ADDIS ABABA UNIVERSITY
School Of Graduate Studies

SOCIO-ECONOMIC DETERMINANTS OF HEALTH STATUS IN ETHIOPIA

BY DESSALEGN FUFA

A Thesis Submitted to the School of Graduate Studies of Addis Ababa University in Partial Fulfillment of the Requirements for Degree of Master of Science in Economics
(Economic Policy Analysis)

July, 2006
Addis Ababa

ADDIS ABABA UNIVERSITY
School Of Graduate Studies

Socioeconomic Determinants of Health Status in Ethiopia

By
Dessalegn Fufa Goboto
Faculty of Business and Economics

Approval by Board of Examiners:

_____	_____
Advisor	Signature
_____	_____
Examiner	Signature
_____	_____
Examiner	Signature

Acknowledgement

First of all I would like to say thanks my lord for the help I received from him.

I wish to express my sincere thanks to Dr. Frida Siddiqui, My Advisor for the invaluable, constructive guidance and comments which enable this study a better work.

My sincere thanks due to Mr.Gemechu Ayyana for his unfailing encouragement, and his kindly assistance while I am conducting the study.

I am deeply grateful to all my friends, Fikadu Adunya, Temesgen Hundara, Teferi Fufa, Dessalegn Tolera and Gebissa kebede for their moral and material support. There are many colleagues and friends who have contributed by making useful suggestions and discussions. I am grateful to all of them.

Also my thanks goes to Azeb Wondium for her good care of me during my course work. It is also my pleasure to thanks African Economic Research Consortium (AERC) for their financial assistance for this study.

Finally, I am indebted to all staff of Ayer Tena Senior Secondary School for their moral and material assistance during the course work and this study.

Contents

List of Tables and Figures

Title **Page**

List of Figures

Acronyms and Abbreviations

EDHS	Ethiopia Demographic and Health Survey
CSA	Central Statistical Agency
MOH	Ministry of Health
SSA	Sub-Saharan Africa
WHO	World Health Organization
WMS	Welfare Monitory Survey
DALE	Disability Adjusted Life Expectancy
OLS	Ordinary Least Square
2SLS	Two Stage Least Square
IV	Instrumental Variable
PHC	Primary Healthcare Services
GLS	General Least Square
MOFED	Ministry of Finance and Economic Development

ABSTRACT

This study attempts to analyze the impact of per capita income, mother education, per capita public health expenditure, access to health facilities, clean water and sanitation on prevalence of child stunting in Ethiopia. For this purpose, regional state panel data is used to estimate a reduced form of health production using fixed effect model estimation technique. The results show per capita income, per capita public health expenditure, access to clean water and mothers' education significantly affect prevalence of child stunting. However, mother education becomes insignificant when the impact of access to clean water source, sanitation facilities and healthcare services are controlled. On the other hand, population per physician (proxy for access to health care services) and access to sanitation facilities have insignificant impact. The results suggest important role of income growth policies and promoting mother education to reduces prevalence of child stunting.

1. Introduction

1.1 Background

Health is a highly valued asset and prerequisite for success in all the sphere of life. It contributes to production of consumable goods and services because the better the state of health, the more time available for income generating activities. Hence, health can be viewed as durable capital stock that produces an output of healthy time (Grossman, 1972).That is why the literature on economic growth suggests accumulation of health and other forms of human and physical capital to increase the level of per capita income. As Schultz (1999) argues, health improves individuals' mental as well as intellectual capabilities, which lead to better educational attainment. Better education and training results in technical innovation and then result in long run economic growth.

About 22 percent and 30 percent of growth rate of per capita income in Sub-Saharan Africa and OECD countries respectively resulted from health human capital (Brempong, et al, 2004).And also 10 percent reduction in malaria prevalence associated with 0.3 percent increase in income growth . Furthermore, HIV/AIDS epidemics reduce growth rate of per capita income by 0.33 percent in Africa by reducing labor, human capital as well as saving. More importantly, the structure of employment in low-income economies often relies heavily on strength and endurance and therefore on good health (Strauss and Thomas, 1998).Therefore education and healthcare are understood to be basic services that are essential in the fight against poverty.

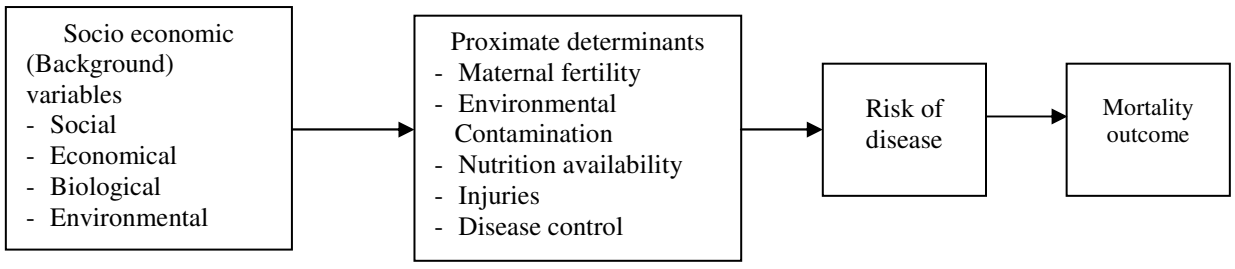
Apart from its contribution to rise in income, health status can be used as one of the key factor by itself to measure and define well being. Thus, in assessing the well being of a society one should pay attention to issues related to longevity, preventable morbidity, avoiding child and infant

mortality and under nourishment which are related to health status. This is why reducing infant and child mortality by two-third between 1990 and 2015 becomes one of the eight Millennium Development Goals (MOH,2004) .This implies developing communities like Ethiopia with poor health status should understand the factors that determine their health status in order to formulate the right policies to achieve targeted level of development.

Health outcomes are a function of wide varieties of factors: biological, economical. Social, cultural, geographical and environmental as well as on health sector interventions. Different approaches are used by different disciplines to identify variables affecting health outcomes .Each of them however leads to different policy conclusions. For example, social science researches focus on the association of socio economic characteristics like income and maternal education and health status. Medical researches however focused on biological process of diseases and clinical trials that assess the therapeutic effects of a particular medical technology by ignoring socioeconomic determinants while both medical and socioeconomic factor contributes to the understanding of determinants of health out comes.

Mosley and Chen (1984) developed a new framework, which combines both social and medical variables affecting health. They group the variables into socioeconomic (back ground) and proximate or intermediate determinates as shown in Figure-1 below.

Figure1. Mosely- Chen framework for analysis of mortality.



Proximate determinants directly influence the risk of morbidity and mortality. All social economic and health system factors operate through a common set of biological or proximate determinants to exert an impact on mortality.

The Mosley-Chen (1984) framework helps us in identifying the proximate determinants through which household and community level variables operates to affect health .However it remain conceptual model and does not provide any analytical strategy for empirical research to estimate the impact of proximate and socioeconomic variables. The other approach is the basic microeconomic model of family, which provides very useful guide to choose the explanatory variable by treating health as a good demanded by household to maximize their utility. This is the approach employed in this study.

1.2 Statement of the Problem

Available data indicate that Ethiopia has poor health status as compared to other low-income countries, even with Sub Sahara Africa (SSA) standard measured by different health indicators. In 2000, Ethiopia's infant mortality rate was 97 per 1000 live birth. This is very high compared to world average, developed countries, low-income countries and Africa, which equals to 55, 7, 65, and 88 per 1000 live birth respectively (MoH, 2004). One in four Ethiopian children under age five shows symptom of acute respiratory infection, and 24 percent had diarrhea in two weeks before the 2000 health and demographic survey (CSA, 2001). Ethiopia's average life expectancy at birth was 54 (52 for male and 55 for female), which is low as compared to 67 for the world as the whole and 64 for less developed countries [World Bank, 2001]. Maternal mortality is also among the highest in the world, which amounts to 871 per 100,000 live births, and one in four Ethiopian women dies of pregnancy related causes.

In addition, according to EDHS (2005) preliminary report, anthropometric measures like height for age, weight for height and weight for age values for children under year five indicates poor health status. That is, one in two Ethiopian children under year five (47 percent) are short for their age (stunted), 11 percents are wasted (thin for their height) and two in five children (38 percent) have lower weight for their age. The prevalence of these anthropometric measures of health status distributed unevenly between urban and rural as well as among different regional state of the country. For instance, children in rural areas are almost two times anthropometrically deficient compared to urban children. Similarly ,one in two children living in Somali and Amhara regions have lower weight for their age compared to one in ten children living in Addis Ababa.

Like that of health outcomes, socioeconomic variables, which are considered as the determinants of health status are also disappointing performance. Ethiopia is a country with very low per capita income and nearly half of the total population (47 percent) lives below poverty line. This may result in low per capita health expenditure (1.5 percent of total GDP). Education, which is one of the critical variables in production of health, has also poor performance (only 25 percent of females and 46 percent of males are literate) [WHO-Co, 2005].

One route of getting access to information that enables us to prevent diseases would be through having access to radio and other mass media. However, it is disappointing in the case of Ethiopia. Only 13 percent of rural population has radio (three times less than SSA) while 87 percent are not exposed to mass media (radio, TV and new paper) at least once in a week (World Bank, 2005).

In terms of health facilities coverage, Ethiopia is characterized by limited access to health infrastructure and staff with uneven distribution both geographically and between primary and secondary healthcare services. About 50 percent of the population lives at a distance of more than

7 kilometers away from the nearest health center. Health facilities (hospital, health centers and health station) population ratio equals 1:19,327 which is very high as compared to 1:8,046 for SSA. Physician population ratio for 2004/05 was 1:29,777, which is, below the standard compared to 1:10,000 WHO standards. With respect to distribution, large proportion of staffs are working in Addis Ababa (for example 63 percent of doctors, 46 percent of nurses and 34 percent of health assistances in 1998/99 work in Addis Ababa even though more than 85 percentage of the population live out in other regions) (MOH, 2004, World Bank, 2005). Moreover, the utilization rate of existing health facilities are quiet low. For instance, only 25 percent of pregnant women receive antenatal care in 1995 compared to 60 percent for SSA over 1985-1990. Less than 10 percent of pregnant women get delivery care with the help of trained health workers (Yarde and Asnakech, 2002). At the same time access to clean drinking water and sanitation facilities are limited as compared to other low-income countries. In 2003/04 for example only 37.3 and 28.9 percent of Ethiopians have access to clean drinking water and sanitation facilities respectively (CSA, 2004).

Thus to propose policy options that enable the country to improve health status, it would be interesting to know factors affecting health outcomes .This is what this paper set out with.

1.3 Objectives of the Study

The main objective of this study is to identify socio-economic determinants of heath status of Ethiopia. Specifically the study aim, to see the impact of per capita income, mothers' education, public health expenditure, access to clean water and sanitation as well as medical facilities on child height (percentage of child stunting in Ethiopia)

1.4 Hypothesis of the Study

- Income affects the level of child health indirectly through its effects on the rate of consumption of items affecting health, such as food, housing, sanitation, medical care and education. That is, increase in income may increase the chance of individuals to get access to nutritious food, safe environment and clean water, medical care and education, which lead to reduction of child stunting. Hence income has negative impact on child stunting rate.
- Maternal Education- education encourages life style supporting good health (use antenatal and delivery care, efficiently allocate medical resources, easily get information about different health risky activities etc).Thus children of educated mother enjoy between domestic hygiene which reduces risk of infection, better food, immunization and other health inputs. This implies negative association between poor child health and mother year of schooling (education).
- Public health expenditure: public spending especially on certain preventive and curative activities such as immunization and control of different communicable disease are cost effective way of improving child health. Hence, we expect negative effect of public health expenditure on prevalence of child stunting.
- Number of population per physician: Physicians per capita reflect the supply of medical facilities in a given country. Lower population per physician implies better accessibility to health facility. So when the number of population per physician decreases, child stunting will decrease
- Access to safe water and sanitation: Access to clean water and sanitation reduces the chances of being infected with bacterial and other water born disease. Thus we expect improved access to clean water and sanitation facilities to have negative impact on poor child health outcomes.

1.5 Significance of the Study

In addition to its intrinsic value, good health has instrumental value by enhancing workers productivity and human capital formation. Thus improving health status of a country becomes one way of reducing poverty and increasing rate of economic growth. At the same time, information on child health provides both specific health status of children and more general

indicator of the over all quality of health conditions and effectiveness of health facilities. So understanding the key determinants of child health have critical importance in designing effective policy intervention to improve health outcomes which lead to achieving targeted level of development.

Most studies that use cross section and time series data are characterized by biased estimates resulted from endogenity problem created by omission of unobserved cross-sectional unit specific heterogeneity .In such cases misleading conclusions and policy implications are drawn from the result .To overcome this problem ,panel data models are used in this study which control for the regional state unobserved heterogeneity .In addition, aggregate panel data is more informative than cross-sectional data for macro policy making, that enable policy maker to allocate public resource to variable that affect more health outcomes.

1.6. Organization of the Study

This paper contains five parts. The first part is an introduction under which the backgrounds of the study, the statement of the problem, objective of the study and significance of the study are presented. In second part, related empirical and theoretical literatures are summarized. In the third part, methodology used in the study will be discussed in detail; estimation techniques used, and data type and sources are described. In fourth part, empirical results are discussed. In the final part, conclusion and recommendation are given.

CHAPTER TWO

2. Literature Review

2.1 Measurement of Health Status

By nature, health is a multidimensional concept. It includes aspect of organ functioning, the capability of human being to perform physical activities and to play a normal social role as well as a subjective feeling of well being. This is why WHO define health as the state of complete physical, mental and social well being and not only the absence of diseases (handicap). This definition is attractive but it is highly subjective and difficult to measure. Berhaman and Deolalikar (1988) identified different measurement units used by different empirical studies at micro and aggregate level. Micro level studies mostly use anthropometric measures (height, weight, thickness etc), self assessed respondent report about symptoms of disease and some clinical body attributes. These measurement units differ in the dimensions of health status they refer to and have their own drawbacks.

Anthropometric measures are interpreted as measure of health status only in comparison to some reference group. But such comparison need appropriate standard for all countries and most studies use data for USA healthy individuals as standard. As Behrman and Deolalikar (1988) states, respondents' self assessment reports are subjected to measurement errors due to incorrect self diagnosis of the respondents. This may depend on the level of education, culture and socio economic status of individuals.

For aggregate studies, the basic health status indicators are life expectancy and mortality (child and infant) rates. Or (2000) argue that childhood mortality rates are preferred to life expectancy

because they are objectively measured, relatively available compared to life expectancy. Using child hood mortality rate also avoid the problem of reverse causation from health to income since children at early age could not contributes much to parent income(Case, et. al., 2002). However, using child mortality as health status measure has some limitations mainly because of it don't take into account morbidity. WHO therefore proposed that health status should be assessed in terms of disability-adjusted life expectancy (DALE) - people expectation of life new of the number of years for which they are incapacitated. In this study child anthropometric measures are used as proxy to measure general health status of Ethiopia. This is because of availability of anthropometric data compared to other measures at regional level and it also gives contemporaneous picture of health status of the country. In addition, as Case, et. al., (2002) indicated using child health as a measure of health status avoid the reverse causation from health to income. At the same time, children are by far the most vulnerable to adverse health risks within the immediate family and community environment. They are also a large group in a country like Ethiopia with high fertility rate.

2.2 Socio-economic Determinants of Health

2.2.1 Income

In general, there are bidirectional causation between health and economic status of individuals. That is higher income causes good health, healthier workers are more productive and become wealthier or some other factor may causes good health and higher income (Pritchett and Summer, (1996)). Higher economic status could leads to better health for many reasons. Individuals with higher income have got the ability to purchase medical inputs, nutritious food and live in safe environment which result in good health condition than the poor (Auster, et. al., (1969)); Or,

(2000)). Additional economic resource may also increase healthcare utilization or induces good health behavior. Risk behaviors like smoking and excess drinking are mostly prevalent among low income and less educated individuals (Smith, 1999). Certain diseases are thought to be dependent largely upon standard of living and hence not amenable to reduction through specific medical and public health measures. For instance, diarrhea diseases are strongly influenced by nutrition and personal sanitation which are results of higher economic status (Flegg, 1982). In children as Case, et. .al (2002) states, varieties of parental characteristics including both genetic and behavioral factors that are correlated with income influence child health. Hence, lower rate of mortality and higher life expectancy are expected from wealthier part of the society.

Reverse causation, from good health to higher income is found in many literatures at individual level. That is, healthier people can work longer hours, thus earn more .However poor health affect saving by reducing labor supply (Smith, 1999) .Also good health result in individual mental and intellectual capability that leads to better educational attainment (Schultz, 1999). This will increase income by increasing wage and improve productivity in self employment. Poor health status however, causes decrease in enrollment rate or missing many school days as well as increase medical expenses which leads to decrease individuals' income. Thus, improved health condition, manifested in the form of lower mortality can lead to superior economic growth.

This bidirectional causation of income and health cause bias estimate if OLS is used for estimation of the impact of income on health status. To overcome such problem instrumental variable estimation method has been commonly used. However, studies conducted by Pritchett and Summer (1996) and Filmer and Pritchett (1997) fail to find causation which runs from health to income. That is, OLS and 2SLS (IV) estimation gives the same result. Case, et. al,(2002) on the other hand suggests other solution to eliminate the channel which run from health to income.

That is using child health as a measure of health status of a given society. This is because children at lower age could not contribute to family income. That means poor health in child hood cannot explain lower earning of parents.

There are different empirical studies that indicate income as a central variable affecting health outcomes. Hanver et. al (2003) using data from 115 countries each with 8 observation estimate double log regression of infant mortality on per capita income. They obtain elasticity of -0.52 (using fixed effect model) and -0.67 (using a random effect model). At the same time, Pritchett and Summer (1998) using instrumental variable estimation method found that elasticity of infant and child mortality with respect to income is -0.2 and -0.4 respectively. Based on their result, they conclude that 40 percent cross country difference in mortality improvement over the last three decade, has been the result of income difference. Similarly Filmer and Pritchett (1997) come up with strong negative association between per capita income and childhood mortality. Using 1990 cross country data of developing country and OLS as well 2SLS estimation method, they found that 84 percent in mortality difference across countries was explained by income alone. Schultz (1993) also supports the above argument but for him its effect diminishes as individual becomes wealthier. On the other hand Kebede,(2003) using rural household survey data of Ethiopia found insignificant impact of per capita expenditure and income on child health when individual heterogeneity are controlled. But he has got significant impact of income and public expenditure when OLS estimation method is used. According to his finding; price of food items that are consumed by children, birth order, parental health and female headed household are important factor affecting child health of rural Ethiopia.

Hiwot (2005) using aggregate time series data form 1980-2004 and life expectancy as dependent variable also found insignificant impact of per capita income and government health expenditure

on health outcome of Ethiopia. She found that life expectancy is affected by health infrastructure, health personnel, degree of urbanization, illiteracy rate and consumption of alcohol and cigarette.

2.2.2 Maternal Education

In most households of developing countries, women undertake different types of activities affecting the health of her family. They manage household day to day activities; keep house clean, process food, and give care to young children as well as look after sick. This is why Barrera (1990) describe mothers as health workers. Education therefore equips mothers with general and specific knowledge to perform these activities which results in good child health. In addition, different channels are indicated by various literatures through which education affect child health.

Education increases economic resources (income) of the family by higher wages or increase productivity in self employment (Schultz (1999); Barrera (1990)). This leads to purchasing of more health services and other health inputs. Sudhanshu and Hunda (1996) analyzed the expenditure pattern of Jamaican household and found that, female headed household increased budget allocation for purchasing of goods and services that help to produce child health and decreases the share of budget devoted to adult goods such as alcohol and tobacco. In Ghana, 42.2 percent of mother without formal education immunized their children against BCG, DPT, Polio and Measles between 1989 and 1993, while it is 86.7 percent for mother with secondary education (Buor, 2003). Increase in income of mothers also greatly influence the quality of care the child receives from conception through the early years of life (Tekce and Shorts (1984)). This implies, in addition to education other polices like access to labor market, credit, legal services and so on that can boost earning and financial security of women will promotes family health

(World Bank, 1993). On the other hand, more educated women may assign higher value to their own time, particularly if they work in the market and receive a higher wage rate. In such cases if mothers' time is essential input in the production of child health, education could then be negatively related to good child health (Schultz, 1984).

Using data from Philippines Barrera (1990) shows that mother education improve child health through the effect it has on efficient allocation of health inputs. Education increases skills and knowledge as well as ability to deal with new ideas and provides a vehicle for importing of different culture (Caldwell (1979), Fucus (2001)). This will improve allocation of resources among different health input to produce health. This implies at any given level of income, educated mother know how to use medical inputs more effectively, choose better diets and other healthy behavior compared to uneducated mothers. To emphasize the importance of information to health, Mackinnon (1995) said:

> *"Public health and educational programme are important to improve people's own understanding of how they combat disease; children die because their parents are not fully informed about the actions they could take to save them. To understand health, we need to understand information."*

Glewwe (1999), using data from Morocco, identify three possible mechanisms through which mothers education improve child health. Firstly, formal education directly teaches health knowledge to future mother. Secondly, literacy and numeracy skills acquired in school assists future mother in diagnosing and treating child health problem. Thirdly, Exposure to modern society through formal education makes women more receptive to modern medical treatment.

Finally, better educated mothers marry and start family later, this will diminish the risk to child health associated with early pregnancy. It is also known that short birth interval contributes to higher child mortality through higher fertility rate. Higher fertility rate result in birth

complication, abnormalities and low birth weight (Felgg, 1982).It also reduces availability of families' resources to fed, educate and provide health care to children as well as result in poor health of mother (Zakir and Wanna (1999) Fayesa, (2001)). These conditions lead to poor child health. But mothers education encourages long birth interval and avoid problems associated with higher fertility rate.

Most cross-country and different countries empirical studies show that mother education is robust determinant of child health (Jain (1985), Caldwe (1979), Barrera (1990) Filmer and Pritchett, (1998), Or (2000), Fucus (2001), Fayisa (2001), CSA (2001)). Impressive achievement of China, Costa Rica, India's Kerala state and Sirilanka in reducing child mortality despite their relative low income is attributed to mother education (World Bank (1993)).

However, there are empirical works that indicate the weak link between mother education and child health when socio economic variables and community level variables such as income, access to health facilities access to clean water and sanitation facilities are controlled. The link is further reduced when area specific factors are controlled for using fixed effect model (Desai and Alva (1998)). For instance, Thomas, et.al. (1990), using household survey data of Brazil found strong impact of mother education on child survival and child height. Its impact, however, reduced when parental height included in to the model (the coefficient of mother education decline by 20-40 percent).This implies education is partly used as proxy for family background.

In case of Ethiopia, the 2000 DHS result show that reduction of neonatal mortality by 60 percent, infant mortality by 55 percent among mother with secondary and higher levels education compared to mother who had no education. Utilization of antenatal and delivery care which is correlated with mother education, reduce infant and child mortality by 92 percent. In

addition, maternal age at birth affect childhood mortality. It is higher among children born to mother under age 20 and above 40 (CSA, 2001).

However, the methodology of such study is inadequate because the conclusions are drawn from simple cross tabulation. It did not control for other important factors like income, public health expenditure, access to basic health services and so on. To fill this gap, multiple regression analysis is used to see the impact of maternal education on child health in this study.

Other studies that use multivariate regression are not comprehensive in the sense that, they are done for certain part of the country. For example,(Asefa, et. al. (2002) undertake a one year follow up study on all identified children born in 46 urban and 64 rural kebeles of Jimma, Keffa and Illubabor zone of South West Ethiopia to study factors associated with infant mortality. Information was collected on socioeconomic, behavioral, biological and environmental factors of infant, mothers and their families' immediately after birth and in consecutive visits. Using information obtained biviarate and multivariate (Cox proportional hazard model with for ward step wise likelihood ratio method) analysis was carried out. Result from Cox regression shows maternal factors such as marital status, education, family size, antecedence of delivery and antenatal follow up, birth weight and soap using habit of mothers to washing their hands have statistically significant effect on infant mortality.

Hailemariam et. al (1997) use the same method to conduct study on Sebeta (small town found South west 25 km of Addis Ababa). They found that higher birth order (more than five), birth to young women under age 20 years and older women more than 34 years of age positively associate with child hood mortality. On the other hand socioeconomic variable such as education, household income, source of drinking water and availability of latrine are negatively associated with child mortality.

2.2.3 Public Health Expenditure

Economic theory indicates three distinct justifications for the state intervention in healthcare market. These are to assure the optimal production of public goods and initiate activities that generate positive externalities, to offset market failure in market for health insurance and healthcare, and to subsidize consumers that are too poor to buy insurance or health care services.

For example, immunization and treatment of communicable diseases are private good but generate positive externalities that improve the health of the society. Control of disease vectors, information provision to consumer and health care providers and preventive activities are pure public good. Such goods are not totally produced at all or produced in very small amount by private market, thus justifying government intervention in health sector. On the other hand, medical insurance are characterized by the problem of adverse selection and moral hazard, which lead to market failure. At the same time in healthcare market, medical professionals act as agent for patient well being having competing objective (financial interest) [Filmer, et. al, 2002] .This results in problem of undertaking optimal action by the later. Imperfect competition among healthcare providers and economies of scale in health production are other causes of market failure in healthcare market. The existence of such market failures induce gap between social and private values of services, thus calling for government intervention for optimal provision of healthcare services [World Bank, 1993].

Government uses different instruments to affect the outcome of private market. It creates and disseminates information, regulate private activities, finance health related services or deliver these services through public health facilities (Musgrove, 1996). All the instruments have costs; even information is not free. Basically government finances these costs from public resources.

For public health spending to improve health status of a given society, there are factors to be considered [Filmer et. al 2000], some of these factors are indicated below.

- ***Composition of public spending (allocation of budget)***: allocation of health expenditure more to ward PHC[2] would bring both health gain and cost saving compared to curative secondary and tertiary health services.
- ***Public efficacy***: amount of expenditure that translates into real supply of health services under existing institutional capacity. If this is low, increase in public health spending is less likely to improve health outcome.
- ***Impact on consumer demand***: the created health services through public spending should increase the utilization of health services.
- ***Impact of used services (health production process)*** after health service utilization increased, the used services should produce good health.

If any of the above four condition have low impact, the total impact of increase in public health spending become less significant in affecting health status.

When the above factors are examined in the context of developing countries, public health expenditure is not promising in improving health status .It is biased toward public hospital to treat urban elites using expensive material and costly trained physicians. This take place while children in the same country dies from easily treated diseases (Filmer and Fritchett, 1997). In Ghana for example, 75 percent of country's health budget is absorbed by public hospitals (Canagrajai, 2001). In Ethiopia's as well public health expenditure is biased toward urban area, wealthier population, and hospitals care. For example, in 2000/01 around 60 percent or more healthcare spending wants to secondary and tertiary services (World Bank, 2005).On the other

[2] Primary Healthcare Services

hand the main burden of diseases in the country is prevented or treated on outpatient basis in primary healthcare setting (MOH, 2004).

In many countries, money spent on PHC may not translate into real services. Even if it does the net addition of public health services result in reduction of private substitutes (Filmer, et. al, 2000).Under the case where public spending translates into effective health facilities, it will not result in, increase in services usage because of their poor quality healthcare services (Filmer and Pritchett, 1998). They are without drugs, equipments and trained health personnel. This lead to the phenomena of bypassing free primary public health services to pay for private health services. This may cause under utilization of existing public facilities. Mariko (2003) using data from Mali found that drug availability and good process of delivery care, which are measures of quality of health facilities; significantly affect utilization of both public and private health care services.

Similarly, Collier, et. al (2002) using household survey data of Ethiopia found that usage of health facilities are not just sensitive to distance to the nearest facilities but also quality of healthcare provided. Based on the result, they conclude that given the present density[3]and quality of services provision, additional expenditure on quality of services delivery will be more cost-effective than increasing density of healthcare services.

Given the above theoretical foundation about public health spending, it is common to find mixed empirical result about the effect of public health spending on health status. There are studies which come up with small or statistically insignificant result (Musgrove (1996), Filmer and Pritchett (1997) Filmer and Pritchett (1999)). Musgrove (1996) found that for a given per capita income, countries that spend more on health do not necessarily buy greater longevity and reduce child mortality. Similarly, Filmer and Pritchett (1999) undertake cross country regression using

[3]Spatial distribution of health infrastructure

UNICEF data of child mortality of developing country. They obtain over 90 percent of variation in child mortality among countries explained by per capita income, inequality, female education, access to safe water and socio-cultural variables. Public health expenditure explains only 0.15 percent of the total. They show that, doubling public expenditure on health from 3 to 6 percent of GDP would reduce mortality by only 9 to 13 percent.

Gupta, et. al (1999) criticizes studies which give insignificant impact of public health spending for overlooking the issue of allocation within the sector (primary versus secondary and tertiary health care). They said Filmer et al (1998) address the issue but fail to find statistically significant impact of PHC spending on infant mortality rate, because the data they used were not consistent with either overall fiscal or intrasectoral data. Gupta, et. al (1999) use comprehensive, internally consistent and up to date cross sectional data of 50 developing and transitional countries. They found that PHC spending has statistically significant impact on child and infant mortality. In addition, they show that a 5 percent increase in the share of primary healthcare spending results in 2.3 and 4.9 percent reduction in infant and child mortality rate respectively.

Bidani and Ravllion (1997) by disaggregating the population under the study into poor and the non- poor, study the impact of public health spending on both groups. Their result indicates that public spending on health has significant impact on the health outcome of the poor than the non-poor. They show that those living under $2 per day can expect to live nine year less on average than the rest and their children 50 percent more likely to die before their first birth day. Anand and Ravallion (1993) with a sample of 22 observations, found the same result. They argue that even economic growth promotes health through poverty reduction and by increasing creation of better public health facility. Hanmer et. al (2003) test the robustness of the determinants of infant and child mortality for set of developing countries. Their result shows that in addition to level of

per capita income, health and education variables are robust determinants as well; rather public spending on health may be poorly targeted.

Furthermore, as Preston (1996) states, some public health spending such as immunization and preventive activity are cost effective ways of saving life. For example, small pox vaccination and purification of milk play an important role in reducing mortality. In Sirlanka close to half the reduction in mortality from 1930 to 1960 can be attributed to anti-malaria program. Some other studies identify the dependence of public spending on the institutional capacity to affect health outcome. Rajkumar and Swaroop (2002) come up with the result that public health spending lowers child mortality in countries with good governance, measured by the level of corruption and the quality of bureaucracy.

2.2.4 Access to Clean Water and Sanitation

Water quality and sanitation can potentially reduce child mortality by reducing the risk of bacterial infection and diarrhea diseases. That is, clean water and sanitation is associated with reduced exposure to pathogens. According to WHO report, annually there are around 2.4 million deaths related to water and sanitation problem. The deaths are mostly occurs among children under 5. In Ethiopia, for example in 2002 dysentery and helmithiasis which are transmitted by contaminated water and poor sanitation are among the top 10 reasons for outpatient visits, inpatient admissions and death (World Bank, 2005).

Even under sufficient food supply for children, diarrhea and other infectious diseases caused by lack of access to clean water and sanitation, cause food shortages by suppressing appetite and intake of food. This will result in inadequate supply of essential nutrient for the body and result in poor body growth. So, when the proportion of a given society that have access to clean water and sanitation increases the chance of children getting water born disease and then mortality decreases. World Bank (1993) indicated that out of one billion peoples infected with one or more

parasites, about 100 million of them suffer from stunting or wasting. In addition, in the absence of diarrhea little difference was found in growth of children up to thirty six months of age despite significant difference in food intake.

Mixed results are observed from different empirical studies about the impact of access to clean water and sanitation on child health. Lee, et.al (1997) estimates the impact of improved nutrition, water sources and waste disposal facilities on anthropometric measures of child health in Bangladesh and Philippines. They found that neither variation in water source nor improvement in sanitation facilities appeared to have significant effect on child survival. In case of Ethiopia, study conducted by World Bank (2005), using piped water bring down the risk of mortality by 5 percent while sanitation has no significant impact.

On the other hand, many studies support the negative impact of access to clean water and sanitation facilities on child health [Preston, 1996, Wang (2003) Ali (2001)]. For example, Ali (2001) using duration model and data for 1995 Egypt DHS., found that using municipal water and sanitation decreases the risk of death. Wang (2003) using data from 2000 DHS of Ethiopia and hazard model examines the environmental determinant of neonatal, infant and child mortality. She obtains strong statistical association between childhood mortality and poor environmental condition. (Preston, 1996)argue reduction in mortality by two-third among British soldier in India between1870-1919 was the result of improved water supply and personal hygiene.

According to the study conduct by Lavy et al (1996), in Ghana, 64 percent of sample from rural area lived under poor water and sanitation condition while in urban area it is about 12 percent. If water and sanitation conditions in the rural community were improved to the level of urban sector, the resulting gain in the child height would reduce the gap between urban and rural children almost three times.

CHAPTER THREE

3. Methodology

3.1 Model Specification

The starting point for studying the determinants of health outcomes of a given society would be individuals or household due to various reasons (Berhaman and Deolaikar, 1988). Usually the health status of individuals is determined by decision made at individual or household level and partly by government action through provision of basic health facilities. Secondly data used to analyze the determinants of health outcomes of a given population are obtained by aggregating over micro factors considered for individuals and household. That is why Rosenzweign and Schultz (1983), Schultz (1984) and Berhaman and Deolikar (1988) derives reduced health demand equation based on optimization behavior of individuals or household assuming health as commodity demanded by consumer. Based on the above indicated reasons, this study adopts the method used by Rosenzweign and Schultz (1983) Schultz (1984) and Berhaman and Deollkar (1988) to specify model for health outcome to conduct empirical analysis.

In traditional consumer demand theory, consumer demand market produced good in order to satisfy their need. In case of health, since it is not marketable commodity, the consumers are their own producers and their demand choices extended to demographic events in addition to market produced goods. That is, household has a preference ordering over their member health (H_i), non health consumption good (X_i) and health producing inputs (Y_i) that contributes to utility of household directly.

$$U = U (X_i, Y_i, H_i) \ldots\ldots (1)$$

Let the production of health outcomes by household be described by the production function:

$$H_i = H (Hg, Y_i, B, A, U_{i,}) \ldots (2)$$

Health of household member (H_i) depend on vectors of marketable health input (Hg) which includes food and medical care services, technology underlying health production (A) which can vary over time, family background (B) such as parental health and environmental factors. There are factors that affect health outcome and specific to individuals or a community but not observed in socio economic data (u_i).

The budget constraint facing the household to purchase good that contributes to their utility is given by

$$PC \leq W (e) L + V \ldots\ldots (3)$$

It represents that total spending on a vector of consumption goods C can not exceed wage income which depend on level of education (e) and amount of labor supplied to the market (L) plus unearned income (V). Maximization of utility function in equation (1) with respect to the constraints, (2) and (3) yields a reduced form of demand for health input and other non- health consumption good indicated by equation (4) and (5).

$$C = C (P, W, V, e, u, A) \ldots\ldots\ldots (4)$$

$$Hg = Hg (P, W, V, e, u, A) \ldots\ldots (5)$$

From the reduced demand of health input and production function, a reduced form of health outcome as function of exogenous variables can be obtained.

$$H = H (P, W, V, e, u, A) \ldots\ldots (6)$$

Based on the above micro foundation and other empirical studies conducted at aggregate level [(Gupta, et., al (1999), Filmer and Pritchett (1998), Wang, (2002))] as well the availability of data the following specification is used in this paper to study socio economic determinants of health outcome in Ethiopia.

$$Lnhfa_{it} = u_i + \beta_1 LnPCI_{it} + \beta_2 LnME_{it} + \beta_3 LnPHE_{it} + \beta_4 \ln PP + \beta_5 Ln\ AcW + \beta_6 LnASF_{it} + \varepsilon_{it} \ldots\ldots (7)$$

Where hfa_{it} – represents health outcomes proxied by anthropometric measures (height- for–age of children of age 3-59 month).

PCI-per capita income

ME – Mothers education

PHE – Per capital public health expenditure

PP – Population per physician

ACW – Percentage of population having access to clean drinking water.

ASF – Percentage of population having access to sanitation facilities

ε_{it}– Stochastic (random) disturbance term

Socioeconomic variables like income, education and so on work through different indirect channel to affect health. This implies health and socioeconomic variables have non-linear relationship. To capture these non-linear relationships, logarithmic function form is used in the specified model. Using double log specifications as in equation (7) is convenient for interpretation, since the coefficient of independent variables represents elasticties. In this case the elasticities represent a percentage change in level of stunting as a result of one percent in socioeconomic variables included in the model. Moreover, log transformations of data reduce the

problem of heteroskedaticity since it reduces the magnitude of the values of variables in the model.

Anthropometric measures (height in this case) are used to measure health status of children even though it does not capture fully all aspects of health. But they do measure one dimension of health (growth attainment) and are related to several other measures of health status. Deficiency in the anthropometry is the result of under performance of skeletal growth resulted from inadequate intake of protein, energy, micro nutrient and frequent infection. This body attributes measure health status in relative terms by comparing the observed measurements with the anthropometric measures of standard population. The anthropometric data that is used as standard developed by United State National Center for Health Statistics and US Center for Disease Control (NCHS/CDS)[4].For interpretation of any given height and weight, standard deviation (SDs) from the reference median also known as the Z-scores are used.

Since genetic variation between healthy children of the same age is expected in any population, height and weight of children across samples of any age group has normal distribution. Therefore, to allow for normal genetic variation in growth attainment, a cutoff point below which all children are considered to have low growth attainment was selected. That is, a cutoff point of minus 2SDs below the reference median is widely used. Children whose height for age below the cutoff point (-2SDs) are said to be stunted while those children with below the cutoff point for weight relative to their height are said to be wasted. Using the above classification children of age 3-59 months were surveyed by CSA and identifies percentage of children that are stunted and wasted in the age group for all regional states of Ethiopia. We use this data for this study.

[4] It was complied from two surveys of well nourished healthy American children during 1970s.

Provision of adequate and safe drinking water and sanitation facilities improves health status since it reduces water born diseases such as diarrhea, cholera, dysentery etc. Water from tap and protected well is relatively considered safe for drinking. We use this variable as proxy to identify proportion of the population having access to clean drinking water. For sanitation facilitates, proportion of population who use flush toilet and pit latrine were used as a proxy to measure accessibility to sanitation facilitates.

To measure mother education, which is cited as the most important determinant of child health by different empirical studies, secondary school female gross enrollment ratio is used. It is expressed by the number of enrolled females in grade 9-12 divided by the total number of females of age 13-18 years. It gives a good estimate of mothers that complete primary education. To measure the availability of health facilitates, number of population per physician is used as proxy measure. Finally for public health expenditure annual per capita government actual expenditure for each regional state was used.

3.2 Estimation Method

People are different in their biological endowment and other individual and community level characteristics. They are living in diverse community with different cultural background and environmental condition (may be some local climates are conductive for outbreak of certain disease like malaria which cause death while other area climate is not). These individuals or community specific variables may not be observed to researchers but contribute to production of individuals health. Some of these variables are correlated to other health input. For example, genetic endowment of individuals may be correlated with their educational attainment, consumption habit correlated with income (Smith, 1999, Case, et al. 2002), adult health and their

income may also be correlated (Pritchet and Summer, 1996). If such unobserved individuals specific heterogeneity are not measured and included into the model used to analyze the determinants of health outcomes, OLS and GLS regression gives biased and inefficient estimates of other explanatory variables due to endogenity problem (Hausman and Taylor, 1981).

Some of the causes of endogeniety problems in the regression analysis includes: omission of unobserved cross sectional unit heterogeneities (self selection), simultaneity and measurement errors. Panel data estimation techniques are used as a remedy to endogeniety problem created by unobserved cross-sectional unity heterogeneities.

Most studies conducted using time series and cross-sectional data don't control for the endogenity problem created by omission of unobserved cross sectional specific heterogeneity. But there are empirical works using cross sectional data that deal with endogenity problem using instrumental variable (IV) techniques. In this case it is difficult to get valid instrument that is correlated with omitted variable but not correlated with disturbance term. This may cause estimators with large standard errors, and in finite samples, IV estimators are biased in the same direction as OLS estimator (Bound,et.al 1995).Furthermore, any benefits derived from using IV can be usually offset by its weak inference power as the estimates of the standard errors from IV methods are usually much larger than from OLS.

Therefore, using time series and cross- sectional data when there are cross-sectional unit specific heterogeneity, produce biased estimate of observed explanatory variable. This may result in misleading conclusion and policy implication. To overcome such problem, panel data analysis method is used in this study.

Panel data models take into account unobserved individual cross-sectional unit specific heterogeneity by including a separate parameter U_i into the model as indicated below.

$$Y_{it} = X_{it}\,\beta + U_i + \varepsilon_{it}$$

Where Y_{it} = vector of dependent variable (anthropometric measures).

X_{it} = is vector of independent variables included in the model (Income, education, public health expenditure, access to clean water sanitation and health facilitates) related to i^{th} regional state at time – t.

ε_{it} - represent disturbance term that is assumed to be uncorrelated with X_{it}, with mean zero and constant variance.

Different alternative specifications are used for analysis of panel data depending upon the way cross- sectional unit specific effect is conceptualized and estimated.

1. Pooled OLS

In pooled OLS, assuming the homogeneity (uniformity) of cross-sectional unit (u_i=0) OLS regression is estimated by pooling cross-sectional time series data. If the assumption is valid, this form of model specification has some advantage over the other. Firstly, it is said to be very parsimonious (only few coefficients will be estimated by NT observation). Secondly, it is computationally simple compared to other models. However, if the assumption becomes violated and unobserved cross-sectional unit specific factors are correlated with explanatory variables, pooled OLS result in estimates which are biased and inefficient. Therefore, to use pooled OLS as an appropriate specification it should pass homogeneity test.

2. Fixed Effect Model

This model treats u_i–unobserved cross-sectional unit specific heterogeneity as time invariant random variable distributed independently across cross-section with variance δ^2_u. It also allow the correlation between u_i and X_{it} under the strict exogenity assumption of disturbance term [E (ε_{it} /X_{it} = O). Using this model one can estimate u_i by including dummy variable for each of n-1 cross- sectional unit and run OLS regression as indicated below.

$$Y_{it} = [d_1, d_2, d3 \ldots d_{n-1}, X_{it}] \begin{bmatrix} U_i \\ \beta \end{bmatrix} + \varepsilon_{it}$$

Since we estimate n -1 extra parameter, dummy variable method of estimation suffer from large loss of degrees of freedom when there are large number of cross- sectional unit and too many dummies aggravate the problem of multi collinearly. Moreover researchers are not interested in most cases to estimate unobserved individual effect rather more interested in estimating the effect of other explanatory variables. Under the above situations, dummy variable has less practical importance (Wooldridge, 2003)

The other method used to estimate fixed effect model is within (fixed effect) transformation method. In this method the data is transformed prior to estimation to washout the effect of unobserved individual specific effect. This can be done by subtracting cross–sectional unit mean from each observation and then run OLS regression. The estimates produced by such method are unbiased and efficient. However if researchers want to estimate u_i, within transformation method may not help. In addition the effect of time invariant explanatory variables like sex, race and religion can not be estimated by within transformation method; since they are remove during transformation. At the same time, when individual specific effect is uncorrelated with each explanatory variable in all time, using within transformation technique to eliminate u_i result in

inefficient estimators by reducing variability. Under such condition random effect specification becomes more appealing model.

3. Random effect model- This model treat group (individual) specific heterogeneity- U_i as group specific random disturbance term and incorporated into disturbance term, ε_{it} to form composite error term v_{it}. It also assumes u_i to be uncorrelated with all explanatory variable in the model ($E(U_i / X_{it}) = O$). As a result, the fixed effect model respecified as:

$$Y_{it} = Y_{it}\beta + V_{it}$$

Where, $V_{it} = U_i + \varepsilon_{it}$

If the assumption of exogenity indicated above is violated, the random effect estimators become biased. Even when the assumption holds, since the residual of random effect are serially correlated ($v_{it} = U_i + \varepsilon_i$), application of OLS result in inefficient estimators. Thus to estimate random effect model, generalized least square (GLS) estimation is used [Teachman, et. al (2001), Hausman and Taylor (1981)].

Fixed effect model has advantage over random effect model, since it allows correlation of unobserved individual specific heterogeneity with other explanatory variables in the model. This is not possible with random effect model. On the other hand, random effect model has two main advantages over fixed effect model. Firstly, it produces efficient estimator under serial correlation and secondly, it allows estimating the effect of explanatory variables that are constant overtime.

So, the choice of specification seems to rest on two considerations (Hausman, 1978). One is logical and the other statistical. The logical consideration is whether U_i can be considered random and drawn from independently and identically distributed large population, or not. When observations are randomly drawn from large population, random effect model specification

seems appropriate, whereas when we can not consider the observations to be draws from large population, fixed effect model is used. The other selection method proposed by Hausman (1978) is to test the exogenity of unobserved individual specific effect. That is, testing the null hypothesis, Ho: E (U_i/x_{it}) = O against alternative hypothesis, H_1: E ($U_i/X_{it} \neq O$). The test of null hypothesis of independence (Orthogonality) of u_i is based on the idea that, under the hypothesis of no correlation, both OLS of fixed effects model and GLS of random effect model estimators are consistence and the two estimates do not differ systematically (Green, 1990). That is if random effect specification is correct, the two estimates should be near to each other.

For decision Hausman(1978) suggests to use a test statistics defined as:

$$m = \hat{q}\,' \,(\text{Var}\,(\hat{q}))\,\hat{q}$$

Where $\hat{q} = \hat{\beta}_{fe} - \hat{\beta}_{GLS}$, $\hat{\beta}_{fe}$ - slope coefficient of fixed effect model

$\hat{\beta}_{GLS}$- slope coefficient of random effect model

m has a chi square - distribution with K- degrees of freedom.

If the assumption under H_o is violated, the random effect estimator is biased and inconsistent, while fixed effect estimator is not affected by the failure of orthogonality of U_i assumption (Hausman, 1978). A rejection of H_o is interpreted as adoption of fixed effects model. This is an indication of the presence of important individual specific effects that are correlated with the right hand side variables. Non- rejection of Ho would be taken as an adoption of the random effect model.

In addition, F-test or Lagrangian Multiplier (LM) test will be conducted to test the homogeneity of regional states of Ethiopia. The selection between LM and F-test will be made based on the alternative panel data model (fixed or random) intended to be used. For LM, which is a random effect test, Breusch and Pagan (1980) developed LM statistic based on the residuals of the fitted

OLS model. It has a Chi square distribution with k degree of freedom (k- represent the number of parameters estimated).This statistics is used to test the null hypothesis, H_o: δ^2_u =o (there is no regional specific effect) against H_1:$\delta^2_u \neq$o. Rejection of Ho interpreted as regions specific factors matters for health production in Ethiopia and panel data model should be used to handle region specific heterogeneity .The F- test is fixed effect test which is based on the F- Statistics constructed from residuals of pooled OLS and within effect model

$$F_{(n-1,\ N(T-1)-k)} = \frac{[RRSS - URSS]/_{N-1}}{URSS/NT-K}$$

RRSS – Residual sum of square from pooled OLS

URSS – Residual sum of square from with in transformation (fixed effect model)

It is used to test, H_o: U_i= o (no regional state difference) against H_1:$U_i \neq$o. Rejection of Ho is interpreted as adoption of fixed effect model whereas non-rejection of Ho implies that pooled OLS should be used to estimate the specified model. Moreover, to correct the problem of heteroskedaticity, which is common in panel data due to difference in the size of cross- sectional unit, robust standard error is computed. This avoids inefficiency of the estimate of regression coefficient and makes t- statistics more reliable test statistics for test of significance.

3.3 Data

The study uses panel data of the nine regional states and two administrative state of Ethiopia, from 1996 to 2004. Panel data has various advantages over conventional time series and cross sectional data. Panel data give large number of data points, more variability, less collinearity among explanatory variables; more degrees of freedom and more efficiency (Baltagi, 2001). In addition, panel data help us to control individual specific heterogeneity which would be unobserved and correlated with other explanatory variable (Hausman and Taylor, 1981,

Wooldridge, 2003). As a result, it enables us to produce more reliable and efficiently parameter estimates.

The data are obtained from various sources. Data on income and public health expenditure is obtained from MOFED. Data on anthropometric measures (height for age), education, access to clean drinking water and sanitation facilities is obtained from 1996, 1998, 2000 and 2004 Ethiopian welfare monitoring survey (WMS), conducted by Central Statistical Agency of Ethiopia (CSA). For population per physician which used as proxy for availability of health facilities health and health related indicators annual publication of planning and project department of ministry of health is used.

CHAPTER FOUR

4. Analysis of Empirical Results

4.1 Descriptive Analysis

In this section the features of data that are not observed in regression analysis is discussed before undertaking regression analysis. Normally, regression analysis is aimed at explaining the total variation in dependent variable by breaking it into the explained variation due to explanatory variables included into the model and the residual variation. Therefore, it is useful to have a preliminary look at the variation of dependent variable to be explained and compare it with the characteristics of variation in explanatory variable. Moreover, many of the problems (unexpected results) which might emerge at the level of multivariate analysis can often be traced back to individual variable data. Hence, conducting descriptive analysis before undertaking regression analysis, help us to learn much about the relationships between dependent and independent variables a priori.

The descriptive analysis that would be carried out in this section mainly depends on summary statistics indicated in Table 4-1, 4-2 and 4-3 below.

Table 4.1 Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
hfa	44	48.230	11.076	22.71	69.3
pci	44	804.359	471.956	103	1802
phc	44	20.546	17.778	4.18	67.8
me	44	13.659	16.490	.05	75.5
pp	44	39419	29065	3208	93235
- acw	44	41.803	28.930	8.14	99
asf	44	31.257	25.578	2.38	91.25

Table 4.2 Summary Statistic (in logarithmic form)

Variable	Obs	Mean	Std. Dev.	Min	Max
lhfa	44	3.829	.242	3.123	4.238
lpci	44	6.446	.836	4.691	7.497
lphc	44	2.664	.867	1.430	4.216
lme	44	1.806	1.509	-2.235	4.324
lpp	44	10.109	1.004	8.073	11.289
lacw	44	3.492	.712	2.098	4.676
lasf	44	3.078	.934	1.122	4.514

The standard deviations of child stunting and socio economic variables indicate the variability of these variables. However, as indicated in Table 4-2, their variability decreases when changed in to logarithmic form[5]. The existence of variation gives signal that variation in dependent variable (Lhfa) can be explained by the variation in explanatory variables (Lpci, Lphc, Lme, Lpp, LACW and LAsf).

The prevalence of child stunting, which is a measure of nutrition and health status, is very high in Ethiopia compared to other low income countries. On average,for the four periods under the study, about one in two children of age 3-59 months (48.2 percent) are short for their age, compared to 39 percent for sub-Saharan Africa. Overtime however it shows a sharp decline. For instance, it declined from 65.7 percent in 1996 to 46.9 percent in 2004.

When we see the distribution of child stunting across regions, Amhara regional state (62.77) becomes the highest followed by Tigray (58.20), SNNPR (55.86), Oromiya (49.64) and Beneshagual Gumuz (49.42). The lowest level of child stunting (good health outcome) is registered in Addis Ababa (35.95) followed by Dire Dawa (36.63), Harari (43.29) and Gambella (43.5).

[5] When the values of the variable converted to logarithmic form they converge to small numbers.

As indicated in review of literature, different empirical studies indicates, one reason for such variation in health outcome among different regional state would be the result of the variation in socio economic variables among them. When this idea is tested using Ethiopia's regional state data, using descriptive analysis the following trends are observed.

When we compare the data for per capita income and prevalence of child stunting, there are regions (Tigray, Amhara, Benshangul Gumuz and Oromiya) with higher per capita income above the national average and at the same time higher rate of child stunting. In addition, regions like Somali, Afar and Harari, with per capita income below the national average have lower child stunting rate (below the national average). This is contrary to other empirical finding and economic theory. It is not surprising therefore to get very low correlation coefficient between per capita income and percentage child stunting(r=-0.063) for Ethiopia with data having the above characteristics.

Table 4.3: The Correlation coefficient among socio-economic variables affecting child health.

	lhfa	lpci	lphc	l me	lacw	lpp	lasf
lhfa	1.0000						
lpci	-0.0632	1.0000					
lphc	-0.4269	0.0540	1.0000				
lme	-0.4570	0.5363	0.5065	1.0000			
lacw	-0.7593	-0.0585	0.4802	0.5765	1.0000		
lpp	0.4489	-0.1818	-0.8141	-0.7026	-0.6824	1.0000	
lasf	-0.7588	0.0895	0.4673	0.6283	0.8463	-0.6927	1.0000

In case of public health expenditure per capita, regional states with public health expenditure per capita above the mean (Harari, Gambela, Beneshagual Gumuz, Addis Ababa and Dire Dawa) have child stunting rate which is below the mean. On the other hand regions with low per capita public health expenditure (Amhara, Oromiya, SNNPR and Tigray) have higher prevalence of child stunting. The correlation coefficient between Lhfa and LPHC (r=-0.43) signifies the inverse relationship between poor child health and per capita public heath expenditure.

Even though the correlation coefficient between Lhfa and Lpp(r=0.45) shows positive relationship between poor child health and higher ratio of population per physician, regional state data show some irregularities. For instance, Somali (78,129) and Afar (69,292) with higher population per physician have lower rate of child stunting than other regions (Tigray (39,261), SNNPR (53,077), Oromiya (66,964)) with relatively lower population per physician. For other regions (Addis Ababa, Dire Dawa, Harari and Gambella), however, lower ratio of population per physician is coupled with lower prevalence of child stunting.

For mother education, as well, except for Somali and Afar, negative relationship between female secondary school gross enrollment ratio and poor child health can be established for all regional states (r= -0.457). That is, region with lower female secondary school enrollment ratio (Tigray, Amhara, Oromiya, SNNPR and Benshangul Gumuz) have higher prevalence of child stunting, while regions (Addis Ababa, Harari and Dire Dawa) with relatively higher female gross enrollment ratio have lower child stunting.

Table 4.4: Distribution of children age3- 59 month who are stunted level of mother education (1998)

	Mother education					
	Illiterate	***1-6***	***7-8***	***9-12***	***Above 12***	***Not stated***
Prevalence of child stunting	52	47.2	43	28.6	24.6	38.0

Source: Ethiopia's health and nutrition survey, 1998

As can be seen in Table 4.4, the prevalence of child stunting among children from mother with no education is about 52 percent, while it is about 43 percent for children from mothers having grade 7-8 schooling. It becomes about 24 percent for children form mother who had education above 12. This may be due to the fact that educated mother tend to make great use of different types of health services and undertake other health enhancing activities as indicated in Table 4.5. Diarrhea and other infectious diseases have negative effect on child health by reducing nutrient intake and utilization. This implies that child stunting would be highest among children frequently affected by diarrhea. Such children are common among illiterate mothers compared to children of literate mother. Moreover, only 36.6 percent of children from illiterate mother get treated childhood diarrhea with ORS (oral re-hydration salt) compared to 55.8 and 79.8 percent for mothers with primary school and secondary school education respectively as shown in Table 4.5.In terms of healthcare services utilization mothers with more years of schooling tend to receive more antenatal care , delivery attendance by health worker , use supplementary food during lactation and pregnancy as well as their children get vaccinated regularly. These services have great implication for mother and the child health. Thus based on the above biviarate analysis we can conclude that mother education is one of the most important factors that affect child health outcomes.

Finally, data for access to safe water and sanitation facilities show strong inverse relationship (with correlation coefficient of -0.76) with poor child health. On average regions with better access to clean water and sanitation facilities (Addis Ababa, Dire dawa, Harari, and Somali)have lower prevalence of child stunting ,while regions with less access to clean water and sanitation facilities (Amahara, Oromyia ,SNNPR and Beneshagul Gumzi)have relatively higher prevalence of child stunting.

Table 4.5 distribution of healthcare utilization by mothers with different level of education

	Level of Mother Education					
Background variables (%)	**Illiterate**	**1-6 grade Complete**	**7-8 grade Complete**	**9-12 grade Complete**	**Above 12**	**Not stated**
mother who receive antenatal care 2 years before the survey	28.8	54.9	70.8	88.7	94.8	72.7
Attended delivery with medical professional	3.9	14.6	29.6	60.2	66.3	50.6
children age under five having diarrhea, vomiting and coughing two week prior to the survey	23.7	22.3	21.3	15.8	14.6	21.7
children who had diarrhea two week prior to the survey and treated with ORS	12.8	15.8	26.2	24.9	3.2	14.4
children of age under five who had vaccination at any time before the survey	36.6	55.8	64.8	79.8	75.5	45.7
children who are breast feeding up to age year two	21.1	14.8	16.8	11.2	11.7	5.2
women who took supplementary food during pregnancy and lactation	11.8	23.1	37.6	49.0	46.3	39.2

Source: Ethiopia's health and nutrition survey, 1998.

The correlation coefficients between dependent and independent variables as well as among independent variables in the study are given in Table 4-3. This may help to see the degree of multicollinearity among explanatory variables. In regression analysis, high degree of multicollinearity between independent variables creates problems by inflating the variance of the estimators by a factor of $\frac{1}{1-r^2_{ji}}$ [6]which is known as variance inflation factor (VIF).[7] This results in wrong sign for the coefficients and dramatically increases their standard error, thereby making t-values smaller. As a result, the probability of accepting the null hypothesis that the relevant true populations' value is zero increases (the estimators become statistically insignificant).

As indicated in Table 4-3, there is a strong correlation between population per physician (Lpp) and per capita public health expenditure (Lphc) (r= -0.814) as well as access to clean drinking water (LACW) and access to sanitation facilities (LASF) (r= 0.846). This may create a problem on the statistical significance of their estimators. On the other hand the correlation coefficients among other independent variables are low and not that much in a position to create statistical problem.

4.2 Estimation and Interpretation of Regression Results

Under estimation of the model, the first task is testing the assumption imposed on the alternative model to select the most appropriate estimation method for the data under the study. For this purpose first we conduct F-test, to test the cross sectional unit homogeneity assumption of pooled OLS. The test is based on the residual sum of square form fixed effect model and pooled OLS as

[6] r- Represent the correlation coefficients between the variables.

[7] Var (β) = $\frac{\delta^2}{\Sigma x_{ij}}$.(VIF)

is indicated in section 3.2. The result from regression of pooled OLS and fixed effect model up on which the test based is given in Table 4.6.

The test result indicate that the null hypothesis of homogeneity of regional state of Ethiopia (U_i= o) can be rejected at 5 percent level of significance (P= 0.0259). This implies the existence of regions specific factors that contribute to production of health. As a result, using pooled OLS to estimate equation (7), by ignoring such regions specific factor, results in biased and inefficient coefficient, thus leading to misleading policy conclusion. Thus fixed effect estimator, which accounts for unobserved cross-sectional unit specific factor, is preferred to pooled OLS estimator under such condition.

Table 4.6: Pooled OLS and fixed effect model regression result

Dependent variables: percentage of child stunting (Lhfa)				
	OLS		**Fixed effect**	
Explanatory Variable	**Coeff.**	**P>/t/**	**Coeff.**	**P>/t/**
LPCi	-0.0613 (-1.79)	0.082	-0.246 (-3.25)	0.003
LPhc	-0.145 (-3.47)	0.001	-0.276 (-3.18)	0.004
LMe	0.016 (0.16)	0.544	0.005 (0.13)	0.901
Lpp	-0.183 (-3.79)	0.001	0.089 (0.57)	0.575
Lacw	-0.213 (-3.60)	0.001	-0.199 (0.022)	0.022
LASF	-0.142 (-3.26)	0.002	-0.068 (0.240)	0.240
R^2 R^2Adj. No. Obs	0.74 0.70 44		0.76 44	

F-test that all U_i= 0: F (10, 27) = 2.55 Prob > F= 0.0259

Note that figure in parenthesis are t-values

Finally, to choose between fixed and random effect estimator, we conduct Hausman(1978) specification test, and the result is reported in Table 4.7.

Table 4.7: Result for Hausman specification test.

	. . .Coefficient. . .			
	(b) fixed	(B) random	b-B (difference)	Squrt [diag(v(b)–V(B))] (S.E)
LPci	-0.246	-0.091	-0.155	0.064
Lphc	-0.276	-0.169	0.019	0.70
Lme	0.005	0.024	0.019	0.24
LPP	0.89	-0.197	0.287	0.14
LACW	-0.199	-0.247	0.47	0.049
LASF	-0.068	-0.127	0.061	0.030

Test Ho: difference in coefficients not systematic

Chi^2 (6) = (b-B)' [V (b) – V (B) ^ (-1)] (b –B) = 15.87

Prob > Chi2 = 0.0145

The test result above indicates that we can reject the null hypothesis that fixed effect and random effect estimators are not systematically different at 5 percent level of significance (P= 0.0145). This implies unobserved regional state specific heterogeneity which affects health outcomes are correlated with socio-economic variables included in the model. Technically, this means the orthogonality assumption of random effect model (E (u_i/x_{it}=o) is violated and the estimators for random effect model becomes biased. So, fixed effect model specification fit more our data, since it is robust to endogeneity of explanatory variable provided that the endogeneity is the result of time invariant unobserved regional state specific factor.

Thus equation (7) in chapter three is estimated using fixed effect estimation method, and the result with heteroskedaticity adjusted standard errors are reported in Table 4.8(For the sake of comparison, result from pooled OLS and random effects are given in the Appendix 1).

Table 4.8: Regression result of fixed effect model with heteroskedaticity robust standard error

Dependent Variable: Prevalence Of Child Stunting			
Explanatory Variable	**Coefficient**	**Robust Standard error**	**P > /t/**
LPCi	-0.2463	0.092	0.013
LPhC	-0.2756	0.109	0.017
LMe	0.0047	0.033	0.888
LPP	0.0894	0.127	0.487
LACW	-0.1994	0.59	0.002
LASF	-0.0684	0.044	0.132

F (6, 27) = 14.49 Prob > F = 0.000

R^2= *0.76*

Corr (Ui, Xb) = -0.904

No observation = 44

As indicated in the Table 4.8, the explanatory variables in the model explain about 76 percent of variation in prevalence of child stunting in different regional states of Ethiopia. The F- statistics, which is used to test the overall significance of the explanatory variables, is statistically significant at one percent level of significance, indicating the importance of the explanatory variables. Furthermore, all the variables are in the natural log form, as a result the regression coefficients are interpreted as elasticity of child stunting with respect to explanatory variables.

In line with most empirical studies and economic theory, the regression results indicate that income is an important determinant of child stunting. This is represented by its negative and significant coefficient. It means, increase in per capita income decreases the prevalence of child stunting. More specifically, it indicates that, a one percent increase in per capita income may reduce child stunting by about 0.25 percent. Similarly, public health expenditure has statistical significant impact on child stunting with expected negative sign. Compared to other variables in the model, public health expenditure has more practical importance in affecting child height. On average, one percent increase in public health expenditure may result in reduction of child stunting by about 0.28 percent.

In bivariate analysis, mothers' education has got negative association with prevalence of child stunting (r=-0.457). However, in multivariate analysis using fixed effect model, mother education fail to have a significant impact on prevalence of child stunting. Even dropping mother education from the model do not affect the coefficient of other explanatory variables; their t- values and the explanatory power of the model (R^2 remain 0.76) as given in Table 4.9. To identify the reasons behind such finding, it is help full to look into the theoretical foundation of the channel through which mother education affect child health.

Mother education affect child health through its impact on household income which is a great impediment to use health services, food and other health input. That is, educated mother has better chance to get more income than uneducated mother through wage earning, and increase productivity in self employment. Thus, educated mothers are able to provide their children with better food, access healthcare services, and clean water and live in clean environment.

The other channel through which mother education affect child health is, through the perceptions they have for illness and use of modern medical services. By overcoming the cultural constraints

and prohibitive social norms, educated mothers are in a better position to appreciate the value of health services, owing to their health knowledge. This implies when the impact of income, access to health care services, clean water and sanitation facilities are controlled, it may not be surprising to see mother education being insignificant, or weakly linked, to child health. In addition, mother education partly represents unobserved community specific heterogeneities. These heterogeneities include feeding habits, different sanitation and cleanliness level, quality of healthcare services, taste for children etc. The impact of such unobserved heterogeneities can be controlled (eliminated) by using fixed effect estimation method. Thus the impact of mother education on child health can be further reduced when unobserved regional state specific factors are controlled using fixed effect model.

Table 4.9: Selected fixed effect regressions of Ln of prevalence of child stunting on various explanatory variables.

Coefficient of Explanatory variables						
LPci	**Lphc**	**LME**	**LPP**	**LACW**	**LASF**	**R^2**
-0.246*	-0.276*	0.005	0.089	-0.199**	-0.068	0.76
(-3.25)	(-3.18)	(0.13)	(0.57)	(-2.43)	(-1.20)	
-0.246*	-0.276*		0.087	-0.196**	-0.066	0.76
(-3.31)	(-3.24)	-	(0.57)	(-2.59)	(-1.26)	
-0.259*	-0.296*	-0.027	0.1868	-	-0.124**	0.71
(-3.17)	(-3.16)	(-0.71)	(1.13)		(-2.20)	
-0.253*	-0.283*	-0.012	0.127	-0.239*	-	0.75
(-3.33)	(-3.25)	(-0.33)	(0.82)	(-3.16)		
-0.281*	-0.322*	-0. 076**	0.310***		-	0.70
(-3.25)	(-3.26)	(-2.30)	(1.88)	-		
-0.277*	-0.337*	-0.107*	-	-	-	0.61
(-3.09)	(-3.29)	(-3.62)				

Note: - Figure in parenthesis is t- values

- The level of statistical significance of each estimate indicated by *, **, *** for one, five and ten percent level respectively.

Consistent with the above theoretical argument and empirical finding from other countries, the impact of mother education on child health is conditional on controlling for different socio economic variables. Hence, for instance, dropping access to clean water source (LACW), sanitation facilities (LASF) and access to health care services (LPP) in pairs or one at a time changes both the practical as well as statistical significance of mother education (LME) as reported in Table 4.9.

Dropping LACW and LASF one at a time, result in change in the coefficient of LME from 0.005 to -.027 and -0.012 respectively. When both are dropped from the model at the same time, the coefficient of mother education becomes -0.076 and statistically significant at five percent level. Furthermore, dropping LPP in addition to LASF and LACW at the same time, will give mother education both strong practical and statistical significance. This implies that mother education is insignificant in our finding not because it has no impact at all on child stunting but its impact is captured by other variables in the model.

Population per physician which is used as a proxy for access to healthcare services in this study has no statistically significant impact on prevalence of child stunting. This could be due to its high correlation with public health expenditure (r= -0.814). That is, increase in public health expenditure on health results in employment of more health workers and hence increase supply of health services. In such cases, the true impact of access to healthcare services and public health expenditure on prevalence of child stunting might be disguised by high degree of multicollinearlity.

Low utilization of health services might be the other reason for weak impact of access to healthcare services on child stunting. As can be seen in Table 4.10., more than half of the population who had health problem during the survey years did not consult health professional

for treatment. For instance, on average in 2004 about 49 percent of household reported, they did not use any one of the nearest health care services at all due to one or more reasons. About 39 percent of the household mention distance from health services as a reason for not being able to use health services. About twenty nine percent of household have no need of the nearest institution, for 14.5 percent of household the reason was too expensive service charges to use, and other reasons indicated in Table 4.11.

Uneven distribution of health facilities might be the other reason for the insignificant effect of population per physician on child stunting in our finding. Population per physician being an average, it disguises the spatial distribution of physician, as well as the unequal access to the rich and the poor families to health facilities. As World Bank (2005) indicated, large proportion of health facilities is located in the urban centers. For instance, 63 percent of Doctors, 46 percent of Nurses and 34 percent of health assistants are working in Addis Ababa only in 1998/99.

Table4.10: Percentage of household who consult health worker for their health problem over the four survey years (1996, 1998, 2000 and 2004)

Survey year	National level			Rural			Urban		
	Male	**Female**	**Both**	**Male**	**Female**	**Both**	**Male**	**Female**	**Both**
1996	53.7	45.0	49.1	51.1	42.0	46.4	76.5	66.3	70.7
1998	45.8	41.2	43.4	43.1	38.0	40.5	72.2	65.5	68.3
2000	44.5	38.5	41.1	42.0	35.0	38.5	71.5	63.2	66.6
2004	50.2	40.5	49.9	47.3	42.4	44.7	74.7	72.4	73.4

Source : Ethiopia's Welfare Monitoring Survey conducted by Central Statistical Agency, 2004

Table 4.11: Percentage distribution of household by reasons for not using the nearest health service institution by type and place of residence (year 2004)

Background variables	Country Level				Rural				Urban			
	Health post	Clinic	Health center	Hospitals	Health post	Clinic	Health center	Hospitals	Health post	Clinic	Health center	Hospitals
Too far	33.1	27.4	44.4	54.6	33.4	30.8	47.7	56.9	31.1	9.3	20.3	37.8
Too expensive	8.4	25.6	12.5	11.5	9.5	24.7	13.4	11.6	2.3	30.9	6.3	10.5
Poor quality of services	7.0	5.2	4.5	1.9	7.6	5.1	4.0	1.6	3.9	5.8	8.2	4.3
Do not offer full services	8.7	6.3	.9	1.8	9.4	6.3	4.5	1.5	4.6	6.5	9.1	4.2
Lack of staff or equipment	4.2	2.9	1.8	0.8	4.5	2.9	1.7	0.7	2.2	3.3	4.3	1.8
have no need of it	33.9	23.7	0.8	26.5	30.8	26.5	25.3	24.9	51.8	40.8	46.4	37.8
Others . . .	4.4	3.7	26.5	2.8	4.6	3.7	3.5	2.7	3.4	3.5	5.1	3.4
Never use at all	62.6	33.5	40.4	59.6	58.9	33.6	43.2	64.3	86.6	32.8	25.3	35.2
Using the nearest health services	37.2	66.5	59.6	40.3	41	66.4	56.8	35.7	12.1	67.2	74.6	64.8

Source: Ethiopia's Welfare Monitoring Survey conducted by Central Statistical Agency, 2004

Access to clean water, which is proxied by percentage of individuals with access to tap water and protected well, has the expected negative sign, and is statistically significant at 5 percent level of significance. Thus a one percent increases in access to clean drinking water results in reduction of the prevalence of child stunting by about 0.199 percent. Improved water and sanitation facilities are associated with reduced exposure to pathogens. Specifically, access to clean drinking water reduces the prevalence of diarrhea and other water born diseases. Diarrhea causes

underdevelopment of child body by causing loss of micro nutrient energy producing digested food.

In case of the coefficient of access to sanitation facilities, it is with the expected negative sign but statistically insignificant. This might be due to multicollinearity problem given that access to clean water and sanitation facilities have a very high correlation coefficient (r=0.846). That is, the benefit from clean water occurs only when sanitation improves. In such cases it is difficult to estimate the impact of individual variables by isolating form each other. This means that the true impact of one of them is masked by the other.

To assess this muticollineairty problem we run fixed effect regression by dropping LASF first and then dropping LACW. The result of the regression is given in Table 4.9. The coefficient of LACW improved from-0.199 to -0.239 and becomes statistically significant at one percent level of significance when LASF dropped. Further, the coefficient of LASF improved from -0.068 to -0.124 and becomes statistically significant at 5 percent level of significance when LACW is dropped. Their variance inflating factor equals 6.49. This implies access to sanitation facilities is insignificant not because of lack of impact on child stunting but because its impact is disguised by access to clean drinking water. This can be further justified by the high correction of access to sanitation facilities with child stunting, is as indicated in the correlation matrix (r=-0.759).

To ensure that our results are not driven by a few typical regions, we do some robustness check by re-estimating the model after omitting observation for certain regions. The excluded regions are different in terms of child health outcome and socio economic variables. As can be seen in Table 4.12, there is no significant change in the statistical and practical significance of the explanatory variables on child stunting when observation for Addis Ababa, Oromiya, Harari,

Amhara, SNNPRand Somali are dropped. Only the statistical significance of access to sanitation facilities change significantly when observation for Addis Ababa is dropped from the dataset. This may be because of the fact that Addis Ababa has high standard deviation for access to sanitation facilitates compared to other regional state. Thus, from the above analysis, we can conclude that our model is a stable model and the estimated results are not spurious. Therefore, they indicate the real association between the socioeconomic variables and child health in Ethiopia.

Table 4.12 Sensitivity of the results to change in the sample composition and size

	Explanatory Variables						R^2
Composition of sample	**LPCi**	**LPhc**	**LMe**	**LPP**	**LACW**	**LASF**	
The regions11(44 obs.)	0.246*	-0.276*	0.005	0.0894	-0.199**	0.0684	0.76
	(-3.25)	(-3.18)	(0.13)	(0.57)	(-2.43)	(-1.20)	
Without Addis Ababa	-0.214*	-0.176**	0.021	0.128	-0.175**	-0.108**	0.78
(40 obs)	(-316)	(-2.09)	(0.63)	(0.90)	(-2.37)	(-1.99)	
Without Harari	-0.222*	-0.251*	0.003	0.114	-0.200**	-0.059	0.77
(40 obs)	(-2.94)	(-2.91)	(0.09)	(0.75)	(-2.53)	(-1.08)	
Without Oromiyia	-0.248*	-0.281*	0.014	0.075	-0.210**	-0.069	0.75
(40 obs)	(-3.14)	(-3.09)	(0.34)	(0.45)	(-2.38)	(-1.16)	
Without Amhara	-0.246*	-0.298*	0.009	0.075	-0.187**	-0.078	0.75
(40 obs)	(-3.11)	(-3.18)	(0.24)	(0.44)	(-2.05)	(-1.30)	
Without SNNPR	-0.278*	-0.248*	0.011	0.191	-0.184**	-0.079	0.76
(40 obs)	(-3.33)	(-2.57)	(0.29)	(0.97)	(-2.17)	(-1.32)	
Without Somali	-0.247*	-0.248*	0.005	0.086	-0.251**	-0.010	0.75
(40 obs)	(-3.15)	(-2.76)	(0.10)	(0.613)	(-2.12)	(-0.10)	

Note: Values in the brackets are t- values, the level of significance of each estimate indicated by *,** and *** for one, five and ten percent levels respectively.

CHAPTER FIVE

5. Conclusion and Policy Recommendations

5.1 Conclusion

Healthy population is vital for economic growth and development. This implies that building healthy society is not only crucial for individuals' health status, but also is critical element for development plan. Hence, identifying determinant of heath status is important to indicate certain policy options that enable the country to improve its health status, thereby attaining targeted level of development. In this sphere we tried to shed light upon the impact of per capita income, per capita public health expenditure, mother education, access to health facilities, clean water source and sanitation facilitates on health outcome measured by the prevalence of child stunting.

To identify the impact of each variables, a reduced health production function derived from utility maximization problem of household, is estimated using fixed effect estimation method. In addition, descriptive analysis was used to look at the association of socio economic variables and prevalence of child stunting in Ethiopia. For the analysis the data were obtained from Central Statistical agency, Ministry of Finance and Economic Development and Ministry of Health.

From the descriptive analysis it is found that per capita public health expenditure, mothers' education, access to clean water source and sanitation facilities have negative effect on the prevalence of child stunting. On the other hand, population per physician which is a proxy for access to health care services has positive association with prevalence of child stunting.

The regression result also indicated that per capita income, per capita public health expenditure mother education and access to clean water have negative and significant impact, on the

prevalence of child stunting. Population per physician has insignificant impact on prevalence of child stunting.

However, it is found that mother education have insignificant effect on child stunting when the effects of access to sanitation facilities, access to clean water source and physician per population are controlled for. From this, we can conclude that mother education affects child health through its impact on access to health care services, access to clean water source and sanitation facilities.

Furthermore, there is high correlation between per capita public expenditure and population per physician as well as clean water source and access to sanitation facilities. This might be the reason for the insignificant impact of population per physician and access to sanitation on child stunting rate in the fixed effect result. Uneven distribution and low utilization of health facilities might be the other reason for the insignificant impact of population per physician on child stunting in different regional states of Ethiopia.

5.2 Policy Recommendations

The empirical results obtained in our study have important lessons and policy implication for those involved in designing policies to improve prevalence of child stunting in particular and health status in general. These are:

Government should increase investment on schooling particularly for girls. The priorities should be given particularly to the regions with lower level of maternal education. Moreover, to reinforce the effect of schooling on health, it is useful to include health issues in the school curricula.

Public health expenditure should be increased on cost effective healthcare interventions with high payoff. Such intervention include: Different types of immunization programs, prevention and

treatments of infectious diseases, activities generating and disseminating of information on good health producing etc.

The country's development strategies should emphasize economic growth that gives better earning opportunities to the poor and better access to a wide range of health services.

Investment on water and sanitation infrastructures should be increased to increases the chance of getting access to clean water and sanitation facilities.

Reference

Ali, H.A, (2001) The effect of water and sanitation on child mortality in Egypt. Economic department paper, Gutenberg University.

Anand, S., M Ravallion (1993) Human development in poor countries: on the role of private income and public services. Journal of economic perspective 7 (1), 133-150.

Assefa, M, R Drewett, and F. Tessema, (2001) A Birth cohort study in South West Ethiopia to identify factors associated with infant mortality that are amenable to intervention. Ethiopian Journal of Health Development

Auster, R., Leveson, I and Sarochek, D., 1969. The production of Health, an Exploratory study. Journal of human resources Vol. 4,411-436.

Bajkumar, A.S and V., Swaroop, (2002) Public Spending and Health outcomes: Do governance matter? World Bank research group.

Baltagi, B. (2001) Econometric analysis of Panel data. Second ed. New York. Wiley.

Barrera, A., (1990) The Role of Maternal Schooling and its interaction with public health programs in child health production. Journal of development Economics Vol. 32, 69-91. North Holland.

Behrman, J. R. and A.B, Deolalikar, (1988) Health and Nutrition in the handbook of Development Economics volume I, edited by H. Chenery and T.N. Srinivasan.

Bidani, B., M., Ravallion, (1997) Decomposing social indicators using distributional data. Journal of econometrics 77,125-139.

Bound, J., D.A., Jaeger and R.M., Baker (1995) Problems with instrumental variable estimation when the correlation between the instruments and endogenous explanatory variables is weak. Journal of American Statistical Association, 90, 443-450

Brempong, K.G and M., Wilson, (2004) Health human capital and economic growth in sub-Saharan African and OECD countries. The Quarterly Review of economics and finance. 44, 296-320.

Buor, D. (2003) Mother education and child mortality in Ghana. Health Policy, 64, 297-309.

Caldwell. J.C, (1979) Education as a factor in mortality decline: An examination of Nigerian data population studies 33: 395-413.

Case, A., D., Lubotsky, and C., Paxson, (2002) Economic Status and Health in child hood: the origins of the Gradient. American Economic Review Vol. 92 (5), 1308-134.

Cebu Study Team (1992) A Child Health Production Function Estimated for longitudinal data. Journal of development economics 38, 323-351. North Holland.

Collier, P., Dercon, J, and J, Mackinnon. (2002) Density versus quality in health care provision: using house hold data to make budgetary choices in Ethiopia. The world bank economic review Vol. 16 (1), 425-448

Conagarajan, S. and X. Ye, (2001) Public health and education spending in Ghana in 1992-1998. Issue of equity and efficiency. World Bank policy research working paper No. 2579.

CSA, (1996). Welfare Monitoring Survey, Addis Ababa, Ethiopia

---------- (1998). Welfare Monitoring Survey, Addis Ababa, Ethiopia

---------- (1999). Report on the 1998 Health and Nutrition survey of Ethiopia.

---------- (2000). Welfare Monitoring Survey, Addis Ababa, Ethiopia

---------- (2001). Ethiopia Demographic and health Survey.

---------- (2004). Welfare Monitoring Survey, Addis Ababa, Ethiopia

---------- (2005). Preliminary report on demographic and health survey.

Desai, S. and S., Alva, (1998) Maternal education and child Health: Is there a strong causal Relationship? Demography Vol.35 No3.1

Fayissa, B. (2001). The determinants of infant and child mortality in developing countries: The case of sub-Saharan Africa. The Review of Black Political Economy.

Filmer, D. and L Pritchett, (1999) The Impact of Public Spending on Health: Do money matter? Social science and medicine. 49, 1309-1323.

Filmer, D., J.S., Hammer, and L. Pritchett, (1998) Health policy in poor countries: weak links in Chain. World Bank. Policy research working paper No. 1874 Washington DC.

Filmer. D, J. S, Hammer and L, H, Pritehett (2002). Weak link in the chain II: A Prescription for health policy in poor countries. The World Bank Research observer 17 (1), 47-66. Kebede, B. (2003)

Flegg, A.T., (1982) Inequality of income, Illiteracy and medical care as determinants of Infant mortality in underdeveloped countries. Population Studies.

Fuchs, V. (2001): Poverty and health: Asking the right questions. American economic review Vol. 36 (2)

Kebede B, (2003) Genetic Endowment, Parental and child health in rural Ethiopia. CSAEWPS/2003-10.

Glewwe, P., (1999) Why mother's schooling Raise child health in developing countries? Evidence from morocco. Journal of Human Resources Vol. 34 (1) 124-159.

Green, W.H (1990) Econometric analysis. 2nd. Prentice Hall, New Jersey.

Grossman, M. (1972). On the concept of health capital and the demand for health. Journal of political economy.

Gupta, S. M., Verhoeven and E., Tiongson, (1999) Does higher government spending buy better results in education and health care? IMF working paper. 99/21

Handa, B. and Sudhanshu (1996) Expenditure behavior and children's welfare: An analysis of female headed households in Jamaica Journal of development Economics Vol. 50, 165-187.

Hanmer, L., R. Lensink, and H., White, (2003) Infant and child mortality in Developing countries: Analysis the data for robust determinant. Journal of development studies volume 40 (1)- 101-118.

Hausman, J. A and W. Taylor (1981). Panel data and unobserved individual effects. Econometrica, 49 (6), 1377-1398.

Hausman, J. A. (1978) .Specification test in Econometrics. Econometrica, 46 (6), 1251-1271

Hiwote, T. (2005) Health production function in Ethiopia Unpublished M.A Thesis AAU. Ethiopia

Jain, A.K.,(1985) Determinants of Regional Variations in infant mortality in Rural India. Population Studies 39,407-424

Lavy, V., J., Strauss, D, Thomas and P., Vreyer (1996). Quality of healthcare survival and health outcomes in Ghana. Journal of Health Economics 15, 333-357.

Lee, Lf., M.R., Rosenzweig, and M.M., Pitt, 1997. The effect of improved nutrition, sanitation, and warer quality on child health in high mortality populations. Journal of econometrics. Vol. 77, 209-235.

Mackinnon, J., (1995) Health as an information Good: The determinates of child nutrition and mortality during political and economic recovery in Uganda. Wps/95-9. Center for the study of African economies, university of oxford.

Mariko, M., (2003) Quality of care and the demand for health services in Bamako, Mali: the specific roles of structural, process, and outcome components. Social science and medicine vol. 56, 1183-1196.

Ministry of Health (1994-2004): Health and Health related indicators various issues. Planning and programming department.

Mosley, W. and L.C, Chen, (1984) An analytical Framework for the study of child survival in developing countries. Population and development review volume 10, Supplement child survival: Strategies for research 25-45.

Musgrove, P. (1996) Public and Private role in Health. Theory and financing patterns. World Bank discussion paper No. 339 Washington Dc.

Or, Z., (2000) Determinants of health outcomes in industrialized countries: A pooled, cross-country, time serious analysis. OECD Economic Studies.

Preston, S.H., (1996) Population Studies of Mortality .Population Studies Vol. 50, 525-536.

Pritchett, L., L. Summers, (1996) Wealthier is Healthier. Journal of Human resources 3 (4): 841-868

Rosenzweing, M.R and T.P., Schultz (1983) Estimating a Household production function; Heterogeneity, the demand for health in put and their effect on Birth weight. Journal of Political economy, 91(50), 723-746.

Schultz, T.P. (1984). Studying the impact of house hold economic and community variables on child mortality. Population and Development review. Vol. 10 Supplement.

Schultz, T.P. (1999) Health and schooling investments in Africa. Journal of Economic Perspectives, 13 (3), 67-88

Schultz, T.P., (1993) Mortality Decline in low-income world: cause and consequences. The American economic review Vol. 83 (2):337-342.

Smith, J. P, (1999) Healthy bodies and thick wallets: the dual relation between health and economic status. Journal of Economic perspective volume 13 (2), 145-166.

Strauss, J. and Thomas, D., (1998). Health, Nutrition, economic development Journal of economic literature Vol. 35, 766-817.

Teachmam, J., G. J, Duncan, W.J, Yeung and D, Levey (2001) Covariance structure models for fixed and Random effect model. Sociological methods and research, 30 (2), 271-288

Tekce, B. and F., Shorter, (1984) Determinants of child mortality: A Study of Squatter Settlements in Jordan. Population and development Review, volume 10, Supplement: Child Survival: Strategies for research, 257-280.

Thomas, D., J., Strauss and M.H., Henriques (1990).Child Survival, Height for age and household characteristics in Brazil. Journal of Development Economics, 33, 197-234

Wang, L., (2002) Health outcomes in low income countries and policy implications: Empirical findings from Demographic and Health Surveys. World Bank research working paper No. 2831

Who- co.,(2005). Synthesis of Recent and Relevant Reviews and studies conducted in the health sector. Addis Ababa.

Wooldridge, J. M., (2003). Introductory Econometrics. A Modern Approach second ed. Michigan State University.

World Bank (2004) Ethiopia. Public expenditure review the emerging challenge (in two volume) volume I: Public spending in social sectors 2000-2020.

World Bank. (1993) investing in health. World development report. New York: Oxford University Press.

World Bank. (2005) Well- Being and Poverty in Ethiopia. The role of Agriculture and Private Agency.

Yared, M. and M. Asnakech, (2002). Utilization of maternal Health care services in Ethiopia. ORC Marco Calverton, Maryland USA.

Zakir. M and P.V., Wunnava, (1999) Factor Affecting infant Mortality rates: evidence from cross sectional data. Applied Economics Letters, Vol. 6, 271-273.

Appendix -1: Regression result for pooled OLS, fixed and random effect model

Dependent Variable: Provenance of child stunting

Explanatory variables			Methods used for Estimation			
	OLS		Random effect		Fixed effect	
	Coeff.	P>/t/	Coeff.	P>/t/	Coeff.	P>/t/
LPci	-0.0613		-0.0911		-0.2463	
	(-1.79)	0.082	(-2.22)	0.026	(-3.25)	0.003
Lphc	-0.1450		-0.1684		-0.2756	
	(-3.47)	0.001	(-3.26)	0.001	(-3.18)	0.004
LMe	-0.0156		0.02388		0.0047	
	(0.61)	0.544	(0.82)	0.410	(0.13)	0.901
LPP	-0.1813		-0.197	.	0.0895	
	(0.79)	0.001	(-3.47)	0.001	(0.57)	0.575
LACW	-0.2132		-0.2468		-0.1994	
	(-3.60)	0.001	(-3.73)	0.000	(-2.43)	0.022
LASF	-0.1418	0.002	-0.1298		-0.0684	
			(-2.69)	0.007	(-1.20)	0.240
Number obs.	44		44		44	
	F(6,37)= 18.08		wald chi (6)= 90.75		F (6, 27) = (14.49)	
	Prob> F = 0.0000		Prob>chi2 = 0.000		Prob > F = 0.0000	
	R.Squ.- 0.745		R-sq within= 0.6780		R-sq within =0.7631	
	Adj. R-Squr-0.704		Between= 0.8349		Between = 0.4055	
	Root MSE= .13144		Over= 0.7396		Over all= 0.3666	
			Corr (ui, X) = 0 (assumed)		Corr (ui, xb)= -0.9042	

Figures in Parenthesis are t- values