B) Shock-decrease in output prices

From a total of children who were involved in this study that who were face a problem of decrease in output prices were, 12% residence in urban and 88% residence in rural area and 57% were male and 43% were female in sex and from this at least, 5.75% of rural male YL children were more affected by this shock. Pricing with agriculture is the process or method used in exchanging agricultural products for money and other valuables. Farmers grew more crops than the country could use. This led to lower prices for farm products, which hurt rural families. Lower farm product prices were bad for farmers (rural) but good for the businesses and workers that consumed farm products. The aggregate impact of lower farm product prices depended on the relative marginal propensity to consume of the households and businesses losing and gaining from the price change. We argue that farmers likely had a higher marginal propensity to consume than the businesses and workers who gained from lower farm product prices.

From the total impact of the aggregate economic shocks 1.83% covers by the impact of decrease in output price on child health outcomes and 3.81% of these YL children are suffered by this shock as indicated in the above bar graph. As Table 4.3, (row-2, column-1) indicates, the mean height for age z-score of those YL children who were suffered by shock of decrease in output price is higher by about 0.07 than these YL children that did not suffered. Moreover, as we have pointed in the above histogram graph-(A), the area under the normal curve between -3.527 and -3.086 zhfa score is 0.0248; in another word, 2.48% of YL children were severely stunting by this shock.

As displayed in Table 4.3, (row-2, column-2), result indicates that the short_height-for-age of YL children those who experienced the challenge of decrease in output prices in the early child life (ECD) are, 2.61 percent severely stunting and the difference in mean short-height for age between those YL children who severely stunting and those YL children who were not stunting is estimated to be -0.05 and those children who are suffered by shock of decrease in output price is shorter by about 0.05cm.

According to Table 4.3, (row-2, column-3), the average body mass index z-score of those YL children who were challenged by shock of decreasing in output price is lower by about 0.05 unit than those YL children who were not suffered by this shock. Moreover, as we have indicated in the above histogram graph-(B), the area under the normal curve between -3.428 and -3.047 zbfa score is 0.0347 or 3.47% of these YL children were lay in this interval, that is severely thin. Furthermore, depending on Table 4.3 (row-2, column-4), in the case of low BMI view, 2.94 percent severely thinness and the difference in mean low-body mass index for age between those YL children who severely thinness and those YL children who were not thinness is estimated to be -0.03 and those YL children who are suffered by shock of decrease in output price is lower by about 0.03 unit (3%).

This result shows that decreasing the output price of goods and commodities have direct relationship with that of child heath outcome i.e. height and body mass index. From this analysis as the decrement of price of output increase by one percent, the height of the child decreases by 0.05cm and the body mass of the children also decline by 0.03 units. Moreover, rural resident male children were more affected by this economic shock. Here there are two perspectives:-first, farmers those who were agricultural product producers were highly suffered by this shock. Second, consumer of these farm products i.e. urban residence children were beneficiary from decrement of output price and have good child health outcomes and this means that there is excess consumable goods in the market which are cheaper that the child consumes these are important to improve child health outcomes and they had had normal condition.

C) Shock-crop failure

From a total of those YL children who were employed in this study that is exposed to crop failure were 8% urban resident and 92% rural resident and 53% were male and 47% were female in sex and from this approximately about 31.50% of rural male YL children were more affected by this shock. Crop failure happens more in catastrophic weather conditions in which the crops are wiped out by pests, floods or drought and if the rainfall is low.

Out of the total impact of aggregate economic shocks on child health outcomes, 10.92% of the effect was covered by the impact of crop failure and 22.67% of YL children were suffered by this shock as indicated in the above bar-graph. As presented in Table 4.3 (row-3, column-1), the regression results show that the average height-for-age z-scores of these YL children born during the crop failure period (in the affected region) have a 0.06 standard deviations higher than these YL children not born during the crop failure period (in the unaffected regions). Beside to this, as we have seen in the above histogram graph-(A), the area under the normal curve between -2.645 and -2.204 zhfa score is 0.0751 or 7.51% of these YL children were lay in this interval and have 0.03cm shorter in their height than their peers. According to Table 4.3 (row-3, column-2), the short_height-for-age analysis children these experienced the challenge of crop failure in the early child life (ECD) are, 15.04 percent severely stunting and the difference in mean short-height for age between those YL children who severely stunting and those YL children who were not stunting is estimated to be -0.03 and these children who are affected by shock of crop failure is shorter by about 0.03cm.

Based on Table 4.3 (row-3, column-3), the average body mass index z-score of those who are challenged by shock of crop failure is lower by about 0.03 unit. Beside to this, as we have discussed in the above histogram graph-(B), the area under the normal curve between -2.666 and -2.285 zbfa score is 0.0746 which were covered by this shock or 7.46% of these YL children were lay in this interval that hampered by this shock. As Table 4.3 (row-3, column-4) pointed out, the low_BMI of YL children, 15.28 percent severely thinness and have z-score cut point <-3SD; 1.77 percent moderately thin and have z-score cut point between -3SD to -2SD and 5.30 percent of children have normally body mass index. The mean difference in low-body mass index for age between with those severely thinness and those with not thinness is estimated to be 0.013 and those children who are hitter by shock of crop failure is lower by about 0.013(1.3%).

From the above analysis we concluded that the shock of crop failure have a direct association with child health outcome i.e. the height of those child hampered by crop failure decline by about 0.03cm and the body mass index z-score of those children decrease by about 0.03 units compared with that of unaffected children. This result was the same as that of (B. I. Cook et al.,

2019) they found that for boys and children aged 25 to 60 months being hit by crop loss increases the probability of being stunted by 20% and 27% points respectively. Affected boys are on average 0.38 SD smaller two years after crop loss suffering from a height deficit 0.8 to 2.92cm. Children who were hit by crop loss have on average 0.40 SD smaller height for age z-score two and three years after the shock than other children. This shock more affects the rural residence male children. Rural households that earn their living from agricultural activities or crops are generally the most food poor as compared with other households and poor child health outcomes.

D) Shock-pests on storage

From a total of children those who were involved in this study that suffered by shock of pests on stored products 6 % urban resident and 94% rural resident and are 54% male and 46% female in sex and from this approximately about 6.81% of rural male YL children were more affected by this shock. A 'pest of stored products' can refer to any organism that infests and damages stored food and stored crop yields. These pests can include microorganisms such as fungi and bacteria, arthropods such as insects, beetles, moths and mites.

Out of the total impact of aggregate economic shocks, on children health outcomes, 2.26% of the impact was covered by the impact of pests on crop (yields) storage and 4.70% of these YL children are suffered by this shock as shown in the above bar graph. As it can be seen in Table 4.3 (row-4, column-1), the mean height for age z-score of those YL children who were suffered by shock of pests on storage is higher by about 0.05 unit than those LY children who were not suffered. Furthermore, as we have seen in the above histogram graph-(A), the area under the normal curve between 0.442 and 0.881 zhfa score is 0.0316 cover by this shock or 3.16% of these YL children were lay in this area.

On the other side Table 4.3 (row-4, column-2), indicated that the short_ height-for-age analysis of YL children those experienced the challenge of shock of pests on storage in the early child life (ECD) are, 3.45 percent severely stunting, 0.45 percent moderately stunting and 1.14 percent of the children have normally height. The mean difference in short-height for age between those severely stunting and those with not stunting is estimated to be -0.03 and those children who were suffered by shock of pests on storage are shorter by about 0.03cm.

Based on Table 4.3 (row-4, column-3), the average body mass index z-score of those who are challenged by shock of pests on storage is lower by about 0.12 unit. In addition to this, as we have seen in the above histogram graph-(B), the area under the normal curve between 0.00 and 0.380 zbfa score is 0.0432 covered by this shock or 4.32% of YL children lay in this interval. According to Table 4.3 (row-4, column-4), the result of low_BMI shows that, 3.49 percent severely thinness; 0.52 percent moderately thin and 1.02 percent of children have normally body mass index. The difference in mean low-body mass index for age between with those severely thinness and those with not thinness is estimated to be 0.012 and those children who are suffered by shock of pests on storage is higher by about 0.012(1.2%).

From the above report we concluded that the shock of pests on storage have a direct association with child health outcome i.e. the height of those child hampered by the effect of pests on storage decline by about 0.03cm and the body mass index z-score of those children decrease by about 0.012 units compared with that of unexposed children with equally aged. This implies that as the pests affect the store increase by one unit the height of the child decrease by 0.03cm and the body mass index z-score decrease by 0.012 units. This shock more affects the rural residence male children. Rural households that earn their living from agricultural activities or livestock are generally the most food poor as compared with other households that were involved in non-farming activities.

E) Shock-death of livestock

Out of the total of children those who were exposed to death of livestock were 10% live in urban and 90% live in rural areas and from those YL children were 53% male and 47% female in sex and from this approximately about 32.06% of rural female YL children were more affected by this shock. Livestock are affected by the limited availability of water, feed, and grazing lands. The lack of feed, livestock suffer from starvation and become more vulnerable to diseases, leading to an increased rate of animal death. Livestock might buffer households' income or consumption, animals are themselves directly affected by drought through water and feed scarcity.

From the total impact of aggregate economic shocks on children health outcome, 11.31% covers by the impact of death of livestock and 23.48 % of these YL children are suffered by this shock as indicated in the above bar graph. According to Table 4.3 (row-5, column-1), the mean height for age z-score of those YL children who are suffered by shock of death of livestock is higher by about 0.02 unit than those YL children who are not suffered. Beside to this, as we have seen in the above histogram graph-(A), the area under the normal curve between -0.440 and 0.00 zhfa score is 0.0943 covered by this shock or 9.43% of the YL children were lay in this interval. Table 4.3 (row-5, column-2), indicated that the short height-for-age analysis of YL children those who were experienced the challenge of death of livestock in the early child life (ECD) were, 16.52 percent severely stunting; 2.21 percent moderately stunting and 5.08 percent of the children have normally height. The expected mean in short-height for age between those severely stunting and those with not stunting is estimated to be -0.02 and those children who are suffered by shock-death of livestock is shorter by about 0.02 cm.

According to Table 4.3 (row-5, column-3), the average body mass index z-score of those YL children who were challenged by shock of death of livestock is higher by about 0.05 than those YL children who were not affected by this shock. Beside to this, as we have seen in the above histogram graph-(B), the area under the normal curve between -0.762 and -0.380 zbfa score is 0.0859 covers by this shock or 8.59% of YL children were lay in this interval. Based on Table 4.3 (row-5, column-4), from the result of low_BMI view, 16.64 percent severely thinness; 2.09 percent moderately thin and 5.09 percent of children have normally body mass index. The mean difference in low-body mass index for age between those severely thinness and those with not thinness is estimated to be -0.02 and those children who are suffered by shock of death of livestock is lower by about 0.02 unit (2%).

From the above analysis we concluded that the shock of death of livestock have a direct association with child health outcome i.e. the height of those child hampered by death of livestock decline by about 0.01cm and the body mass index of those children decrease by about 0.014 units compared with that of unexposed children. This result is the same as (Datar et al., 2013), they stated that expose to different small-scale weather related shocks in the previous year reduced child height-for-age z-score by approximately 0.12-0.15 SDs and increase the probability of reporting symptoms of actual illness by 9.18%. This shock more affects the rural residence male children. Rural households that earn their living from agricultural activities (crop and livestock) are generally the most food poor as compared with other households

F) Shock-drought

From a total of children those who were prone to drought were 6% in urban area and 94% in rural area and have a sex composition of these children were 54% male and 46% female and from this approximately about 36.43% of rural female YL children were more hiked by this shock. A drought is “the lack of adequate precipitation or a deficiency of precipitation over an extended period of time resulting in a water shortage.” Agriculture: droughts affect livestock and crops. Drought resilience is the capacity of the farming community to resist the impact of drought by effective management of land and water resources.

Out of the total effects of aggregate economic shocks on children health outcomes, 12.36% were covered by the impact of drought and 25.67 % of these YL children are suffered by this shock as indicated in the above bar graph. As displayed in Table 4.3 (row-6, column-1), the mean height for age z-score of those who are suffered by shock of drought is higher by about 0.02 units than those YL children who were not affected by this shock. Beside to this, as we have seen in the above histogram graph-(A), the area under the normal curve between -0.881 and -0.440 zhfa score is 0.1413 covered by this shock or 14.13% of YL children were lay in this interval. As depicted in Table 4.3 (row-6, column-2), indicted that the short_height-for-age analysis shows that children those experienced the challenge of drought shock in the early child life (ECD) were, 16.76 percent severely stunting; 2.65 percent moderately stunting and 6.55 percent of the children have normally height. The mean difference in short-height for age between those severely stunting and those with not stunting is estimated to be -0.02 and those children who are suffered by shock of drought is shorter by about 0.02 cm and it is equal to about 0.38.

As presented in Table 4.3 (row-6, column-3), the average body mass index z-score of those YL children who were challenged by shock of drought is higher by about 0.03 than these YL children that are not affected by this shock. Beside to this, as we have seen in the above histogram graph-(B), the area under the normal curve between -1.142 and -0.761 zbfa score is 0.1257 cover by this shock or 12.57% of YL children were lay in this interval. Furthermore, from Table 4.3 (row-6, column-4), the result of low_BMI indicates, 17.70 percent severely thinness; 2.21 percent moderately thin and 6.06 percent of children have normally body mass index. The mean difference in low-body mass index for age between with those severely thinness and those with not thinness is estimated to be -0.012 and those children who are suffered by shock of drought is lower by about 0.012(1.2%).

From the above report drought has direct impact on child health outcome and have the same result with that of (Hoddinott & Kinsey, 2001), they found that children who were 12-24 months old in the aftermath of drought in 1994/95, grew on average about 2cm less than other children. Children that were born in the aftermath of a drought have lower health outcomes at the age of 36-48 months compared to children who did not belong to the drought cohort. Since the agriculture sector in Ethiopia is predominantly rain-fed subsistence production, and is highly vulnerable to drought those children who were rural residence male were affected by this shock.

G) Loss of job/ source of income/ family enterprise

From a total of children those who were face the challenge of loss job/source of income were 62% residence in urban and 38 % residence in rural and have sex composition of these children were 50 % male and 50 % female and from this approximately about 15.38% of urban female YL children were more affected by this shock. Unemployment – not having a job and actively seeking work – has consistently been found to have a negative impact on a range of health outcomes. Job loss is depicted as a stressful event that evokes perception, emotional, and physical changes in individuals (children) who experience it. The loss of a stable income source cuts off one's access to sufficient food, shelter, and ability to pay bills for health, and such worsening socioeconomic conditions.

From the total effect of aggregate economic shocks on children health outcomes, 3.85% were covered by the impact of job loss and 8.00% of these YL children are suffered by this shock as indicated in the above bar graph. According to Table 4.3 (row-7, column-1), the mean height for age z-score of those YL children who are suffered by shock of loss of job/source of income is lower by about 0.06 units. In addition to this, as we have indicated in the above histogram graph-(A), the area under the normal curve between -3.086 and -2.645 zhfa score is 0.0483 cover by this shock or 4.83% of these YL children were lay in this range and this interval indicates severely stunting. From the regressed result, in Table 4.3 (row-7, column-2), shows the short_height-for-age analysis of those YL children that experienced the challenge of loss of job/source of income in the early child life (ECD) were, 6.28 percent severely stunting. The mean difference in short-height for age between those severely stunting and those with not stunting is estimated to be 0.02 and those children who are suffered by shock of loss job/source of income is higher by about 0.02cm (2%).

Based on Table 4.3 (row-7, column-3), the average body mass index z-score of those YL children who were suffered by shock of loss of job/source of income is higher by about 0.03 units than those YL children who were unaffected. On the other hand, as we have seen in the above histogram graph-(B), the area under the normal curve between -3.04 and -2.666 zbfa score is 0.0488 covered by this shock or 4.88% of YL children were lay in this range and they are severely thinness. From the regression Table 4.3 (row-7, column-4), in the case of low_BMI view, 6.11 percent severely thinness. The difference in mean low-body mass index for age between with those severely thinness and those with not thinness is estimated to be -0.003 and those children who are suffered by shock of loss of job/ source of income is lower by about 0.003 units(.30%).

The above result shows that, those children that whose families loss their jobs (loss his/her source of incomes) contrasts with the following findings. Income loss decline significantly with a loss between 0.25 and 0.62 international SDs in height –for-age z-scores among children aged between 2 and 4 years old (Kazibwe, 2019). Furthermore, results on gender show that girls were more affected than boys, a result which contrasts finding by (Pongou, Salomon, et al., 2006). As the loss of job/source of income increase by one percent the body mass index decline by about 0.003 units. In addition to this urban resident male children were affected by this shock.

H) "Shock- death of father"

Out of a total of those YL children who were employed in this study and exposed to death of father, 46 % were live in urban area and 54% were live in rural area and have a sex composition of 57% male and 43% female and from this approximately about 3.58% of urban male YL children were more affected by this shock.

From the total impact of aggregate economic shocks on children health outcomes, 1.19% were covered by the impact of shock death of father and 2.47 % of these YL children were suffered by this shock as indicated in the above bar graph. Depending on regression Table 4.3 (row-8, column-1), the mean height for age z-score of those YL children who were suffered by shock of death of father is lower by about 0.06 than those children who were not suffered by this shock. In addition to this, as we have presented in the above histogram graph-(A), the area under the normal curve between -3.968 and -3.527 zhfa score is 0.0132 covered by this shock or 1.32% of these YL children were lay in this interval and this range indicates they are severely stunting. The regressed result in Table 4.3 (row-8, column-2) shows, the short_height-for-age of these YL children experienced the challenge of death of father in the early child life (ECD) were, 1.67 percent severely stunting. The mean difference in short-height for age between with those severely stunting and those with not stunting is estimated to be 0.08 and that those YL children who were suffered by shock of death of father is higher by about 0.08 cm.

From Table 4.3 (row-8, column-3), the average body mass index z-score of those who were suffered by shock of death of father is lower by about 0.09 than those YL children who were not suffered. Furthermore, as we have indicated in the above histogram graph-(B), the area under the normal curve between -3.800 and -3.428 zbfa score is 0.0251 covered by this shock or 2.51% of YL children were severely thinness. Furthermore, based on regression result in Table 4.3 (row-8, column-4), the result of low_BMI indicates that, 1.71 percent severely thinness. The difference in mean low-body mass index for age between those severely thinness and those with not thinness is estimated to be 0.03 and those children who are suffered by shock of death of father is higher by about 0.03(3%).

From this analysis the absence of a father in a family has detrimental effect on child health outcome for those who were young children during the early transition and also not for those who were above this age at that time. It means that in terms of health children under age five are not more vulnerable to the economic shocks to their families than older children. Negative health effects are observed both in urban and rural areas and also for male and female but rural residence males' health are more sensitive to father's shocks. This implies that death of father does not have direct impact on child health outcome and it is statistically insignificant.

I) "Shock- death of mother"

From a total of those children employed in this study who were suffered by death of mother were 31 % live in urban area and 69 % live in rural area and have a sex composition of 58 % male and

42 % female and from this approximately about 1.36% of urban female YL children were more affected by this shock.

Out of the total effect of aggregate economic shocks on children health outcomes, 0.56% were covered by the impact of shock death of mother and 1.17 % of these YL children are suffered by this shock as indicated in the above bar graph. Based on regression result on Table 4.3(row-9 column-1), shown that the expected change in height for age z-score of these YL children that are suffered by shock of death of mother is higher by about 0.18 units than these YL children who were not suffered. In addition to this, as we have presented in the above histogram graph-(A), the area under the normal curve between 1.322 and 1.763 zhfa score is 0.0065 covered by this shock or 0.65% of YL children were lay in this range. According to the regression result on Table 4.3 (row-9 column-2), from these YL children that are experienced the challenge of absence of mother in the early child life (ECD) were, 0.54 percent severely stunting. The mean difference in short-height for age between those severely stunting and those with not stunting is estimated to be 0.04 and these children who are suffered by shock of loss of mother is higher by about 0.04cm.

Depending on Table.4.3 (row-9 column-3), the average body mass index z-score of these YL children that are challenged by shock of death of mother is higher by about 0.16 than these YL children her mother's live. In addition to this, as we have presented in the above histogram graph-(B), the area under the normal curve between 0.761 and 1.142 zbfa score is 0.0143 covered by this shock or 1.43% of these YL children were lay in this range. From regression result on Table.4.3 (row-9 column-4), from these YL children that are experienced the challenge of absence of mother in the early child life (ECD), 0.67 percent severely thinness. The difference in mean low-body mass index for age between with those severely thinness and those with not thinness is estimated to be -0.19 and those children who are suffered by shock of death of mother is lower by about 0.19(19%).

Absence of a mother in a family has detrimental effect on child health outcome for those who were young children during the early transition i.e. the height of these children increase by about 0.04cm and their body mass index also decrease by about 0.19 units but not for those who were above this age at that time. This result shows that health outcome children under age five are more vulnerable to the economic shocks to their families than older children, particularly in single-mother families. The fact that younger children are more susceptible to the economic hardships in the family means that early intervention policies may be needed to remedy the potential negative effects and those rural residence male children were affected by this shock.

J) Family shocks

These shocks are included the following shocks that is severely illness or injury of father or mother, shock of divorce or separation, shock imprisonment, and shock migration. Loss of income resulting from parental health shock can adversely impact a child's physical development. From a total of those children employed in this study those who were face the problem family shock were 33 % in urban and 67 % in rural areas and have a sex composition of 54 % male and 46 % female and from this approximately about 44.00% of rural male YL children were adversely striking by this shock.

Out of the total effect of aggregate economic shocks on the children health outcomes, 20.21% of the impact was covered by family shock and 41.97 % of these YL children are suffered by this shock as indicated in the above bar graph and it is significant at 1% level. From the regression result on Table.4.3(row-10 column-1), shown the expected mean in height for age z-score of these YL children that are suffered by family shock is lower by about 0.07 than these YL children that are not suffered by family shocks. In addition to this, as we have presented in the above histogram graph-(A), the area under the normal curve between -1.322 and -0.881 zhfa score is 0.1953 covered by this shock or 19.53% of YL children were lay in this range. According to Table.4.3 (row-10 column-2), from these YL children that are experienced the challenge of family shock in the early child life (ECD) are, 30.95 percent severely stunting. The mean difference in short-height for age between with these severely stunting and these with not stunting is estimated to be 0.05 and those children who are suffered by shock of family is higher by about 0.05cm.

Depending on Table.4.3 (row-10 column-3), the mean variation in the body mass index z-score of these YL children that are challenged by shock of family is higher by about 0.15 than these YL children that are not challenged by shock of family. In addition to this, as we have presented in the above histogram graph-(B), the area under the normal curve between -1.523 and -1.142 zbfa score is 0.1688 covered by this shock or 16.88% of YL children were lay in this interval.

From Table.4.3 (row-10 column-4), from these YL children that are challenged by shock of family, 32.27 percent severely thinness. The men difference in low-body mass index for age between those severely thinness and those with not thinness is estimated to be -0.06 and those children who are suffered by shock of family is lower by about 0.06(6%).

The above report implies that family shock has direct impact on child health outcome which is the body mass index lowers by about 0.06 units and those rural residence male children were suffered by this shock. This shows that family shocks includes illness of father, mother, sister, brother etc. have significant effect on child health outcomes and it is statistically significant at 1% level.

K) Small Shocks

Small shocks are comprises shock increase in food prices, shock decrease in food availability, shock closure place of employment, and shock contract disputes/ sale of output. Food price shocks mainly emanates from two sources: from crop failure which, in turn, is due to unfavorable weather condition and from the direct and indirect effects of the rise in international food prices. Trends in the food price used to mimic the performances witnessed in food growing rain-fed agricultural sector. From a total of those children whose family were susceptibility to different small economic shocks were, 40 % in urban and 60 % in rural area and have a sex composition of 53 % male and 47 % female and from this approximately about 46.61% of urban female YL children were more suffered by this shock.

From the total impact of aggregate economic shocks on children health outcomes, 19.09% of the effect covers by small shock and 39.65% of these YL children were suffered by this shock as indicated in the above bar graph and it is significant at 1% level. From regression result on Table.4.3 (row-11 column-1) report the mean difference in height for age z-score of these YL children that are suffered by small_shock is higher by about 0.15units than these YL children that were not suffered by this shock. In addition to this, as we have presented in the above histogram graph-(A), the area under the normal curve between -1.763 and -1.322 zhfa score is 0.1787 covered by this shock or 17.87% of YL children were lay in this range. According to Table.4.3 (row-11 column-2), from these YL children that are experienced the challenge of different small economic shocks in the early child life (ECD), 30.72 percent severely stunting.

The mean difference in short-height for age between those severely stunting and those with not stunting is estimated to be -0.06 and those children who are suffered by small economic shocks are shorter by about 0.06cm and it is equal to about 0.34 and it is statistically significant at 1% level.

Based on Table.4.3 (row-11 colunm-3), the average body mass index z-score of these YL children that are challenged by small economic shocks are lower by about 0.26 units than these YL children that are not challenged by small economic shocks. In addition to this, as we have seen in the above histogram graph-(B), the area under the normal curve between -1.904 and -1.523 zbfa score is 0.1585 covered by small shocks or 15.85% of YL children were lay on this region and statistically significant at 1% level. On the other hand from Table.4.3 (row-11 column-4), in the case of low_BMI view, from these YL children that are experienced the challenge of different small economic shocks in the early child life (ECD), 28.12 percent severely thinness. The mean difference in low-body mass index for age between those severely thinness and those with not thinness is estimated to be 0.05 and those children who are suffered by small economic shocks are higher by about 0.05(5%).

From the above analysis we concluded that small shock has direct association with the child health outcome i.e. the height of these children hampered by this shock has shorter by 0.06cm; this result is similar to that of (Douglas et al., 2009), which revealed that a 1% increase in tea price in early life stage improves child nutrition with a 32.67 SDs, increase in height-for-age z-scores and reduces under five mortality rate by 1.74% point among children born in tea producing zones relative to those born in non-tea growing zones in Kenya. Those urban resident male children were more suffered by this shock.

L) House Shock

House shock shows the effect of shock fire affecting house and shock house/building collapse on households indirectly child health outcomes. From a total of those children whose household faces different house and assets shocks were 27 % in urban and 73 % in rural areas and have a sex composition of 57 % male and 43 % female and from this approximately about 1.64% of rural male YL children were more affected by this shock.

Out of the total effects of aggregate economic shocks on children health outcomes, 0.65% of the impact was covered by small shock and 1.34% of these YL children are suffered by this shock as indicated in the above bar graph. From Table.4.3 (row-12 column-1), the mean height for age z-score of these YL children that are suffered by different house and asset shock is higher by about 0.13 units than those YL children that are not exposed to this shock In addition to this, as we have presented in the above histogram graph-(A), the area under the normal curve between 0.883 and 1.322 zhfa score is 0.0124 cover by small shocks or 1.24% of YL children found under this region. Depending on the regression Table.4.3 (row-12 column-2), from these YL children that were experienced the challenge of different house and asset shocks in the early child life (ECD) are, 1.07 percent severely stunting. The mean change in short_height-for-age of between those severely stunting and those with not stunting is estimated to be -0.10 and these children who are suffered by different house and asset shock is shorter by about 0.1 unit and it is equal to about 0.30 and statistically significant at 5% level.

According to Table.4.3 (row-12 column-3), the average body mass index z-score of those YL children who were challenged by house related shock is lower by about 0.07 units than those YL children that were not suffered by house shocks. In addition to this, as we have presented in the above histogram graph-(B), the area under the normal curve between 0.380 and 0.761 zbfa score is 0.0198 cover by this shock or 1.98% of YL children were lay under this area. From Table.4.3 (row-12 column-4), from these YL children that are experienced the challenge of different house and asset shocks in the early child life (ECD), 1.14 percent severely thinness. The mean difference in low-body mass index for age between those severely thinness and those with not thinness is estimated to be -0.03 and those children who are suffered by house related shock is lower by about 0.03(3 %).

This result shows that different house and asset shock has direct impact on child health outcome this means that their height decrease by 0.1cm and their body mass index also decrease by about 0.03 units. Moreover, rural residence male children were suffered by this shock

M) Crime Shock

Crime shocks are the sum of the following shocks i.e. shock theft or destruction of housing and tools for production, shock theft of cash, shock theft of livestock, and shock victim of crime on households. From a total of children those whose household exposed to different crime shocks were 25 % in urban and 75 % in rural and have a sex composition of 55 % male and 45 % female and from this approximately about 10.74% of rural male YL children were more affected by this shock.

From the total impacts of aggregate economic shocks on children health outcomes, 4.47% of the effects were covered by crime shock and 9.28% of these YL children are suffered by this shock as indicated in the above bar graph. Based on the regression result on Table.4.3 (row-13 colomn-1), the expected difference in the height for age z-score of these YL children that are suffered by crime shocks is higher by about 0.01 unit than those YL children that are unaffected by this shock. In addition to this, as we have presented in the above histogram graph-(A), the area under the normal curve between 0.00 and 0.440 zhfa score is 0.0582 covered by this shock or 5.82% of YL children were lay in this interval. According to Table.4.3 (row-13 colunm-2), the expected change in short_height-for-age of these YL children these experienced the challenge of different crime shocks in the early child life (ECD) were, 6.80 percent severely stunting. The mean difference in short-height for age between these severely stunting and these with not stunting is estimated to be -0.01 and those children who are suffered by shock of different crime is shorter by about 0.01cm and it is equal to about 0.39.

The result from Table.4.3 (row-13 colunm-3), shows that the average body mass index z-score of these YL children who are face challenge of different crime shock is higher by about 0.11 units than these YL children that are not facing this shock. In addition to this, as we have presented in the above histogram graph-(B), the area under the normal curve between -0.380 and 0.00 zbfa score is 0.0666 covered by this shock or 6.66% of YL children were lay on this region. In the case of low_BMI view, from Table.4.3 (row-13 colunm-4), from these YL children affected by this shock, 7.05 percent severely thinness. The expected variation in low-body mass index for age between those severely thinness and those with not thinness is estimated to be -0.07 and those children who are suffered different crime shock is lower by about 0.07(7%) and it is statistically significant at 1% level.

From this analysis we concluded that these different crime shocks have direct impact on child health outcome i.e. the height of these children shorter by 0.01cm and in stunting level. In addition to this the body mass index of these children also lower by 0.07 units and statistically significant at 1% level. The rural residence male children were more suffered by this shock. As the crime shock increase by one percent of these children decrease by about 0.01cm and the body mass index also decrease by about 0.07 units.

Table 4.4: Coping Mechanisms of the above Aggregate Economic Shocks

Types of Shocks	Coping Strategy
Increase in input price	❖ Encourage explicit subsidies (Use traditional inputs) ❖ Adequate credit and extension services
Decrease in output price	➢ Fixation of price according to output or production costs (Save for a while) ➢ Adequate market information
Death of Livestock	✓ Give medical treatment by veterinary experts ✓ Livestock or Livelihood diversification
Loss of job	• Income diversification (Search other job) • Seeking alternative income sources
Drought	➢ Planting drought resistance crops and cultivating marginal land ➢ Introduced Micro-Irrigation
Crop failure	➢ Planting early maturing crops ➢ Changing cropping pattern
Pests on storage	✓ First prepare anti-pest ✓ Spray anti-pest chemicals in the storage or appropriate storage
Death of Father Death of Mother	➢ Relatives give care for Grandchildren ➢ Healthy insurance
Family Shock	➢ Adequate Healthy extension services ➢ Health promotion strategy
Small Shocks	❖ Off farm opportunities (activities) to diversify their incomes
House shock	• Cooperate with neighbors community
Crime shock	✓ Use law dependent society

Table 4.5: Impact of type of site (urban and rural) and region on children health outcome

	(1) Zhfa	(2) short_heiht	(3) zbfa	(4) low_bmi
Regions				
Amhara region	.502	-.227	-.232***	.123***
	(.407)	(.24)	(.062)	(.032)
Oromiya region	.003	-.189	.426***	-.209***
	(.381)	(.225)	(.063)	(.032)
SNNP region	-.303	.244	.354***	-.145***
	(.336)	(.198)	(.061)	(.031)
Addis Ababa City	.389	-.354	.308***	-.125***
	(.376)	(.222)	(.078)	(.04)
Type site	-.036	.053	.297***	-.099***
	(.106)	(.063)	(.057)	(.03)

Note: zhfa stands for height-for-age z-score; short_height stands for short height for age and their results are derived from fixed effect regression estimator.

Zbmi stands for body mass index for age z-score; low-bmi stands for low body mass index for age and their results comes from random effect regression estimator.

In all regression, standard errors are adjusted for 8824 young live children in Ethiopia. Asterisks p, p**, and p*** indicates statistically significance of coefficients at 10%, 5%, and 1% respectively.*

1) Regional dummy. The data considers four main regioms and one administration city in Ethiopia(i.e. Tigray, Amhara, Oromiya, and SNNP region and Adiss Ababa city). Regional dummies are considered to see the differences among those regions taking one of the region as a reference, from this study Tigray region is used as a reference.

From Table.4.4 (row-1, column-1), using YL childs inTigray region as a refference,the height for age z-score of YL childs that are in Amhara region are on average approximately 0.50 standardivation higher than these of YL child in Tigray region and it is statistically insignificant. Similarly from Table 4.4 (row-1, column-2), the short_height for age of these YL childs that are in Amhara region are on average approximately 0.23 standard devation lower than these ofYL child in Tigray region and they have shorter height by about 0.23cm and it is statistically insignificant. Moreover, from Table 4.4 (row-1 column-3), the body mass index for age z-score of these YL childs that are in Amhara region are on average 0.23 standard devation lower than these YL childsin in Tigray region and it is statistically significant at 1% level. On the other side from Table 4.4 (row-1, column-4), the low_body mass index for age of these YL childs that are in Amhara region are on average 0.12 standardivation higher than these YL childs in Tigray region and it is statistically significant at 1% level.

This resulr indicates that YL childs that are in Amhara region have higher zhfa, higher low_body mass index for age, lower short_height for age and lower body mass index z_scores than those YL childs that are in Tigray region.

From the above Table 4.4 (row-2,column-1), using Tigray region as a refference, these YL children that are in Oromiya region have a 0.003 standardivation higher heght for age z-scores than these of YL children in Tigray region and it is about -1.58 z-score which indicates that the children in Oromia region are in marginally stunted. Secondly, from Table 4.4 (row-2,column-2), they also have a 0.19 standard devation lower mean short_height for age than these YL children in Tigray region and it is statistically insignificant.

On the other side from Table 4.4 (row-2,column-3), they have also a 0.43 standard devation higher in body mass index for age z-score than these YL children in Tigray region and it is statistically significant at 1% level. According to Table 4.4 (row-2,column-4), they have a 0.21 standard devation lower in the average expected value of low_body mass index for age than these YL children in Tigray region and it is statistically significant at 1% level.

The above analysis show that these YL children that are in Oromiya region have higher zhfa, higher zmbi, lower short_height for age and less low_body mass index for age than those YL children that are in Tigray region.

As presented in Table 4.4 (row-3,column-1), using Tigray region as a refference, these YL childs that are in SNNP region have a 0.30 standard devation lower the mean difference in height for age z-score than these YL children in Tigray region i.e they are marginally stunted indicated by the result -1.89 z-score but it is statistically insignificant. From Table 4.4 (row-3,column-2), they have also a 0.24 standard devation higher the mean difference in short_height for age than these YL children in Tigray region and it is statistically insignificant. In other way, from Table 4.4 (row-3,column-3), they have a 0.35 standard devation more on average the body mass index for age z-scores than these YL children in Tigray region and it is statistically significant at 1% level. From Table 4.4 (row-3,column-4),YL childs that are in SNNP region have 0.15 standard devation lower on average the lower body mass index for age than in Tigray region and it is statistically significant at 1% level.

The mean difference of these YL children live in SNNP region are, lower zhfa, less lower_body mass index for age, higher short_height for age, and higher zbmi than these YL children live in Tigray region.

From the above Table 4.4 (row-4, column-1), using Tigray region as a refference, these YL children that are in Addis Ababa adiministration city have a 0.39 standard devation higher in the average height for age z-score than these YL childern in Tigray region and it is statistically insignificant. From Table 4.4 (row-4, column-2), these YL children that are in Addis Ababa adiministration city also have 0.35 standard devation lower in the mean of short_ height for age than these YL children in Tigray region and it is statistically significant at 10% level. In addition to this from Table 4.4 (row-4, column-3), these YL children in addis ababa city has 0.31 standard deviation higher in body mass index z-score than these children in Tigray region and it is statistically significant at 1% level. From Table 4.4 (row-4, column-4),these YL children that are in Addis Ababa adiministration city have a 0.13 standard devation lower in the average value of low_body mass index for age than these YL children in Tigray region and it is statistically significant at 1% level.

From the above analysis the expected mean value of those YL children that are in Addis Ababa adiministration city have higher in zhfa and in zbmi, but lower in short_height for age and low_body mass index for age when compared to those YL children in Tigray region.

2) Dummy place of Residence(Rural and Urban)

The average number of YL children below five years of age is about 4.89 with the average being lower in rural areas(0.36) than in urban areas(0.64).

From Table 4.4 (row-5, column-1), the mean difference in zhfa between these YL children live in rural and these YL children live in urban is lower by 0.04 standard deviation and it is equal to about -1.63and this value indicats that the YL child live in rural is marginally stunted and rural YL children have lower z-score height for age than the urban YL child which have equal age in month. Secondly from Table 4.4 (row-5, column-2), the mean difference of short-height for age between these YL children live in rural and these YL children live in urban is higher by 0.05 standard deviation and this means the height for age of the YL child live in rural area is about 0.47cm increase in a month.

From Table 4.4 (row-5, column-3), the average value of zbmi of these YL children live in rural area is greater by 0.30 unts than these YL children live in urban area with a 0.06 standard deviation and which has 0.23 z-score, this result indicates that these children live in rural aree are in the normal body mass index z-scor. It is statistically significant at 1% level. In the other hand, from Table 4.4 (row-5, column-4), those YL children live in rural area has a 0.03 standard deviation lower body mass index by about 0.1 unit compared to these YL children live urban areas and this negative result indicates that these YL children live in rural have lower body mass index for age by about 0.16 units than urban YL children and they are marginally thin. It is statistically significant at 1% level.

This implies that the health outcome of children is directlly affected by their current residence, especially thezbfa, and lower body mass index for age. In other word, YL child live in urban area are more beneficial than rural areas.

4.3.2. Child Characteristics (Sex, Age, Injury, Health Relations)

Table 4.6: The impact of children characteristics on child health outcome

	(1) Zhfa	(2) short_heiht	(3) zbfa	(4) low_bmi
Child sex			-.139***	.109***
			(.039)	(.02)
Kids under 5 year	.067	-.002	-.077*	.026
	(.044)	(.026)	(.045)	(.024)
Child's injury	-.093**	.059**	-.152***	.068**
	(.047)	(.028)	(.051)	(.027)
Better child health				
Same child's health	-.005	.023	-.108***	.03**
	(.026)	(.015)	(.029)	(.015)
Worse child's health	-.039	.011	-.12**	-.019
	(.046)	(.027)	(.05)	(.027)

The gender proportionality in this study is 52.44% male and 47.56% female from the young live sample.

I) sex dummies: There could be a difference between male and female YL children. A male dummy is included in the regression model where “0” is for female and “1” is for male YL children**.**

From above Table 4.5 (row-1 column-3), the body mass index z-score of those male YL children have a 0.04 standard deviation lower by 0.14unit than those female YL children. According to Table 4.5 (row-1 column-4), the difference in the meanof lower_body mass index for age between those female YL children and those male YL children is lower by higher by 0.11 units respectively. An increment of 1 standard deviation in zbmi, and in lower body mass index for age of being female results in a 0.04, and 0.02 standard deviation increment of being a male. All of the variables were statistically significant at 1% level.

By this analysis body mass index z-score results have inverse relationship with age and this indicates that there is a cause which affects the height and body mass index of the child that is child health outcome indicators which affected by various shocks. But lower-body mass index for age have direct linear progress between them this implies that there is no a cause which affects these two child health outcomes.

II) Age of YL children: Age of the YL child under-5 is found to have a significant negative relationship with body mass index z-score. This could be justified as young cohort children have long term effect on their body mass index z-score.

From the above Table 4.5 (row-2 from column-1-4),the difference in the average zhfa, short-height for age, zbmi, and lower body mass index for age between those children who were under five and those children who were above five is 0.06, -0.003, -0.077 and 0.026 units respectively. An increase of 1 standard deviation in zhfa, short-height for age, zbmi, and lower body mass index for age of children who were under five results in a 0.02, 0.01, 0.022, and 0.012 standard deviation increase for those children who were above five. However, only body mass index z-score was statistically significant at 10% level but the other variables were statistically insignificant.

III) Serious injury in YL children: current health condition of YL children is found to have a significant negative relationship on zhfa and zbmi but they have a positive significant relationship on short_height for age and low_body mass index for age; which is determined by serious injury since last round.

From Table 4.5 (row-3, column-1), the mean difference in zhfa these YL children who have had serious injury since last round have lower by 0.09 than those YL children did not have serious injury and those YL children are marginally stunting. According to Table 4.5 (row-3, column-2), the average short-height for age,of those YL children who have had serious injury since last round have higher by 0.06 than those YL children did not have serious injury.

Based on Table 4.5 (row-3, column-3), the mean expected value of zbmi for those children who have had serious injury since last round is lower by 0.15 than those children did not have. Depending on Table 4.5 (row-3, column-4), the mean difference of lower body mass index for age between these YL children who have had serious injury since last round and those YL children did not have is 0.07 unit.

An increase of 1 standard deviation in zhfa, short-height for age, zbmi, and lower body mass index for age being a female results in a 0.05, 0.03, 0.05, and 0.03 standard deviation increase being a male. The two variables zhfa, and short-height for age were statistically siginificant at 5% level and zbmi, and lower body mass index for agevariables were statistically significant at 1% level.

From the above analysis height and body mass index z-score results have direct relationship with serious injury since last round and this indicates that there is a cause which affects the height and body mass index of the child this indicates child health outcome indicators could be affected by various shocks. But short_ height and lower-body mass index for age have inverse linear progress between them this implies that there is no a cause which affects these two child health outcomes. From this result that serious injury in child has significant effect on child height and body mass index of child.

IV) Child's health compared to peers

From the above Table 4.5 (row-4, column-1), the difference in the average zhfa, of these YL children who have the same health condition is lower by 0.01 unit than these YL children that have better health status when campared to pears. Based on Table 4.5 (row-4, column-2), the expeted mean value of short-height for age, ofthose YL children who have the same health condition is higher by 0.01 unit than those YL children that have better health status when campared to pears.

According to Table 4.5 (row-4, column-3), the expeted mean value of zbmi, ofthose YL children who have the same health condition is lower by 0.08 unit than those YL children that have better health status when campared to pears. Furthermore based on Table 4.5 (row-4, column-4), the expeted mean value of lower body mass index for age, ofthose YL children who have the same health condition is higher by 0.01 unit than those YL children that have better health status when campared to pears.

An increase of 1 standard deviation in zhfa, short-height for age, zbmi, and lower body mass index for age better health status of child campared to pears results in a 0.02, 0.01, 0.02, and 0.01 standard deviation increase worse health status campared to pears. However, only body mass index z-score was statistically significant at 1% level.

From Table 4.5 (row-5, column-1), the mean difference in zhfa, of these YL children who have worse health condition is lower by 0.04 unit than these YL children that have better health status when campared to pears. Based on Table 4.5 (row-5, column-2), the expeted mean value of short-height for age, of these YL children who have worse health condition is higher by 0.01 unit than these YL children that have better health status when campared to pears.

According to, Table 4.5 (row-5, column-3), the expeted mean value of zbmi, of these YL children who have worse health condition is lower by 0.12 unit than those YL children that have better health status when campared to pears. Furthermore, based on Table 4.5 (row-5, column-4), the expeted mean value of lower body mass index for age, ofthose YL children who have worse health condition is lower by 0.02 unit than those YL children that have better health status when campared to pears.

From the above analysis height and body mass index z-score results have indirect relationship with health condition of child compared to his/her pears and this indicates that there is a cause which affects the height and body mass index of the child this implies that child health outcome indicators could be affected by various shocks. The current health status of child’s that categorized as better, same, and worse health compared to his/her peers.

4.3.3. Parent Characteristics (Father or Mother)

Table 4.7: The impact of parental characteristic on child's health outcomes

	(1) Zhfa	(2) Short-height	(3) zbfa	(4) low_bmi
Mother's age	.008*	-.002	-.028***	.011***
	(.004)	(.003)	(.003)	(.002)
Illiterate mother				
Primary education	-.022	.026	.013	-.048**
	(.065)	(.038)	(.044)	(.023)
Secondary education	.086	.019	.05	-.028
	(.145)	(.086)	(.084)	(.043)
Mother live in HH				
Doesn't live in HH	-.016	.037	-.129	.07
	(.091)	(.053)	(.092)	(.049)
Mother has died	-.236	-.053	.3	-.08
	(.21)	(.124)	(.242)	(.129)
Father's age	.002	.002	.002	-.002
	(.005)	(.003)	(.004)	(.002)
Illiterate father				
Primary education	-.034	.011	-.16	.102*
	(.108)	(.064)	(.106)	(.056)
Secondary education	.041	.014	-.142	.1
	(.176)	(.105)	(.155)	(.082)
Father live in HH				
Doesn't live in HH	-.166**	.03	-.032	.012
	(.078)	(.046)	(.076)	(.04)
Father has died	-.014	-.074	.184	-.01
	(.135)	(.08)	(.154)	(.082)

I) Mother's age: Age of mother is found to have a significant positve association with zhfa and low_body mass index for age but it has a negative significant relationship with zbmi and short_height for age.

From Table 4.6 (row-1, from column-1-4), an increament of mother's age by one year, the average of zhfa and low body mass index of the children were improved by 0.01, and 0.01 units respectively but the average of short height for age and body mass index z-score of the children declines by 0.002, and 0.03 units respectivelly.

This implies that mother's age has direct relationship with zhfa and low body mass index of the children but inversily relationship with short height for age and body mass index z-score of the children. An increase of 1 standard deviation in zhfa, short-height for age, zbmi, and lower body mass index for age of children who were under five results in a 0.004, 0.003, 0.003, and 0.002 standard deviation increase for those children who were above five. However, only body mass index z-score was statistically significant at 10% level but the other variables were statistically insignificant.

II) Mother's level of education: Considering mother as the determinant decision maker, the education level of mother would influence the magnitude of child health outcomes.

From Table 4.6 (row-2, column-1) on average, these YL children whose mother completes primary education has lower zhfa by 0.02 units than these YL children whose mother is illiterate. According to Table 4.6 (row-2, column-2), these YL children whose mother completes primary education has moer short_height for age than these YL children whose mother is illiterate by about 0.03cm. From these YL children whose mother is illiterate about 29.98 percent is severely stunting and 3.80 percent is moderately stunting. Moreover, from these YL children whose mother isprimary education completed about 35.51 percent is severely stunting and 3 percent is moderately stunted and from these YL children whose mother is secondary education compled and above about 8.77 percent is severely stunting and 0.34 percent is moderately stunting.

Based on Table 4.6 (row-2, column-3) on average, these YL children whose mother completes primary education has higher zbmi by 0.01 units than these YL children whose mother is illiterate. Depending on Table 4.6 (row-2, column-4),those YL children whose mother completes primary education has low body mass index for age than these YL children whose mother is illiterate by about 0.05units and it is statistically significant at 10% level. In addition to this, from these YL children whose mother is illiterate about 28.91 percent is severely thinness and 4.26 percent is moderately thin. Moreover, from these YL children whose mother isprimary education completed about 34.06 percent is severely thinness and 3.17 percent is moderately thin and from thsse YL children whose mother is secondary education compled and above about 7.94 percent is severely thinness and 0.68 percent is moderately thin.

From Table 4.6 (row-3, column-1) on average, these YL children whose mother completes secondary education level and above has higher zhfa by 0.09 units than these YL children whose mother is illiterate. According to Table 4.6 (row-3, column-2), these YL children whose mother completes secondary education level and above has moer short_height for age than these YL children whose mother is illiterate by about 0.02cm.

Based on Table 4.6 (row-3, column-3) on average, those YL children whose mother completes secondary education level and above has higher zbmi by 0.05 units than those YL children whose mother is illiterate. Depending on Table 4.6 (row-3, column-4), those YL children whose mother completes secondary education level and above has low body mass index for age than those YL children whose mother is illiterate by about 0.03units but both of the variable are statistically insignificant.

As mother's level of education status increase by one standard deviation of grade level with 0.06, 0.03 and 0.037 standard deviations of the height for age z-score, the short_ height for age, and body mass index z-score of the child increase by 0.02, 0.02 and 0.026 units respectively and they are statistically insignificant. However the short_ body mass index for age has a standard deviation of 0.019 and declines by 0.032 related to mother's level of educational status and it is statistically significant at 10% level.

This result shows that mother's level of education directly related with the height for age z-score, the short_ height for age, and body mass index z-scores of child health outcome indicators but inversely association with low-body mass index for age. In principle children with more educated parents are likely to have better health outcomes compared to children with less educated parents. Mother's level of education has significant effect on children's health outcomes.

III) Location of YL child's mother

From Table 4.6 (row-4, column-1), the mean difference in height for age z-score of those YL children whose mother does not live in the household is decrease by about 0.08 than those YL children whose mother live in the household; it is equal to -1.67 that is marginally stunting. On the other side based on Table 4.6 (row-4, column-2), the expected mean for short-height for age of those YL children whose mother does not live in the household is higher by about 0.04cm than those YL children whose mother live in the household. However, from those YL children whose mother is live in the household about 68.72 percent is severely stunting and 6.79 percent is moderately stunted. Moreover, from those YL children whose mother does not live in the household about 4.20 percent is severely stunting and 0.31 percent is moderately stunted and from those of YL children whose mother has died about 0.34 percent is severely stunting and 0.03 percent is moderately stunted.

According to Table 4.6 (row-4, column-3), the mean difference in body mass index for age z-score of those YL children whose mother does not live in the household is decline by about 0.13 than those YL children whose mother live in the household. On the other side, based on Table 4.6 (row-4, column-4), the expected mean for low body mass index for age of those YL children whose mother does not live in the household is higher by about 0.07units than those YL children whose mother live in the household. However, from those YL children whose mother is live in the household about 66.68 percent is severely thinness and 7.69 percent is moderately thin. Moreover, from those YL children whose mother does not live in the household about 3.82 percent is severely thinness and 0.40 percent is moderately thin and from those of YL children whose mother has died about 0.41 percent is severely thinness and 0.01 percent is moderately thin.

From Table 4.6 (row-5, column-1), the difference in mean height for age z-score of those YL children whose mother has died is lower by about 0.24 than those YL children whose mother live in the household; it is equal to -1.83 that is marginally stunting. On the other side, based on Table 4.6 (row-5, column-2), the expected mean for short-height for age of those YL children whose mother has died is less by about 0.05cm than those YL children whose mother live in the household.

According to Table 4.6 (row-5, column-3), the mean difference in body mass index for age z-score of those YL children whose mother has died is more by about 0.30 units than those YL children whose mother live in the household. On the other side, based on Table 4.6 (row-5, column-4), the expected mean for low_body mass index for age of those YL children whose mother has died is lower by about 0.08units than those YL children whose mother live in the household.

However, all the variables were statistically insignificant. The variation of child's mother location does not has direct impact on child health outcome

IV) Father's age: Age of father is found to have a significant positve association with zhfa, short_height for age and body mass index for age z-scores but it has a negative significant relationship with low_body mass index for age.

From Table 4.6 (row-6, from column-1-4), an increament of father's age by one year, the average of zhfa, short_height for age and body mass index z-score of the children were improved by 0.002, 0.002 and 0.002 units respectively but the average of low_body mass index for age of the children declines by 0.002 units.This implies that father's age has direct relationship with zhfa, short_height for age and body mass index for age z-score of the children but inversily relationship with low_body mass index for age of the children.

An increase of 1 standard deviation in zhfa, short-height for age, zbmi, and lower body mass index for age of children who were under five results in a 0.005, 0.003, 0.004, and 0.002 standard deviation increase for those children who were above five.

V) Father's education level: Considering father as the determinant decision maker, the education level of father would influence the magnitude of child health outcomes.

From Table 4.6 (row-7, column-1) on average, those YL children whose father completes primary education has lower zhfa by 0.03 units than those YL children whose father is illiterate. According to Table 4.6 (row-7, column-2), those YL children whose father completes primary education has moer short_height for age than those YL children whose father is illiterate by about 0.01cm. From those YL children whose father is illiterate about 18.77 percent is severely stunting and 2.37 percent is moderately stunting. Moreover, from those YL children whose father is primary education completed about 42.35 percent is severely stunting and 4.06 percent is moderately stunted and from those YL children whose father is secondary education compled and above about 12.14 percent is severely stunting and 0.70 percent is moderately stunting.

Based on Table 4.6 (row-7, column-3) on average, those YL children whose father completes primary education has lower zbmi by 0.16 units than those YL children whose father is illiterate. Depending on Table 4.6 (row-7, column-4), those YL children whose father completes primary education has higher body mass index for age than those YL children whose father is illiterate by about 0.10units and it is statistically significant at 10% level. In addition to this, from those YL children whose father is illiterate about 19.41 percent is severely thinness and 2.15 percent is moderately thin. Moreover, from those YL children whose father is primary education completed about 4o,27 percent is severely thinness and 4.86 percent is moderately thin and from those YL children whose father is secondary education compled and above about 11.23 percent is severely thinness and 1.09 percent is moderately thin.

From table 4.6 (row-8, column-1) on average, those YL children whose father completes secondary education level and above has higher zhfa by 0.04 units than those YL children whose mother is illiterate. According to table 4.6 (row-8, column-2), those YL children whose father completes secondary education level and above has moer short_height for age than those YL children whose father is illiterate by about 0.01cm.

Based on table 4.6 (row-8, column-3) on average, those YL children whose father completes secondary education level and above has lower zbmi by 0.05 units than those YL children whose father is illiterate. Depending on table 4.6 (row-8, column-4), those YL children whose father completes secondary education level and above has heavy body mass index for age than those YL children whose father is illiterate by about 0.10units but both of the variable are statistically insignificant.

This result shows that father's level of education directly related with the height for age z-score, the short_ height for age, and low_body mass index for age of child health outcome indicators but inversely association with body mass index for age z-score of children. In principle children with more educated parents are likely to have better health outcomes compared to children with less educated parents. Father's level of education has significant effect on children's health outcomes.

Thus father's level of education has direct relationship with child health outcome indicators of height for age score, short-height for age and low-body mass index for age but it has inversely relationship with body mass index z-score indicators. As the child's father level of education increase by one educational standard deviation level the zhfa, short-height for age, zbmi, and low-body mass index increase by 0.08, 0.05, 0.08 and 0.04, standard deviation respectively. However, all of these variables are not statistically significant.

VI) Location of YL child's father

From Table 4.6 (row-9, column-1), the difference in mean height for age z-score of those YL children whose father does not live in the household is decrease by about 0.17 than those YL children whose father live in the household; it is equal to -1.76 that is marginally stunting and it is statistically significant at 5% level. On the other side, based on Table 4.6 (row-9, column-2), the expected mean for short-height for age of those YL children whose father does not live in the household is higher by about 0.03cm than those YL children whose father live in the household. However, from those YL children whose father is live in the household about 66.53 percent is severely stunting and 6.59 percent is moderately stunted. Moreover, from those YL children whose father does not live in the household about 5.72 percent is severely stunting and 0.45 percent is moderately stunted and from those of YL children whose father has died about 1.00 percent is severely stunting and 0.10 percent is moderately stunted.

According to Table 4.6 (row-9, column-3), the mean difference in body mass index for age z-score of those YL children whose father does not live in the household is decline by about 0.03 than those YL children whose father live in the household. On the other side, based on Table 4.6 (row-9, column-4), the expected mean for low_body mass index for age of those YL children whose father does not live in the household is higher by about 0.01units than those YL children whose father live in the household. However, from those YL children whose father is live in the household about 64.10 percent is severely thinness and 7.45 percent is moderately thin. Moreover, from those YL children whose father does not live in the household about 5.74 percent is severely thinness and 0.54 percent is moderately thin and from those of YL children whose father has died about 1.07 percent is severely thinness and 0.11 percent is moderately thin.

From Table 4.6 (row-10, column-1), the mean difference in height for age z-score of those YL children whose father has died is lower by about 0.01 than those YL children whose father live in the household; it is equal to -1.60 that is marginally stunting. On the other side, based on Table 4.6 (row-10, column-2), the expected mean for short-height for age of those YL children whose father has died is less by about 0.07cm than those YL children whose father live in the household.

According to Table 4.6 (row-10, column-3), the mean difference in body mass index for age z-score of those YL children whose father has died is more by about 0.18 units than those YL children whose father live in the household. On the other side based on Table 4.6 (row-10, column-4), the expected mean for low_body mass index for age of those YL children whose father has died is lower by about 0.01units than those YL children whose father live in the household.

However, all the variables were not statistically significant. The body mass index z-score and the low-body mass index for age of child have directly related with location of child's father but the height for age z-score and the short-height for age of the child have inversely related with location of child's father. The variation of child's father location has direct impact on child health outcomes.

4.3.4 Household Head Characteristics and Household Size

Table 4.8: The impact of households head characteristics on child's health outcomes

	(1) Zhfa	(2) short_height	(3) zbfa	(4) low_bmi
Household's head sex	-.023	.02	.049	-.042
	(.078)	(.046)	(.067)	(.035)
Household's head age	-.002	-.002	-.009**	.006***
	(.004)	(.002)	(.004)	(.002)
Illiterate household's head				
Primary educated hh's head	-.006	.004	-.039	.028
	(.103)	(.061)	(.107)	(.057)
Secondary educated hh's head	-.362**	.04	-.032	.023
	(.158)	(.094)	(.158)	(.084)
HH's head relationship	.03	-.028	-.007	-.023
	(.031)	(.018)	(.031)	(.017)
Household's size	-.068	.006	.064	-.024
	(.045)	(.027)	(.046)	(.024)
Caregiver's head	-.043	.019	.067	-.002
	(.044)	(.026)	(.047)	(.025)
Wealth index	.088	-.114	-.096	-.029
	(.145)	(.086)	(.127)	(.067)

I) Sex of the household head: There could be a difference between male headed and female headed households. A male dummy is included in the analysis model where “1” is for male headed household and “0” is for female headed household.

From the above Table 4.7 (row-1 column-1), on average, male headed household YL children have a height for age z-score of 0.02 units lower than those female headed household YL children and which is about -1.61 z-score those YL children are marginally stunting. Depending on Table 4.7 (row-1 column-2), male’s headed household YL children average short_height for age is approximately 0.02 cm higher than those female headed household YL children. On the other hand, from those YL children about 58.76 percent male and 14.50 percent female children are severely stunting and 5.91 percent male and 1.23 percent female children are moderately stunted.

According to Table 4.7(row-1 column-3),the difference in the mean body mass index for age z-score of those YL children whose household head being female and with those household being male is increase by about 0.04. From the other side Table 4.7 (row-1 column-4),the mean difference in the low-body mass index for age of those children whose household head being female and with those household being male is decrease by about 0.04.From the above analysis we conclude that those household leading by female has a positive association with zhfa, short-height for age and zbmi but has negative relationship with low-body mass for age this means female headed household children have lower body mass index for age by about 0.04 units.

The difference in the mean height for age z-score of those children whose household head being female and with those household being male is increase by about 0.06 and the difference in the mean short-height for age of those children whose household head being female and with those household being male is increase by about 0.02. This implies that the height of the children those family lead by female has higher height by about 0.02cm.

II) Household head’s age: The age of the household head’s is considered in Ethiopia that there could be a difference among the decision of household with different ages. The variable will be measured by the age in years of household head.

As the household head’s age increase his/her by one year the height for age z-score of the child increase by 0.004 with the standard deviation of 0.004 and the body mass index z-score of child decline by 0.011 with the standard deviation of 0.004 and it is statistically significant at 1% but weight and height for age are not statistically significant. The household head's age increase the child health outcome decrease but it is statistically insignificant. This describe that as the household head's age increase the child health outcome also increase and they have direct relationship but it is statistically insignificant. This describes that as the household head's age increase the child health outcome decrease and it is statistically significant at 5%.

III) Household head's level of education:

As presented in Table 4.7 (row-3 column-1),the mean difference in the body mass index for age z-score of these YL children whose household head's level of education is more educated (secondary education level and above) and with these whose household head's is illiterate is decrease by about 0.03 and the mean difference in low-body mass for age of those children whose household head's level of education is more educated (secondary education level and above) and with those children whose household head's is illiterate is increase by about 0.02.

This result shows that an increase in education level in household head's has positive impact on child health outcome indicators of short-height for age and low-body mass index for age but has negative impact on zhfa and zbmi. However, all of them are statistically insignificant except zhfa.

The difference in the mean height for age z-score of those children whose household head's level of education is more educated (secondary education level and above) and with those whose household head's is illiterate in the family is decrease by about 0.14 and it is statistically significant at 10% level, On the other side, the difference in mean short-height for age z-score of those children whose household head's level of education is more educated (secondary education level and above) and with those children whose household head's is illiterate in the family is increase by about 0.02.

IV) Household head's relationship to YL child:

V) Household size: The effect of aggregate economic shocks in Ethiopia YL children involves household size of the household is considered to see its implication on child health outcomes (height for age and body mass index for age).

According to Table 4.7 (row-5 column-1-4),as the number of household increase by one individual the height for age z-score of the child decrease by 0.06 with the standard deviation of 0.05; the short-height for age of the child increase by 0.005 with the standard deviation of 0.03; the body mass index z-score of the child increase by 0.07 with the standard deviation of 0.05 and the low-body mass index for age of the child decline by 0.024 with the standard deviation of 0.024. But all the variables are statistically insignificant.

Increasing household's size has had direct impact on child health outcome indicators; height for age z-score and low-body mass index for age but has no direct impact on short-height for age and body mass index z-score of children. This can be seen that children in larger households have smaller HAZs and that economic status and higher income standards on the municipality level lead to significantly higher HAZs.

VI) Caregiver's relationship to household head:

Depending on Table 4.7 (row-6, column-1), the mea difference in the height for age z-score of these YL child whose caregiver is partner of household head and with these YL children whose caregiver is household head is himself/herself is decrease by about 0.04. Based on Table 4.7 (row-6, column-2), the expected mean short-height for age of these YL child whose caregiver is partner of household head and with these YL children whose caregiver is household head is himself/herself is increase by about 0.02.

As the caregiver is household head is himself/herself, then 18.78% of YL child severely stunting, 1.83% of the child moderately stunting; as the caregiver is partner of household head, 50.64% of the child were severely stunting, 5.29 % of the child moderately stunting and as the caregiver is other society, 3.09% of the child were severely, 0.22% were moderately stunting and the remain percent of those YL child were not stunting.

According to Table 4.7 (row-6, column-3), the mean difference in the body mass index for age z-score of those child whose caregiver is partner of household head and with those children whose caregiver is household head is himself/herself is increase by about 0.07.

From Table 4.7 (row-6, column-4), the average variation in low-body mass index for age of those child whose caregiver is partner of household head and with those children whose caregiver is household head is himself/herself is decrease by about 0.002.

So as the caregiver is household head, 17.83% of child severely thinness, 2.25% of the child moderately thin; on the other side, when the caregiver is partner of household head, 50.02% of the child were severely thinness, 5.66% of the child moderately thin and out of these relatives, 3.07% of the child were severely thinness, 0.28% were moderately thin and the remain percent of the YL child were not thinness.

From the above analysis we conclude that caregiver's relationship to household head has a positive association with zhfa, short-height for age and zbmi but negative relationship with zhfa low-body mass for age health indicators and the body mass index z-score is statistically significant at 10% level.

VII) Wealth index:

Individual asset ownership is used to describe households. Wealth Index is constructed from individual assets as an indicator of relative wealth. Household wealth gives an idea of ability to access food and economic vulnerability. In relation to food security, the Wealth index is used to differentiate poorer households from the relatively wealthier ones. Households are ranked into quintiles, dividing the population into five equal groups. Data on assets and wealth is also very useful to triangulate income and expenditure information as accurate income and expenditure data is difficult to obtain from households.

According to Engel's Law, the share of income spent on food falls as the income of the household rises.

According to Table 4.7 (row-7 column-1), as the wealth index of households increase by one percent the height for age z-score of the child increase by 0.09 with the standard deviation of 0.15, this result indicates that the wealth of household and the height for age z-score of the child have positive relationship. Secondly from Table 4.7 (row-7 column-2), the short_height for age of the children decrease by 0.11 with a 0.09 standard deviation this mean that as wealth index of household increase by one percent the height of the child decline by 0.11cm as compared to his/her peers. On the other side from Table 4.7 (row-7 column-3), the body mass index z-score of the child decrease by 0.10 with the standard deviation of 0.13. Furthermore based on Table 4.7 (row-7 column-4), as the wealth index of households increase by one percent the low-body mass index for age of the YL child was decreased by 0.03 with a 0.07 standard deviation.

This shows that wealth index has indirect impact on child health outcomes i.e. short_height for age, the body mass index z-score and the low_body mass index for age of these YL children.

A wealth index is used to describe the relative wealth of the household where mother and child reside based on quintiles. Quintiles are divided into poorest, poorer, middle, richer and richest. Without data on household incomes and consumption per capita, tea revenue and household wealth index are instead used as proxies. The share of expenditure on food is an important indicator of households' food security and economic vulnerability. It is widely documented that poorer and vulnerable households tend to allocate higher share of their expenses on food in relation to other consumed items/services.

CHAPTER FIVE

CONCLUSION AND POLICY IMPLICATION

5.1 Summary and Conclusion

A) Height for age z-score

Using FE estimator, the following variables are positively and significantly correlated with either height-for-age z-scores or the discrete indicator of stunting or moderately stunting: crop failure shock, small shocks including increase price of food availability and decrease in food availability, mothers age but they are positively correlated with height for age z-scores: shock increase in input price, shock decrease in output price, shocks pests on storage, shock death of livestock, drought, shock death of mother, house shock i.e. shock fire affecting house and collapse or destruction of house, crime shock, kids under five year, father age, mother and father above secondary education level, head relation and wealth index.

However, some variable are negatively and significantly correlated with height for age z-scores: family shocks, illness of mother and father sisters and brothers, child injury, father does not live in the household, and households above secondary education; while type site, shock of job loss, shock death of father, child health relation, mother's and father's primary education level, mother and father did not live in the household, household's sex and age, household's primary education level, household's family size, and care head.

B) Short height-for-age (marginally stunting)

Using FE estimator, the next variables are directly and significantly correlated with either short-height-for-age or the discrete indicator of stunting or moderately stunting: family shock including illness of mother, father, sister, and brothers, children has serious injury since last round; but some variables are inversely and significantly correlated with short-height for age: crop failure shock, small shocks including shock closure place of employment, increase price of food availability and decrease in food availability, and house shock i.e. house collapses and destructions.

In the other side, there are many variables that are positively correlated with short-height for age: type site, shock of job loss, shock death of father, death of mother, child has health problem since last round, mother's and father's primary and secondary education level, mother and father did not live in the household, fathers age, household's sex, household's primary and secondary education level, household's family size, and care head.

Negatively correlated variables; shock increase in input price, shock decrease in output price, shocks pests on livestock, shock death of livestock, drought, shock, crime shock, kids under five year, mother age, mother and father has died, head age, head relation and wealth index

C) Body mass index-for-age z-score (marginally thin)

Using RE estimator, the following variables are positively and significantly correlated with either height-for-age z-scores or the discrete indicator of severely thinness or moderately thin: type site, shock increase in input price, family shock and crime shock; but some variables are negatively and significantly correlated with body mass index for age z-scores; shock of pests on livestock, small shocks, child sex, kids under-five, child-injury, and child health, and mother's head's age.

On the other side, the following some variables have a positive correlation with body mass index for age z-score: death of livestock, drought, shock loss of job, shock death of mother, mother primary and above secondary education level, mother and father has died, father's age, household's head sex, family size, and care head. However, there are other some variables that are negatively correlated with body mass index for age z-scores: shock decrease in output price, crop failure, shocks father, house shock i.e. House collapse destruction of house, mother did not live in the household, father's and household's head primary and above secondary education, father live in the household, head relation and wealth index

D) low-body mass index-for-age (marginally stunting)

Using RE estimator, the following variables are directly and significantly correlated with either low-body mass index-for-age or the discrete indicator of severely thinness or moderately thin; small shocks, child sex child injury, worse child health, mother's age, father's primary education, and household's head age. Parallel to this, there are few variables which have inversely and significantly correlated with lower body mass index; type site, death of mother, family shock, crime shock, and mother's primary education.

In the other side there are many variables that are positively correlated with short-height for age: type site, crop failure, shocks pests on livestock, shock death of father, kids under five year, mother and father did not live in the household, father's above secondary education level and household's primary and above secondary education

Negatively correlated variables; shock increase in input price, shock fire affecting house, shock decrease in output price, shock house collapse, shock death of livestock, shock of job loss, drought, worst child health, mother's above secondary education, mother's and father's death, father's age, household's sex, household's relation, household size, care head and wealth index.

In this section, we have explored the impact of aggregate economic shock on children health outcomes, making specific use of evidence from Ethiopia on the impact of crop failure, family shock, and small shock. We found that the children health outcomes as measured by height and body mass are more significantly affected by the three mentioned shocks.

In the first instance, these YL children exposed to a crop failure in the affected regions are particularly vulnerable, with these YL children have on average, 0.03 standard deviations lower height-for-age z-scores, and 0.02 standard deviations lower body mass index-for-age and the impact is even worse for children in poor households. In addition, about 15.04% of these YL children are severely stunting and about 15.28% of these children are severely thinness because of this shock and categorized in z-score cut point **(<-3SD)**.

These YL children experienced a family shock in the affected areas are specifically vulnerable, with these children have on average, 0.07 standard deviations lower height-for-age z-scores, and 0.03 standard deviations higher body mass index-for-age z-score and the impact is even worse for children in poor households. Furthermore, about 30.95% these YL children are severely stunting and about 32.27% of these children are severely thinness and have z-score cut point **(< -3SD)** due to this shock.

These YL children exposed to a small shocks in the affected communities are particularly vulnerable, with these children have on average, 0.03 standard deviations lower height-for-age z-scores, and 0.02 standard deviations lower body mass index-for-age and the impact is even worse for children in poor households. In spite of this, about 30.72% these children are severely stunting and about 28.12% of these children are severely thinness and have z-score cut point **(< -3SD)** by this shock. Rural male children are more affected by these aggregate economic shocks.

5.2 Policy Recommendations

Government must apply irrigation policies, which increase agricultural production and investment in irrigation equipment and encourage investment simultaneously in other sectors, and raise rural households' income and consumption. Since these policies secure adequate agricultural food supply, resulting in lower prices and higher consumption for rural and urban poor people, enabling them to earn enough money to invest in new technologies. It leads to an increase in income for all labor types and consumption for urban and rural households.

Advocate for better child nutrition, encouraging a higher diversity of food items consumed and a higher frequency of meals. Promote the availability and accessibility to diverse, safe, and nutrient dense food items required for proper child nutrition. Increase nutrition sensitive safety nets and pro-poor growth initiatives tailored to specific needs in urban and rural areas, to promote income generation and asset acquisition.

Government should maintain strategic food reserves for emergency use and establishes strong food and security institutions in order to prevent unpredictable natural shocks such as drought, crop failure, death of livestock's, etc. …

Households must give priority to these children under five years old rather than these children older than five years. Continue to scale up and implement seasonal interventions to help households experiencing seasonal food insecurity and ensure that transfer programs take seasonal peaks of food insecurity into account.

REFERENCES

Adhvaryu, A., Kala, N., & Nyshadham, A. (2016). Management and Shocks to Worker Productivity. *Management and Shocks to Worker Productivity*.

Akombi, B. J., Agho, K. E., Hall, J. J., Wali, N., Renzaho, A. M. N., & Merom, D. (2017). Stunting, wasting and underweight in Sub-Saharan Africa: A systematic review. *International Journal of Environmental Research and Public Health*.

Akresh, R., Verwimp, P., & Bundervoet, T. (2011). Civil war, crop failure, and child stunting in Rwanda. *Economic Development and Cultural Change*.

Alderman, H., & Behrman, J. R. (2019). Nutrition, Malnutrition, and Economic Growth. *Health and Economic Growth,*

Alderman, H., Behrman, J. R., & Hoddinott, J. (2004). The Challenge of Hunger and Malnutrition Challenge Paper. *Copenhagen Consensus Challenge Paper*.

Alderman, H., Hoddinott, J., & Kinsey, B. (2006). Long term consequences of early childhood malnutrition. *Oxford Economic Paper*.

Almond, D., & Almond, D. (2017). *Almond Currie 2017 Childhood Health Impact*.

Almond, D., & Currie, J. (2011). Killing me softly: The fetal origins hypothesis. *Journal of Economic Perspectives*.

Baird, S., Friedman, J., & Schady, N. (2011). Aggregate income shocks and infant mortality in the developing world. *Review of Economics and Statistics*.

Banerjee, A. V, & Research, N. B. of E. (2007). Long run health impacts of income shocks. *Wine and Phylloxera in 19th Century France*.

Becker, G. S. (1965). A Theory of the Allocation of Time. *The Economic Journal*.

Berhane, G., Hoddinott, J., Kumar, N., & Taffesse, A. (2011). The impact of Ethiopia's productive safety nets and household asset building programme: 2006–2010. *International Food Policy Research Institute*.

Bhalotra, S. (2012). Poverty and survival. *Journal of Development Studies*.

Black, R. E., Allen, L. H., Bhutta, Z. A., Caulfield, L. E., de Onis, M., Ezzati, M., Mathers, C., & Rivera, J. (2008). Maternal and child undernutrition: global and regional exposures and health consequences

Brown, M. E., Backer, D., Billing, T., White, P., Grace, K., Doocy, S., & Huth, P. (2020). Empirical studies of factors associated with child malnutrition: highlighting the evidence about climate and conflict shocks. *Food Security*.

Brown, R. (2018). The Mexican Drug War and EARLY-Life Health: The Impact of Violent Crime on Birth Outcomes. *Physiology & Behavior*.

Central Statistical Agency. (2001). *Ethiopia DHS 2000*.

Chay, K. Y., & Greenstone, M. (2003). Mortality: Evidence From Geographic. *Quarterly Journal of Economics,*

Chen, E., Martin, A. D., & Matthews, K. A. (2006). Understanding health disparities: The role of race and socioeconomic status in children's health. *American Journal of Public Health*.

Christiaensen, L., & Alderman, H. (2004). Child malnutrition in Ethiopia: Can maternal knowledge augment the role of income? *Economic Development and Cultural Change*.

Cogneau, D., & Jedwab, R. (2012). Commodity price shocks and child outcomes: The 1990 cocoa crisis in Côte d'ivoire. *Economic Development and Cultural Change*.

Committee on Evaluation of Children's Health, & Board of Children Youth and Families. (2004). Children's Health: A New Conceptual Framework. In *Children's Health, The Nation's Wealth: Assessing and Improving Child Health*.

Cook, B. I., Seager, R., Park Williams, A., Puma, M. J., McDermid, S., Kelley, M., & Nazarenko, L. (2019). Climate change amplification of natural drought variability: The historic mid-twentieth-century North American drought in a warmer world. *Journal of Climate*.

Cook, D. T. (2020). United Nations Convention on the Rights of the Child (UNCRC). *The SAGE Encyclopedia of Children and Childhood Studies*.

Cutler, D., Deaton, A., & Lleras-Muney, A. (2006). The determinants of mortality. *Journal of Economic Perspectives*.

Cutler, D. M., Knaul, F., Lozano, R., Méndez, O., & Zurita, B. (2002). Financial crisis, health outcomes and ageing: Mexico in the 1980s and 1990s. *Journal of Public Economics*.

Datar, A., Liu, J., Linnemayr, S., & Stecher, C. (2013). The impact of natural disasters on child health and investments in rural India. *Social Science and Medicine*,

Deaton, A. S., & Paxson, C. H. (1998). Aging and Inequality in Income and Health. In *American Economic Review* (Vol. 88).

Dercon, S. (2002). Growth, Shocks and Poverty during Economic Reform: evidence from rural Ethiopia. *IMF Conference "Macroeconomic Policies and Poverty*.

Dercon, S., & Porter, C. (2014). Live aid revisited: Long-term impacts of the 1984 Ethiopian famine on children. *Journal of the European Economic Association*.

Douglas, A., Lena, E., & Mårten, P. (2009). Chernobyl's subclinical legacy: Prenatal exposure to radioactive fallout and school outcomes in Sweden. *Quarterly Journal of Economics*,

Duflo, E. (2003). *Grandmothers and Granddaughters : Old-Age Pensions and Intrahousehold Allocation in South Africa*.

Durevall, D., Loening, J. L., & Ayalew Birru, Y. (2013). Inflation dynamics and food prices in Ethiopia. *Journal of Development Economics.*

EPHI and ICF. (2019). *Ethiopia Mini Demographic and Health Survey 2019: Final Report. Rockville, Maryland, USA: EPHI and ICF.*

FAO. (2008). The state of food insecurity in the World-high food prices and food security – threats and opportunities. In *United Nations Food and Agricultural Organization* (Vol. 30,).

Ferreira, F. H. G., & Schady, N. (2009). Aggregate economic shocks, child schooling, and child health. *World Bank Research Observer*.

Finlay, J. E., Özaltin, E., & Canning, D. (2011). The association of maternal age with infant mortality, child anthropometric failure, diarrhoea and anaemia for first births: Evidence from 55 low- and middle-income countries.

FMOH. (2015). Ethiopian Health Sector Transformation Plan.2015/16 - 2019/20. *Federal Democratic Republic of Ethiopia Ministry of Health*.

Food and Agriculture Organization of the United Nations. (2011). The State of Food Insecurity in the World: How does international price volatility affect domestic economies and food security?

Foster, A. D. (2016). *Prices , Credit Markets and Child Growth in Low-Income Rural Areas Author (s): Andrew D . Foster Published by : Wiley on behalf of the Royal Economic*

Society Stable URL.

Gallup, J. L., & Sachs, J. D. (2001). The economic burden of malaria. *American Journal of Tropical Medicine and Hygiene*.

Georgiadis, A., Benny, L., Crookston, B. T., Duc, L. T., Hermida, P., Mani, S., Woldehanna, T., Stein, A. D., & Behrman, J. R. (2016). Growth trajectories from conception through middle childhood and cognitive achievement at age 8 years: Evidence from four low- and middle-income countries. *SSM - Population Health*.

Gilligan, D. O., Hoddinott, J., & Taffesse, A. S. (2009). The Impact of Ethiopia's productive safety net programme and its linkages. *Journal of Development Studies*.

Gitau, R., Makasa, M., Kasonka, L., Sinkala, M., Chintu, C., Tomkins, A., & Filteau, S. (2005). Maternal micronutrient status and decreased growth of Zambian infants born during and after the maize price increases resulting from the southern African drought of 2001–2002. *Public Health Nutrition*.

Grantham-McGregor, S., Cheung, Y. B., Cueto, S., Glewwe, P., Richter, L., & Strupp, B. (2007). Developmental potential in the first 5 years for children in developing countries.

Grossman, M. (1972). Health capital.pdf. In *Journal of Political Economy* (Vol. 80,).

Gwatkin, D. R., Rutstein, S., Johnson, K., Suliman, E., & Wagstaff, A. (2007). *Socio-economic differences in health nutrition and population. Rwanda: 2000. December 2014*.

Hoddinott, J., & Kinsey, B. (2001). Child growth in the time of drought. *Oxford Bulletin of Economics and Statistics*.

Jensen, R. (2000). Agricultural volatility and investments in children. *American Economic*

Kazibwe, D. (2019). *Early life economic shocks and child health outcomes*.

Kerac, M., & McGrath, M. (2017). Management of acute malnutrition in infants under 6 months of age. *The Biology of the First 1,000 Days*,

Khan, S., Zaheer, S., & Safdar, N. F. (2019). *Determinants of stunting , underweight and wasting among children < 5 years of age : evidence from 2012-2013 Pakistan demographic and health survey*.

Maccini, S., & Yang, D. (2009). Under the weather: Health, schooling, and economic consequences of early-life rainfall. *American Economic Review*.

Maluccio, J. A. (2005). Coping with the coffee crisis in Central America: the role of the Nicaraguan Red de Protección Social. *FCND Discussion Papers*.

Miller, G., & Urdinola, B. P. (2010). Cyclicality, mortality, and the value of time: The case of coffee price fluctuations and child survival in Colombia. *Journal of Political Economy*.

MOFED. (2002). Ethiopian Sustainable Poverty Reduction Program 2002-2005. *Ministry of Finance and Economic Development*, *July*.

MoWUD. (2009). Plan for Accelerated and Sustained Development to End Poverty (2005/06-2009/10): Plan for Urban Development and Urban Good Governance. *MoFED*, *I*(2007), Documents/Plan_for_Accelerated_and_Sustained_(PASDEP)_final_July_2007_Volume_I_

Narayan, N., & Handra, C. (2007). M P RA Munich Personal RePEc Archive HEALTH AND HEALTH ECONOMICS: A CONCEPTUAL FRAMEWORK. *Munich Personal RePEc.*

Neelsen, S., & Stratmann, T. (2011). Effects of prenatal and early life malnutrition: Evidence from the Greek famine. *Journal of Health Economics*.

OECD. (2012). Review of the World Food Programme ' s Humanitarian and Development Effectiveness 2006-2011.

Of, Ournal. (2008). *Determinants of Children's Nutritional Status in Kenya: Evidence from Demographic and Health Surveys Jane Kabubo-Mariara*.

Of, Overview, & Ratings, O. (2012). *International Fund for Agricultural Development (IFAD).*

Ort, E. P. (2001). The world health report 2001 — Mental health: new understanding, new hope. *Bulletin of the World Health Organization*.

Patz, T. (2005). Ethiopia (Federal Democratic Republic of Ethiopia). *Handbook of Federal Countries.*

Paxson, C., & Schady, N. (2005). Child health and economic crisis in Peru. *World Bank Economic Review*.

Pongou, R., Ezzati, M., & Salomon, J. A. (2006). Household and community socioeconomic and environmental determinants of child nutritional status in Cameroon. *BMC Public Health*.

Pongou, R., Salomon, J. A., & Ezzati, M. (2006). Health impacts of macroeconomic crises and policies: Determinants of variation in childhood malnutrition trends in Cameroon. *International Journal of Epidemiology*.

Press, C. (1988). *Birth Order and Child Nutritional Status : Evidence from the Philippines Author (s): Susan Horton Source : Economic Development and Cultural Change.*

Preston, S. (1980). Causes and consequences of mortality declines in LDCs during the 20th century. In *Population and Economic Change in Developing Countries*.

Rogot, E., Sorlie, P. D., & Johnson, N. J. (1992). Life expectancy by employment status, income, and education in the National Longitudinal Mortality Study. *Public Health Reports*.

Ruhm, C. J. (2000). Are recessions good for your health? *Quarterly Journal of Economics*.

Serbesa, M. L., Iffa, M., & Geleto, M. (2019). Factors associated with malnutrition among pregnant women and lactating mothers in Miesso Health Center, Ethiopia. *European Journal of Midwifery*.

Smith, L. C., Ramakrishnan, U., Ndiaye, A., Haddad, L., & Martorell, R. (2003). The importance of women's status for child nutrition in developing countries. *Research Report of the International Food Policy Research Institute*.

Thornberry, P. (2012). The UN draft Declaration on the Rights of Indigenous Peoples. *Indigenous Peoples and Human Rights*.

Victora, C. G., Adair, L., Fall, C., Hallal, P. C., Martorell, R., Richter, L., & Sachdev, H. S. (2008). Maternal and child undernutrition: consequences for adult health and human capital.

WHO. (2012). *World Health Statistics* (Vol. 148).

Woldehanna, T. (2010). *Do pre-natal and post-natal economic shocks have a long-lasting effect on the height of 5-year-old children?* (Issue 60).

World Bank. (2006). *the World Bank Annual Report 2006 Operational Summary | Fiscal 2006*.

Yamano, T., Alderman, H., & Christiaensen, L. (2005). Child growth, shocks, and food aid in rural Ethiopia. *American Journal of Agricultural Economics*,

APPENDICES

Appendixes 1: Fixed and Random effect Regression results on Height for age z-scores

	(1)	(2)	(3)	(4)
	Zhfa fe	Zhfa re	short_height fe	short_heightrre
1bn.region				
3.region	.502	-.103	-.227	.06*
	(.407)	(.066)	(.24)	(.034)
4.region	.003	.069	-.189	.037
	(.381)	(.065)	(.225)	(.034)
7.region	-.303	.047	.244	.06*
	(.336)	(.063)	(.198)	(.033)
14.region	.389	.254***	-.354	-.077*
	(.376)	(.081)	(.222)	(.042)
Type site	-.036	.114**	.053	-.021
	(.106)	(.055)	(.063)	(.03)
Shock input price	.046	.055*	-.015	-.025
	(.03)	(.029)	(.018)	(.017)
Shock output price	.07	.032	-.048	-.014
	(.061)	(.057)	(.036)	(.033)
Crop failure	.06*	.048	-.031*	-.011
	(.032)	(.03)	(.019)	(.018)
Shock pest store	.049	.032	-.03	-.03
	(.055)	(.052)	(.032)	(.03)
Death livestock	.022	.009	-.015	-.007
	(.032)	(.03)	(.019)	(.017)
Shock drought	.018	-.055*	-.022	.02
	(.032)	(.03)	(.019)	(.017)
Shock job loss	-.064	-.07*	.024	.023
	(.045)	(.042)	(.026)	(.024)
Death of father	-.064	-.006	.077	.032
	(.109)	(.102)	(.065)	(.058)
Death of mother	.182	.147	.004	.014
	(.169)	(.16)	(.101)	(.093)
Family shock	-.07***	-.064***	.048***	.041***
	(.026)	(.024)	(.016)	(.014)
Small shock	.145***	.139***	-.063***	-.059***
	(.023)	(.023)	(.014)	(.013)

House shock	.126	.107	-.102*	-.091*
	(.089)	(.084)	(.053)	(.049)
Crime shock	.012	.021	-.013	-.011
	(.043)	(.04)	(.026)	(.023)
Child sex		-.35***		.148***
		(.041)		(.021)
kids_under_5	.067	.066*	-.002	-.007
	(.044)	(.039)	(.026)	(.023)
Child injury	-.093**	-.082*	.059**	.053**
	(.047)	(.044)	(.028)	(.025)
1bn.child_health				
2.child_health	-.005	-.029	.023	.028**
	(.026)	(.024)	(.015)	(.014)
3.child_health	-.039	-.102**	.011	.042*
	(.046)	(.043)	(.027)	(.025)
Mom age	.008*	-.001	-.002	.002
	(.004)	(.003)	(.003)	(.002)
0bn.mom_educ				
1.mom_educ	-.022	.087**	.026	-.039*
	(.065)	(.042)	(.038)	(.023)
2.mom_educ	.086	.231***	.019	-.058
	(.145)	(.081)	(.086)	(.044)
1bn.mom_residenc				
2.mom_residence	-.016	-.049	.037	.03
	(.091)	(.081)	(.053)	(.046)
3.mom_residence	-.236	-.242	-.053	-.011
	(.21)	(.203)	(.124)	(.118)
Dad age	.002	.002	.002	.001
	(.005)	(.004)	(.003)	(.002)
0bn.dad_educ				
1.dad_educ	-.034	.024	.011	-.001
	(.108)	(.094)	(.064)	(.054)
2.dad_educ	.041	.183	.014	-.016
	(.176)	(.139)	(.105)	(.079)
1bn.dad_residence				

2.dad_residence	-.166**	-.109	.03	.018
	(.078)	(.067)	(.046)	(.038)
3.dad_residence	-.014	.001	-.074	-.041
	(.135)	(.13)	(.08)	(.075)
Head sex	-.023	.037	.02	-.026
	(.078)	(.061)	(.046)	(.034)
Head age	-.002	.001	-.002	-.002
	(.004)	(.003)	(.002)	(.002)
0bn.head_educ				
1.head_educ	-.006	-.036	.004	.025
	(.103)	(.093)	(.061)	(.053)
2.head_educ	-.362**	-.259*	.04	.034
	(.158)	(.139)	(.094)	(.08)
Head relation	.03	.019	-.028	-.018
	(.031)	(.027)	(.018)	(.016)
hh size	-.068	-.077*	.006	.015
	(.045)	(.04)	(.027)	(.023)
Care head	-.043	-.029	.019	.007
	(.044)	(.04)	(.026)	(.023)
Wealth index	.088	.622***	-.114	-.382***
	(.145)	(.115)	(.086)	(.065)
_cons	-1.593***	-1.451***	.415**	.325***
	(.287)	(.125)	(.17)	(.069)
Observations	6004	6004	5987	5987
Pseudo R^2	.z	.z	.z	.z

Standard errors are in parentheses

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

Appendixes 1A: Haussmann test using sigmamore for estimation of Height for age z-scores

		(b) Fixed effect	(B) Random effect
Independent variables			
	3	0.502217	-0.1032
	4	0.003406	0.068972
	7	-0.30298	0.04688
	14	0.388513	0.254028
Type site		-0.03584	0.113917
Shock input price		0.045881	0.054946
Shock output price		0.070153	0.032205
Crop failure		0.060008	0.04759
Pests on storage		0.048877	0.032258
Death livestock		0.022107	0.009022
Shock drought		0.018089	-0.05543
Shock job loss		-0.06375	-0.06972
Death of father		-0.06446	-0.00599
Death of mother		0.181959	0.146901
Family shock		-0.0696	-0.06397
Small shock		0.1452	0.138642
House shock		0.12633	0.106586
Crime shock		0.011846	0.021121
kids_under_5		0.066705	0.065645
Child injury		-0.09283	-0.08172
Child health			
	2	-0.0052	-0.02866
	3	-0.0387	-0.10228
Mom age		0.007671	-0.00139
Mom education			
	1	-0.0222	0.086965
	2	0.085918	0.23147
Mom residence			
	2	-0.01641	-0.04892
	3	-0.23584	-0.24248
Dad age		0.002308	0.001984
Dad education			
	1	-0.03424	0.024446
	2	0.041194	0.182745
Dad residence			
	2	-0.16613	-0.1088
	3	-0.0143	0.001346
Head sex		-0.02257	0.036516
Head age		-0.00153	0.001003

Head education			
	1	-0.00641	-0.03649
	2	-0.36188	-0.25893
Head relation		0.030121	0.019457
hh size		-0.06824	-0.07738
Care head		-0.04289	-0.02943
Wealth index		0.087935	0.621996

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(40) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 163.59

Prob>chi2 = 0.0000

Therefore, from this hausman test result (163.59) fixed effect estimator is preferable for this model to estimate the effect of the selected aggregate economic shocks on child height for age z-scores.

Appendixes1B: Fixed effect Regression results by using vce (robust) method

(Hetroscedasticity and Multi-linearity tests by using vce (robust) method

```
Fixed-effects (within) regression               Number of obs     =      6,004
Group variable: child_id                        Number of groups  =      2,206

R-sq:                                           Obs per group:
     within  = 0.0315                                         min =          1
     between = 0.0023                                         avg =        2.7
     overall = 0.0001                                         max =          3

                                                F(40,2205)        =       3.89
corr(u_i, Xb)  = -0.3174                        Prob > F          =     0.0000

                                     (Std. Err. adjusted for 2,206 clusters in child_id)
```

zhfa	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
region						
Amhara	.5022167	.252512	1.99	0.047	.0070305	.9974029
Oromiya	.0034061	.3170857	0.01	0.991	-.6184118	.625224
SNNP	-.3029799	.289246	-1.05	0.295	-.870203	.2642432
Addis Ababa City Administration	.3885125	.2954842	1.31	0.189	-.1909439	.967969
type_site	-.035844	.1194561	-0.30	0.764	-.2701022	.1984142
shock_input_price	.0458811	.0313086	1.47	0.143	-.0155163	.1072785
shock_output_price	.070153	.0648472	1.08	0.279	-.057015	.1973209
crop_failure	.0600082	.0363204	1.65	0.099	-.0112175	.131234
livestock_pest	.0488769	.0621421	0.79	0.432	-.0729863	.17074
shock_livestock	.0221069	.030585	0.72	0.470	-.0378716	.0820854
shock_drought	.0180888	.0303296	0.60	0.551	-.0413889	.0775664
shock_job_loss	-.0637461	.0405177	-1.57	0.116	-.143203	.0157108
shock_father	-.064455	.1175574	-0.55	0.584	-.2949897	.1660798
shock_mother	.1819587	.2449592	0.74	0.458	-.2984163	.6623337
family_shock	-.0695977	.0246684	-2.82	0.005	-.1179734	-.021222
small_shock	.1451995	.0215227	6.75	0.000	.1029927	.1874064
house_shock	.1263295	.1314483	0.96	0.337	-.1314459	.3841048
crime_shock	.0118464	.048626	0.24	0.808	-.0835111	.107204
child_sex	0	(omitted)				
kids_under_5	.0667045	.0445372	1.50	0.134	-.0206348	.1540438
child_injury	-.0928299	.0525456	-1.77	0.077	-.1958739	.0102141
child_health						
Same	-.005195	.0266994	-0.19	0.846	-.0575536	.0471637
Worse	-.038703	.0473301	-0.82	0.414	-.1315192	.0541131
mom_age	.0076713	.0041537	1.85	0.065	-.0004743	.0158169
mom_educ						
Primary Educaion	-.0221965	.0622582	-0.36	0.721	-.1442873	.0998944
Secondary and above Education	.0859175	.1511529	0.57	0.570	-.2104995	.3823345
mom_residence						
Does not live in household	-.0164088	.0762662	-0.22	0.830	-.16597	.1331523
Has died	-.2358407	.2400343	-0.98	0.326	-.7065577	.2348762
dad_age	.0023081	.0045642	0.51	0.613	-.0066425	.0112587
dad_educ						
Primary Educaion	-.0342374	.0950003	-0.36	0.719	-.2205368	.1520619
Secondary and above Education	.0411942	.2020429	0.20	0.838	-.3550201	.4374085
dad_residence						
Does not live in household	-.166131	.0719434	-2.31	0.021	-.307215	-.0250471
Has died	-.0142967	.1463804	-0.10	0.922	-.3013547	.2727612
head_sex	-.022573	.0779368	-0.29	0.772	-.1754103	.1302643
head_age	-.0015251	.0042994	-0.35	0.723	-.0099565	.0069063
head_educ						
Primary Educaion	-.0064104	.0880185	-0.07	0.942	-.1790183	.1661974
Secondary and above Education	-.3618832	.1628779	-2.22	0.026	-.6812934	-.042473
head_relation	.0301213	.0313803	0.96	0.337	-.0314167	.0916593
hh_size	-.0682354	.046043	-1.48	0.138	-.1585275	.0220567
care_head	-.0428909	.0489458	-0.88	0.381	-.1388756	.0530939
wealth_index	.0879348	.1540582	0.57	0.568	-.2141796	.3900493
_cons	-1.592754	.2451382	-6.50	0.000	-2.07348	-1.112028
sigma_u	1.0937374					
sigma_e	.72281997					
rho	.69601471	(fraction of variance due to u_i)				

Appendixes 2: Fixed and Random effect Regression results on Short Height for age

	(1) Zhfa fe	(2) Zhfa re	(3) short_height fe	(4) short_heightrre
1bn.region				
3.region	.502	-.103	-.227	.06*
	(.407)	(.066)	(.24)	(.034)
4.region	.003	.069	-.189	.037
	(.381)	(.065)	(.225)	(.034)
7.region	-.303	.047	.244	.06*
	(.336)	(.063)	(.198)	(.033)
14.region	.389	.254***	-.354	-.077*
	(.376)	(.081)	(.222)	(.042)
Type site	-.036	.114**	.053	-.021
	(.106)	(.055)	(.063)	(.03)
Shock input price	.046	.055*	-.015	-.025
	(.03)	(.029)	(.018)	(.017)
Shock output price	.07	.032	-.048	-.014
	(.061)	(.057)	(.036)	(.033)
Crop failure	.06*	.048	-.031*	-.011
	(.032)	(.03)	(.019)	(.018)
Shock pest store	.049	.032	-.03	-.03
	(.055)	(.052)	(.032)	(.03)
Death livestock	.022	.009	-.015	-.007
	(.032)	(.03)	(.019)	(.017)
Shock drought	.018	-.055*	-.022	.02
	(.032)	(.03)	(.019)	(.017)
Shock job loss	-.064	-.07*	.024	.023
	(.045)	(.042)	(.026)	(.024)
Death of father	-.064	-.006	.077	.032
	(.109)	(.102)	(.065)	(.058)
Death of mother	.182	.147	.004	.014
	(.169)	(.16)	(.101)	(.093)
Family shock	-.07***	-.064***	.048***	.041***
	(.026)	(.024)	(.016)	(.014)
Small shock	.145***	.139***	-.063***	-.059***
	(.023)	(.023)	(.014)	(.013)
House shock	.126	.107	-.102*	-.091*
	(.089)	(.084)	(.053)	(.049)
Crime shock	.012	.021	-.013	-.011
	(.043)	(.04)	(.026)	(.023)
Child sex		-.35***		.148***
		(.041)		(.021)
kids_under_5	.067	.066*	-.002	-.007
	(.044)	(.039)	(.026)	(.023)
Child injury	-.093**	-.082*	.059**	.053**
	(.047)	(.044)	(.028)	(.025)
1bn.child_health				
2.child_health	-.005	-.029	.023	.028**
	(.026)	(.024)	(.015)	(.014)
3.child_health	-.039	-.102**	.011	.042*
	(.046)	(.043)	(.027)	(.025)
Mom age	.008*	-.001	-.002	.002

	(.004)	(.003)	(.003)	(.002)
0bn.mom_educ				
1.mom_educ	-.022	.087**	.026	-.039*
	(.065)	(.042)	(.038)	(.023)
2.mom_educ	.086	.231***	.019	-.058
	(.145)	(.081)	(.086)	(.044)
1bn.mom_residenc				
2.mom_residence	-.016	-.049	.037	.03
	(.091)	(.081)	(.053)	(.046)
3.mom_residence	-.236	-.242	-.053	-.011
	(.21)	(.203)	(.124)	(.118)
Dad age	.002	.002	.002	.001
	(.005)	(.004)	(.003)	(.002)
0bn.dad_educ				
1.dad_educ	-.034	.024	.011	-.001
	(.108)	(.094)	(.064)	(.054)
2.dad_educ	.041	.183	.014	-.016
	(.176)	(.139)	(.105)	(.079)
1bn.dad_residence				
2.dad_residence	-.166**	-.109	.03	.018
	(.078)	(.067)	(.046)	(.038)
3.dad_residence	-.014	.001	-.074	-.041
	(.135)	(.13)	(.08)	(.075)
Head sex	-.023	.037	.02	-.026
	(.078)	(.061)	(.046)	(.034)
Head age	-.002	.001	-.002	-.002
	(.004)	(.003)	(.002)	(.002)
0bn.head_educ				
1.head_educ	-.006	-.036	.004	.025
	(.103)	(.093)	(.061)	(.053)
2.head_educ	-.362**	-.259*	.04	.034
	(.158)	(.139)	(.094)	(.08)
Head relation	.03	.019	-.028	-.018
	(.031)	(.027)	(.018)	(.016)
hh size	-.068	-.077*	.006	.015
	(.045)	(.04)	(.027)	(.023)
Care head	-.043	-.029	.019	.007
	(.044)	(.04)	(.026)	(.023)
Wealth index	.088	.622***	-.114	-.382***
	(.145)	(.115)	(.086)	(.065)
_cons	-1.593***	-1.451***	.415**	.325***
	(.287)	(.125)	(.17)	(.069)
Observations	6004	6004	5987	5987
Pseudo R^2	.z	.z	.z	.z

Standard errors are in parentheses

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

Appendixes 2A: Housman Test using sigmamore for estimation of Short Height for age

		(b) Fixed effect	(B) Random effect
Independent variables			
	3	-0.22655	0.060032
	4	-0.18859	0.036787
	7	0.244256	0.06017
	14	-0.35432	-0.07704
Type site		0.052823	-0.02109
Shock input price		-0.01547	-0.02518
Shock output price		-0.04765	-0.0144
Crop failure		-0.03148	-0.01075
Pests on storage		-0.02987	-0.03002
Death livestock		-0.01516	-0.00693
Shock drought		-0.0219	0.019602
Shock job loss		0.023813	0.022758
Death of father		0.076544	0.032456
Death of mother		0.003631	0.014188
Family shock		0.048383	0.041392
Small shock		-0.06328	-0.05864
House shock		-0.10202	-0.09137
Crime shock		-0.01273	-0.01086
kids_under_5		-0.00249	-0.00717
Child injury		0.059308	0.053426
Child health			
	2	0.023399	0.028116
	3	0.011183	0.041778
Mom age		-0.0019	0.001723
Mom education			
	1	0.026439	-0.03894
	2	0.019389	-0.05829
Mom residence			
	2	0.036746	0.030112
	3	-0.05339	-0.01079
Dad age		0.002434	0.000915
Dad education			
	1	0.010687	-0.00135
	2	0.013544	-0.01581
Dad residence			
	2	0.030284	0.018395
	3	-0.0738	-0.04078
Head sex		0.019644	-0.02592
Head age		-0.00174	-0.00157

head education			
	1	0.00375	0.024762
	2	0.040093	0.034075
Head relation		-0.02795	-0.01812
hh size		0.006197	0.014976
Care head		0.019149	0.006976
Wealth index		-0.1145	-0.38221

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(40) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 119.78

Prob>chi2 = 0.0000

Therefore, from this hausman test result (119.78) fixed effect estimator is preferable for this model to estimate the effect of the selected aggregate economic shocks on child short height for age.

Appendixes 2B: Fixed effect Regression results by using vce(robust) method on Short Height for age

(Hetroscedasticity and Multi-linearity tests by using vce(robust) method.

```
Fixed-effects (within) regression               Number of obs     =      5,987
Group variable: child_id                        Number of groups  =      2,206

R-sq:                                           Obs per group:
     within  = 0.0234                                         min =          1
     between = 0.0021                                         avg =        2.7
     overall = 0.0031                                         max =          3

                                                F(40,2205)        =       2.24
corr(u_i, Xb)  = -0.3298                        Prob > F          =     0.0000

                                (Std. Err. adjusted for 2,206 clusters in child_id)
```

short_height	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
region						
Amhara	-.2265453	.2073272	-1.09	0.275	-.6331224	.1800317
Oromiya	-.188588	.2629799	-0.72	0.473	-.7043023	.3271263
SNNP	.2442557	.2342033	1.04	0.297	-.2150264	.7035379
Addis Ababa City Administration	-.3543248	.2398373	-1.48	0.140	-.8246555	.1160059
type_site	.0528227	.0668303	0.79	0.429	-.0782343	.1838796
shock_input_price	-.0154686	.0180596	-0.86	0.392	-.0508842	.019947
shock_output_price	-.0476492	.0365383	-1.30	0.192	-.1193023	.0240039
crop_failure	-.0314816	.0206602	-1.52	0.128	-.0719971	.0090339
livestock_pest	-.0298706	.0356119	-0.84	0.402	-.0997069	.0399657
shock_livestock	-.0151624	.0193519	-0.78	0.433	-.0531123	.0227874
shock_drought	-.0219005	.0199061	-1.10	0.271	-.0609371	.0171362
shock_job_loss	.0238133	.0251471	0.95	0.344	-.0255012	.0731278
shock_father	.0765441	.0636398	1.20	0.229	-.0482562	.2013444
shock_mother	.0036305	.0950545	0.04	0.970	-.1827753	.1900363
family_shock	.0483829	.0153469	3.15	0.002	.0182871	.0784788
small_shock	-.0632825	.0125924	-5.03	0.000	-.0879767	-.0385883
house_shock	-.1020236	.058072	-1.76	0.079	-.2159051	.011858
crime_shock	-.0127264	.0262514	-0.48	0.628	-.0642065	.0387537
child_sex	0	(omitted)				
kids_under_5	-.002492	.0269111	-0.09	0.926	-.0552658	.0502817
child_injury	.0593081	.0281584	2.11	0.035	.0040883	.1145278
child_health						
Same	.0233987	.014881	1.57	0.116	-.0057836	.0525809
Worse	.0111826	.0271716	0.41	0.681	-.0421019	.0644671
mom_age	-.0019031	.0024484	-0.78	0.437	-.0067045	.0028983
mom_educ						
Primary Educaion	.0264388	.0422394	0.63	0.531	-.0563943	.109272
Secondary and above Education	.0193886	.0761166	0.25	0.799	-.1298791	.1686563
mom_residence						
Does not live in household	.036746	.047848	0.77	0.443	-.0570859	.1305779
Has died	-.0533851	.1094525	-0.49	0.626	-.2680259	.1612558
dad_age	.0024336	.0027323	0.89	0.373	-.0029247	.0077918
dad_educ						
Primary Educaion	.0106867	.0717738	0.15	0.882	-.1300645	.1514379
Secondary and above Education	.0135438	.1240868	0.11	0.913	-.2297954	.2568831
dad_residence						
Does not live in household	.030284	.0488963	0.62	0.536	-.0656036	.1261716
Has died	-.0738033	.0745261	-0.99	0.322	-.2199519	.0723454
head_sex	.0196436	.0483744	0.41	0.685	-.0752205	.1145077
head_age	-.0017441	.002547	-0.68	0.494	-.0067389	.0032507
head_educ						
Primary Educaion	.0037501	.0677692	0.06	0.956	-.1291479	.1366482
Secondary and above Education	.0400931	.1024464	0.39	0.696	-.1608085	.2409947
head_relation	-.0279483	.0189182	-1.48	0.140	-.0650478	.0091511
hh_size	.0061973	.0273743	0.23	0.821	-.0474848	.0598793
care_head	.0191485	.0249943	0.77	0.444	-.0298664	.0681634
wealth_index	-.1144981	.0920743	-1.24	0.214	-.2950595	.0660633
_cons	.4147594	.1858574	2.23	0.026	.0502854	.7792333
sigma_u	.55696695					
sigma_e	.42620725					
rho	.63068588	(fraction of variance due to u_i)				

Appendixes 3: Fixed and Random effect Regression results on Body mass index z-score

	(1) Zbfa fe	(2) Zbfa re	(3) low_bmi fe	(4) low_bmi re
1bn.region				
3.region	-.485	-.232***	-.488*	.123***
	(.488)	(.062)	(.265)	(.032)
4.region	-.214	.426***	-.147	-.209***
	(.457)	(.063)	(.251)	(.032)
7.region	-.456	.354***	-.17	-.145***
	(.403)	(.061)	(.219)	(.031)
14.region	-.301	.308***	-.063	-.125***
	(.452)	(.078)	(.246)	(.04)
Type site	-.06	.297***	.013	-.099***
	(.128)	(.057)	(.07)	(.03)
Shock input price	.051	.08**	-.018	-.021
	(.037)	(.034)	(.02)	(.018)
Shock output price	-.035	-.051	-.043	-.029
	(.073)	(.067)	(.04)	(.036)
Crop failure	-.037	-.031	.022	.014
	(.039)	(.036)	(.021)	(.019)
Shock pest on stor	-.122*	-.121**	.003	.012
	(.066)	(.061)	(.036)	(.033)
Death of livestock	.013	.053	-.012	-.015
	(.038)	(.035)	(.021)	(.019)
Shock drought	.024	.029	-.024	-.012
	(.039)	(.035)	(.021)	(.019)
Shock job loss	.002	.025	.007	-.003
	(.054)	(.049)	(.029)	(.026)
Death of father	-.125	-.094	.095	.03
	(.131)	(.119)	(.072)	(.063)
Death of mother	.108	.163	-.177	-.192*
	(.203)	(.188)	(.11)	(.1)
Family shock	.083***	.154***	-.022	-.06***
	(.032)	(.029)	(.017)	(.015)
Small shock	-.22***	-.255***	.031**	.046***
	(.028)	(.027)	(.015)	(.014)
House shock	-.078	-.074	-.026	-.032
	(.107)	(.099)	(.058)	(.053)
Crime shock	.055	.109**	-.046	-.065***
	(.052)	(.047)	(.028)	(.025)
Child sex		-.139***		.109***
		(.039)		(.02)
kids_under_5	-.083	-.077*	.03	.026
	(.053)	(.045)	(.029)	(.024)
Child injury	-.036	-.152***	.031	.068**
	(.056)	(.051)	(.031)	(.027)
1bn.child_health				
2.child_health	-.035	-.108***	-.002	.03**
	(.031)	(.029)	(.017)	(.015)
3.child_health	-.03	-.12**	-.085***	-.019
	(.055)	(.05)	(.03)	(.027)
Mom age	-.052***	-.028***	.021***	.011***
	(.005)	(.003)	(.003)	(.002)

0bn.mom_educ				
1.mom_educ	-.144*	.013	.006	-.048**
	(.078)	(.044)	(.042)	(.023)
2.mom_educ	.028	.05	.014	-.028
	(.174)	(.084)	(.094)	(.043)
1bn.mom_residenc				
2.mom_residence	-.159	-.129	.067	.07
	(.109)	(.092)	(.059)	(.049)
3.mom_residence	.11	.3	-.028	-.08
	(.252)	(.242)	(.136)	(.129)
Dad age	-.015***	.002	.005	-.002
	(.006)	(.004)	(.003)	(.002)
0bn.dad_educ				
1.dad_educ	-.283**	-.16	.182***	.102*
	(.129)	(.106)	(.071)	(.056)
2.dad_educ	-.271	-.142	.128	.1
	(.212)	(.155)	(.116)	(.082)
1bn.dad_residence				
2.dad_residence	-.026	-.032	.047	.012
	(.094)	(.076)	(.051)	(.04)
3.dad_residence	.023	.184	.036	-.01
	(.162)	(.154)	(.089)	(.082)
Head sex	.089	.049	-.023	-.042
	(.093)	(.067)	(.051)	(.035)
Head age	-.004	-.009**	.004	.006***
	(.005)	(.004)	(.003)	(.002)
0bn.head_educ				
1.head_educ	.147	-.039	-.037	.028
	(.124)	(.107)	(.068)	(.057)
2.head_educ	.323*	-.032	-.085	.023
	(.19)	(.158)	(.104)	(.084)
Head relation	.05	-.007	-.066***	-.023
	(.037)	(.031)	(.02)	(.017)
hh size	.034	.064	-.015	-.024
	(.054)	(.046)	(.029)	(.024)
Care head	.021	.067	.029	-.002
	(.052)	(.047)	(.029)	(.025)
Wealth index	-.301*	-.096	.05	-.029
	(.174)	(.127)	(.095)	(.067)
_cons	2.146***	-.07	-.778***	-.155**
	(.345)	(.133)	(.187)	(.07)
Observations	6004	6004	5975	5975
Pseudo R^2	.z	.z	.z	.z

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*

Appendixes 3A: Housman Test using sigmamore for estimation of Body mass index for age z-score

		(b) Fixed effect	(B) Random effect
Independent variables			
	3	-0.48535	-0.23212
	4	-0.21422	0.426066
	7	-0.45581	0.354316
	14	-0.30067	0.307525
Type site		-0.05998	0.296839
Shock input price		0.051228	0.080288
Shock output price		-0.03537	-0.05131
Crop failure		-0.03745	-0.03147
Pests on storage		-0.12155	-0.12102
Death of livestock		0.013016	0.053348
Shock drought		0.024216	0.029357
Shock job loss		0.002126	0.025322
Death of father		-0.1255	-0.09371
Death of mother		0.107703	0.163387
Family shock		0.083109	0.154465
Small shock		-0.21992	-0.25482
House shock		-0.07799	-0.07429
Crime shock		0.055269	0.10876
kids_under_5		-0.08288	-0.07688
Child injury		-0.03594	-0.15161
Child health			
	2	-0.03491	-0.10773
	3	-0.02977	-0.12033
Mom age		-0.05208	-0.02843
Mom education			
	1	-0.1437	0.012964
	2	0.027786	0.050294
Mom residence			
	2	-0.15949	-0.12915
	3	0.110394	0.300138
Dad age		-0.01484	0.001782
Dad education			
	1	-0.28293	-0.15957
	2	-0.2715	-0.14215
Dad residence			
	2	-0.02565	-0.0325
	3	0.023259	0.183718
Head sex		0.088735	0.048565

Head age		-0.00391	-0.00878
Head education			
	1	0.146777	-0.03877
	2	0.323323	-0.03196
Head relation		0.0503	-0.00748
hh size		0.033921	0.063835
Care head		0.020644	0.066999
Wealth index		-0.30126	-0.09609

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(40) = (b-B)'[(V_b-V_B)^(-1)](b-B)= 405.41

Prob>chi2 = 0.0000

Therefore, from this hausman test result (405.41) random effect estimator is preferable for this model to estimate the effect of the selected aggregate economic shocks on child body mass index for age z-scores.

Appendixes 3B: Random effect Regression results by using vce(robust) method (Hetroscedasticity and Multi-linearity tests by using vce(robust) method)

```
Random-effects GLS regression                   Number of obs     =      6,004
Group variable: child_id                        Number of groups  =      2,206

R-sq:                                           Obs per group:
     within  = 0.1768                                         min =          1
     between = 0.0720                                         avg =        2.7
     overall = 0.0997                                         max =          3

                                                Wald chi2(41)     =     859.05
corr(u_i, X)   = 0 (assumed)                    Prob > chi2       =     0.0000

                                   (Std. Err. adjusted for 2,206 clusters in child_id)
```

zbfa	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
region						
Amhara	-.2321208	.0640036	-3.63	0.000	-.3575655	-.1066761
Oromiya	.4260662	.0630145	6.76	0.000	.30256	.5495724
SNNP	.3543159	.0632525	5.60	0.000	.2303434	.4782885
Addis Ababa City Administration	.3075245	.0792973	3.88	0.000	.1521047	.4629443
type_site	.2968393	.0618318	4.80	0.000	.1756513	.4180273
shock_input_price	.0802879	.0327934	2.45	0.014	.016014	.1445617
shock_output_price	-.0513098	.0677062	-0.76	0.449	-.1840116	.081392
crop_failure	-.0314683	.036688	-0.86	0.391	-.1033754	.0404388
livestock_pest	-.1210165	.0631614	-1.92	0.055	-.2448106	.0027775
shock_livestock	.0533483	.0342706	1.56	0.120	-.0138208	.1205175
shock_drought	.0293568	.034783	0.84	0.399	-.0388166	.0975303
shock_job_loss	.0253222	.0487923	0.52	0.604	-.070309	.1209533
shock_father	-.0937055	.1230711	-0.76	0.446	-.3349204	.1475093
shock_mother	.1633867	.1718222	0.95	0.342	-.1733785	.5001519
family_shock	.1544652	.0280638	5.50	0.000	.0994612	.2094691
small_shock	-.2548228	.0253642	-10.05	0.000	-.3045358	-.2051098
house_shock	-.0742866	.1246216	-0.60	0.551	-.3185404	.1699672
crime_shock	.1087601	.0473492	2.30	0.022	.0159575	.2015628
child_sex	-.1391012	.0392047	-3.55	0.000	-.2159411	-.0622614
kids_under_5	-.076881	.0474474	-1.62	0.105	-.1698761	.0161142
child_injury	-.1516066	.0580123	-2.61	0.009	-.2653086	-.0379045
child_health						
Same	-.1077273	.0290822	-3.70	0.000	-.1647272	-.0507273
Worse	-.120327	.0502854	-2.39	0.017	-.2188846	-.0217693
mom_age	-.0284256	.003488	-8.15	0.000	-.035262	-.0215892
mom_educ						
Primary Educaion	.0129643	.0463483	0.28	0.780	-.0778766	.1038052
Secondary and above Education	.0502937	.0855747	0.59	0.557	-.1174295	.218017
mom_residence						
Does not live in household	-.1291494	.0892797	-1.45	0.148	-.3041344	.0458355
Has died	.300138	.1979332	1.52	0.129	-.0878039	.6880799
dad_age	.0017824	.0043779	0.41	0.684	-.0067981	.0103628
dad_educ						
Primary Educaion	-.1595675	.1102047	-1.45	0.148	-.3755649	.0564298
Secondary and above Education	-.1421535	.164549	-0.86	0.388	-.4646635	.1803565
dad_residence						
Does not live in household	-.0325	.0730702	-0.44	0.656	-.1757149	.110715
Has died	.1837182	.1586199	1.16	0.247	-.1271711	.4946074
head_sex	.0485651	.0722586	0.67	0.502	-.0930591	.1901893
head_age	-.0087843	.0038924	-2.26	0.024	-.0164133	-.0011553
head_educ						
Primary Educaion	-.0387698	.1088426	-0.36	0.722	-.2520974	.1745578
Secondary and above Education	-.0319647	.1648571	-0.19	0.846	-.3550786	.2911493
head_relation	-.0074829	.0311672	-0.24	0.810	-.0685695	.0536037
hh_size	.0638346	.0485954	1.31	0.189	-.0314106	.1590798
care_head	.0669989	.050058	1.34	0.181	-.0311128	.1651107
wealth_index	-.0960895	.1309221	-0.73	0.463	-.3526921	.1605131
_cons	-.0703764	.1327169	-0.53	0.596	-.3304967	.189744
sigma_u	.69922066					
sigma_e	.86744229					
rho	.39384812	(fraction of variance due to u_i)				

Appendixes 4: Fixed and Random effect Regression results on Lower body mass index for age

	(1) Zbfa fe	(2) Zbfa re	(3) low_bmi fe	(4) low_bmi re
1bn.region				
3.region	-.485	-.232***	-.488*	.123***
	(.488)	(.062)	(.265)	(.032)
4.region	-.214	.426***	-.147	-.209***
	(.457)	(.063)	(.251)	(.032)
7.region	-.456	.354***	-.17	-.145***
	(.403)	(.061)	(.219)	(.031)
14.region	-.301	.308***	-.063	-.125***
	(.452)	(.078)	(.246)	(.04)
Type site	-.06	.297***	.013	-.099***
	(.128)	(.057)	(.07)	(.03)
Shock input price	.051	.08**	-.018	-.021
	(.037)	(.034)	(.02)	(.018)
Shock output price	-.035	-.051	-.043	-.029
	(.073)	(.067)	(.04)	(.036)
Crop failure	-.037	-.031	.022	.014
	(.039)	(.036)	(.021)	(.019)
Shock pest on stor	-.122*	-.121**	.003	.012
	(.066)	(.061)	(.036)	(.033)
Death of livestock	.013	.053	-.012	-.015
	(.038)	(.035)	(.021)	(.019)
Shock drought	.024	.029	-.024	-.012
	(.039)	(.035)	(.021)	(.019)
Shock job loss	.002	.025	.007	-.003
	(.054)	(.049)	(.029)	(.026)
Death of father	-.125	-.094	.095	.03
	(.131)	(.119)	(.072)	(.063)
Death of mother	.108	.163	-.177	-.192*
	(.203)	(.188)	(.11)	(.1)
Family shock	.083***	.154***	-.022	-.06***
	(.032)	(.029)	(.017)	(.015)
Small shock	-.22***	-.255***	.031**	.046***
	(.028)	(.027)	(.015)	(.014)
House shock	-.078	-.074	-.026	-.032
	(.107)	(.099)	(.058)	(.053)
Crime shock	.055	.109**	-.046	-.065***
	(.052)	(.047)	(.028)	(.025)
Child sex		-.139***		.109***
		(.039)		(.02)
kids_under_5	-.083	-.077*	.03	.026
	(.053)	(.045)	(.029)	(.024)
Child injury	-.036	-.152***	.031	.068**
	(.056)	(.051)	(.031)	(.027)
1bn.child_health				
2.child_health	-.035	-.108***	-.002	.03**
	(.031)	(.029)	(.017)	(.015)
3.child_health	-.03	-.12**	-.085***	-.019
	(.055)	(.05)	(.03)	(.027)
Mom age	-.052***	-.028***	.021***	.011***

	(.005)	(.003)	(.003)	(.002)
0bn.mom_educ				
1.mom_educ	-.144*	.013	.006	-.048**
	(.078)	(.044)	(.042)	(.023)
2.mom_educ	.028	.05	.014	-.028
	(.174)	(.084)	(.094)	(.043)
1bn.mom_residenc				
2.mom_residence	-.159	-.129	.067	.07
	(.109)	(.092)	(.059)	(.049)
3.mom_residence	.11	.3	-.028	-.08
	(.252)	(.242)	(.136)	(.129)
Dad age	-.015***	.002	.005	-.002
	(.006)	(.004)	(.003)	(.002)
0bn.dad_educ				
1.dad_educ	-.283**	-.16	.182***	.102*
	(.129)	(.106)	(.071)	(.056)
2.dad_educ	-.271	-.142	.128	.1
	(.212)	(.155)	(.116)	(.082)
1bn.dad_residence				
2.dad_residence	-.026	-.032	.047	.012
	(.094)	(.076)	(.051)	(.04)
3.dad_residence	.023	.184	.036	-.01
	(.162)	(.154)	(.089)	(.082)
Head sex	.089	.049	-.023	-.042
	(.093)	(.067)	(.051)	(.035)
Head age	-.004	-.009**	.004	.006***
	(.005)	(.004)	(.003)	(.002)
0bn.head_educ				
1.head_educ	.147	-.039	-.037	.028
	(.124)	(.107)	(.068)	(.057)
2.head_educ	.323*	-.032	-.085	.023
	(.19)	(.158)	(.104)	(.084)
Head relation	.05	-.007	-.066***	-.023
	(.037)	(.031)	(.02)	(.017)
hh size	.034	.064	-.015	-.024
	(.054)	(.046)	(.029)	(.024)
Care head	.021	.067	.029	-.002
	(.052)	(.047)	(.029)	(.025)
Wealth index	-.301*	-.096	.05	-.029
	(.174)	(.127)	(.095)	(.067)
_cons	2.146***	-.07	-.778***	-.155**
	(.345)	(.133)	(.187)	(.07)
Observations	6004	6004	5975	5975
Pseudo R^2	.z	.z	.z	.z

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*

Appendixes 4A: Housman Test using sigmamore for estimation of Lower body mass index for age

		(b) Fixed effect	(B) Random effect
Independent variables			
	3	-0.48776	0.12322
	4	-0.14658	-0.20855
	7	-0.17027	-0.1449
	14	-0.06251	-0.12504
Type site		0.013193	-0.0989
Shock input price		-0.01762	-0.02123
Shock output price		-0.04304	-0.02914
Crop failure		0.022292	0.014395
Pest on storage		0.002875	0.012165
Death of livestock		-0.01215	-0.01478
Shock drought		-0.02357	-0.0123
Shock job loss		0.006847	-0.00346
Death of father		0.094932	0.029878
Death of mother		-0.17707	-0.19188
Family shock		-0.02174	-0.05983
Small shock		0.031363	0.046335
House shock		-0.02551	-0.03244
Crime shock		-0.04607	-0.06538
kids_under_5		0.029932	0.026334
Child injury		0.031436	0.067838
Child health			
	2	-0.00212	0.030289
	3	-0.08517	-0.01915
Mom age		0.020816	0.011215
Mom education			
	1	0.00554	-0.04849
	2	0.014283	-0.02787
Mom residence			
	2	0.067113	0.07025
	3	-0.02773	-0.08033
Dad age		0.004809	-0.0019
Dad education			
	1	0.181887	0.101858
	2	0.128301	0.10025
Dad residence			
	2	0.046599	0.012376
	3	0.035619	-0.00997
Head sex		-0.02347	-0.04236
Head age		0.004218	0.005579

Head education			
	1	-0.03732	0.028496
	2	-0.0854	0.022591
Head relation		-0.06586	-0.02328
hh size		-0.01531	-0.02429
Care head		0.02938	-0.00237
Wealth index		0.05043	-0.02863

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(40) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 312.03

Prob>chi2 = 0.0000

Therefore, from this hausman test result (312.03) random effect estimator is preferable for this model to estimate the effect of the selected aggregate economic shocks on child lower body mass index for age.

Appendixes 4B: Random effect Regression results by using vce(robust) method on Lower body mass

(Hetroscedasticity and Multi-linearity tests by using vce(robust) method)

```
Random-effects GLS regression                   Number of obs     =      5,975
Group variable: child_id                        Number of groups  =      2,206

R-sq:                                           Obs per group:
     within  = 0.1177                                         min =          1
     between = 0.0659                                         avg =        2.7
     overall = 0.0764                                         max =          3

                                                Wald chi2(41)     =     499.23
corr(u_i, X)   = 0 (assumed)                    Prob > chi2       =     0.0000

                                            (Std. Err. adjusted for 2,206 clusters in child_id)
```

low_bmi	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
region						
Amhara	.1232199	.0370716	3.32	0.001	.050561	.1958788
Oromiya	-.208546	.0329052	-6.34	0.000	-.2730389	-.1440531
SNNP	-.1449003	.0328136	-4.42	0.000	-.2092137	-.0805868
Addis Ababa City Administration	-.125043	.0403477	-3.10	0.002	-.2041231	-.0459628
type_site	-.0989041	.0305944	-3.23	0.001	-.1588681	-.0389401
shock_input_price	-.0212268	.0169231	-1.25	0.210	-.0543954	.0119419
shock_output_price	-.0291442	.0354045	-0.82	0.410	-.0985357	.0402473
crop_failure	.0143954	.0204604	0.70	0.482	-.0257064	.0544971
livestock_pest	.0121645	.0323443	0.38	0.707	-.0512293	.0755583
shock_livestock	-.0147801	.01909	-0.77	0.439	-.0521957	.0226356
shock_drought	-.0122987	.0195466	-0.63	0.529	-.0506093	.0260119
shock_job_loss	-.0034558	.0251832	-0.14	0.891	-.0528141	.0459024
shock_father	.0298775	.0641113	0.47	0.641	-.0957782	.1555333
shock_mother	-.1918756	.0871821	-2.20	0.028	-.3627494	-.0210017
family_shock	-.0598326	.0149731	-4.00	0.000	-.0891793	-.0304858
small_shock	.0463353	.0139307	3.33	0.001	.0190316	.073639
house_shock	-.0324436	.0528576	-0.61	0.539	-.1360426	.0711554
crime_shock	-.06538	.0228949	-2.86	0.004	-.1102532	-.0205067
child_sex	.1088683	.0195897	5.56	0.000	.0704731	.1472635
kids_under_5	.0263335	.0249603	1.06	0.291	-.0225878	.0752548
child_injury	.0678375	.0299224	2.27	0.023	.0091906	.1264844
child_health						
Same	.0302888	.0150255	2.02	0.044	.0008394	.0597382
Worse	-.0191515	.0256297	-0.75	0.455	-.0693848	.0310818
mom_age	.011215	.0018303	6.13	0.000	.0076277	.0148023
mom_educ						
Primary Educaion	-.0484882	.0253937	-1.91	0.056	-.0982589	.0012824
Secondary and above Education	-.0278698	.0446137	-0.62	0.532	-.1153111	.0595714
mom_residence						
Does not live in household	.0702501	.0503641	1.39	0.163	-.0284617	.1689618
Has died	-.0803265	.0841588	-0.95	0.340	-.2452748	.0846217
dad_age	-.0018998	.0023256	-0.82	0.414	-.0064579	.0026584
dad_educ						
Primary Educaion	.1018583	.05892	1.73	0.084	-.0136229	.2173394
Secondary and above Education	.1002504	.0895751	1.12	0.263	-.0753136	.2758144
dad_residence						
Does not live in household	.0123756	.0362593	0.34	0.733	-.0586914	.0834426
Has died	-.0099695	.085332	-0.12	0.907	-.1772172	.1572781
head_sex	-.0423637	.0397878	-1.06	0.287	-.1203463	.035619
head_age	.005579	.0021943	2.54	0.011	.0012783	.0098797
head_educ						
Primary Educaion	.0284955	.0587471	0.49	0.628	-.0866467	.1436376
Secondary and above Education	.0225911	.0892837	0.25	0.800	-.1524017	.1975838
head_relation	-.0232806	.0175054	-1.33	0.184	-.0575906	.0110294
hh_size	-.0242903	.0254785	-0.95	0.340	-.0742272	.0256466
care_head	-.0023709	.0274612	-0.09	0.931	-.0561938	.0514521
wealth_index	-.0286347	.0687215	-0.42	0.677	-.1633263	.1060569
_cons	-.1553722	.0667339	-2.33	0.020	-.2861682	-.0245761
sigma_u	.35294888					
sigma_e	.46996508					
rho	.36062089	(fraction of variance due to u_i)				

Fig shows the link between each economic shock with area of residence and children's sex