MPhil Research Thesis

The Macroeconomic Determinants of Non Communicable Diseases: A Panel Data Study of Low, Middle and High Income Countries

By

Zammarah Khalid

Registration No. 02/MS-HE/PIDE/2014

Supervised by:

Dr. Mahmood Khalid

Senior Research Economist

PIDE, Islamabad.

Department of Health Economics

Pakistan Institute of Development Economics,

Islamabad.

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Pakistan Institute of Development Economics

CERTIFICATE

This is to certify that this thesis entitled: **"The Macroeconomics Determinants of Non Communicable Diseases: A Panel Study of Low, Middle & High Income Countries".** submitted by Ms. Zammarah Khalid is accepted in its present form by the Department of Health Economics, Pakistan Institute of Development Economics (PIDE), Islamabad as satisfying the requirements for partial fulfillment of the degree of M. Phil in Health Economics.

Supervisor:

Dr. Mahmood Khalid
SRE PIDE,
Islamabad

Internal Examiner:

Dr. Ahsan Ul Haq
Assistant Professor
PIDE, Islamabad.

External Examiner:

Dr. Siham Sikandar
Assistant Professor
HSA, Islamabad

Head, Department of Health Economics:

Dr. Fazli Hakim Khattak

Date of Examination: April 09, 2018

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ACRONYMS

NCD	Non communicable diseases
CVD	Cardio-vascular Disease
CRD	Chronic Respiratory Disease
GDP	Gross Domestic Product
GNI	Gross National Product
LFP	Labor Force Participation
SSE	Secondary School Education
UPOPG	Urban Population Growth
HE	Health Expenditure
WHO	World Health Organization
HICs	High Income Countries
MICs	Middle Income Countries
LICs	Lower Income Countries
LMICs	Lower Middle Income Countries

ABSTRACT

The purpose of the study is to discuss the determinants of non communicable diseases at macro level in high, middle and low income countries through panel data which has incorporated 34 countries disaggregated on the basis of GNI (Gross National Income) per capita through 'Atlas Method' with a time of four years (with an average of 5 years each) that is: 2000, 2005, 2010 and 2015. The findings of the study shows that variables such as GDP and secondary school education when increase, they tend to decrease the Non communicable diseases, (i.e. cardiovascular disease, chronic respiratory disease, diabetes and cancers) whereas the labor force participation and health expenditure when increase they increase non communicable diseases. The study concludes that countries with higher level of incomes have less vulnerability to non communicable diseases and they can better protect themselves against such diseases and hence their macro variables have a positive impact on non communicable diseases.

CHAPTER 1

INTRODUCTION

1.1 Introduction

Non-communicable diseases are threatening the entire world now at the beginning of the third millennium. Moreover an upward movement is seen in developing countries, where it is not easy to handle the burden of diseases in a weak and broken health structure. This could be due to a socio-economic and demographic changeover, which enforces more demand on handling infectious and non infectious diseases in an underprivileged setting. By 2020 is has been fearfully predicted that the cause of every seven out of ten deaths will be due to non communicable diseases in developing countries which is alarmingly higher. Particularly cardiovascular disease, diabetes, cancer and chronic respiratory disease are considered the main cause of death among NCDs because they have a higher disease burden globally with an increasing tendency in developing countries (Boutayeb, A. 2006)

Non-communicable diseases (NCD) are the kind of diseases which prolong for long durations and are not infectious, which means they cannot be transmitted to one another. NCDs can be referred as chronic diseases because of their long durations and slow progression. As mentioned earlier about the four main abundantly occurring diseases among NCDs which are cardiovascular disease, diabetes, cancer and chronic respiratory disease can cause prompt deaths. These diseases occur as a result of a combination of genetic, physiological, environmental and behavioral factor. (WHO 2017. Retrieved from http://www.who.int/mediacentre/factsheets/fs355/en/).

NCD's are not limited to any age group or region but it affects people of all age groups, regions and countries. The conditions of NCD's are frequently linked with age group of older

people but facts indicate it's occurrence between the ages of 30 and 69 years in total of 15 million deaths. It is estimated that over 80% of the NCD's deaths arise in the area under discussion that is low- and middle-income countries. The risk of NCDs is not bound to any age group, rather people from all age groups weather it is the children, the adults or the elderly are vulnerable to it. The cause of the risk factors can arouse from harmful diets, inactive body and also excessive or unsafe use of tobacco and alcohol. (WHO 2017. http://www.who.int/mediacentre/factsheets/fs355/en/).

1.2 Economic Burden

The evaluation of burden of disease in populations majorly concerns the capacity of morbidity and mortality. The cost of poor health can be huge on the economy due to which a partial picture of the undesirable effect of ill health is provided on human welfare. A lot of policy questions are taken into consideration regarding the cost of disease and injury while analyzing the economic shock of poor health. Out of these questions some are related to household's income, or a firm's profit at micro level. The questions also relate to macroeconomic level like the total impact of a disease on a country's gross domestic product (GDP) including both current and foreign. (WHO 2017. Retrieved from http://www.who.int/mediacentre/factsheets/fs355/en/).

1.3 The Macro Economic Context

Macroeconomics studies phenomenon of economy-wide movements in macro variables like output, unemployment and inflation. Such growth is related with expansions and recessions alternatively overtime and is not steady, keeping in view that the developed economies are often characterized by their growth. This growth is also associated with movements in unemployment (Blanchard, 1989).

Besides creating a cost to the economics resources of a country the Non communicable diseases create a great deal of disease burden which reduces the overall productivity,

increases unemployment and poverty. Not only these, there are many other macroeconomic variables which affect the NCDs. The effect of macroeconomic variables on NCDs will be taken into consideration in the study.

1.4 The Economic Impact of Chronic Diseases

Chronic diseases as the name implies have lifelong harmful effects not only on the economy but also on individuals, their families, the health system and society in which they live. Such diseases have a tendency to influence people particularly who are in their fruitful age, thus reducing the labor productivity and their capacity to earn at a household level. Treatment of chronic diseases puts much damage on the already overloaded health system, because it requires additional resources. Investments are required for interventions to control the burden of chronic diseases so that it can bring economic benefit to the country in the long term. The interventions implemented in other countries can be taken as lessons learnt in reducing the burden of chronic diseases from them (Puoane et.al 2008)

NCD's are considered to be diseases of the rich and elderly since old times, however they are now severely impacting on people in low- and middle-income countries (LMICs). Four people out of five live in low-middle income countries with an NCD.

The driving force of NCD's is by four main modifiable risk factors that includes tobacco use, unhealthy diet, physical inactivity, and harmful use of alcohol. NCDs are considered a major cause of poverty and a barrier to economic and social development. Many NCDs can be preventable and premature claiming health and lives, considering the global burden of NCDs which is expected to increase by 17 percent by 2025.

With the largest NCD burden occurring in LMICs and leading to poverty, the prevention and control of NCDs is an urgent development need. The cost to individuals and society

of healthcare and loss of income-earners hampers poverty reduction and sustainable development. NCDs constrain the bottom billion in chronic poverty. (NCD alliance network website).

Non- communicable diseases pose a threat towards the sustainable development goal to be achieved as of 2030 has incorporated the goal of reducing premature deaths by one third. The non-communicable diseases are also associated with poverty. If the non communicable diseases spread substantially, they will increase the cost of households for health care, thus increasing poverty, hence NCD's are considered to increase poverty in low income countries. People who are defenseless and who are underprivileged are at a greater risk to die of such diseases than people who are socially and financially stable. The poor are exposed to unhealthy diets like tobacco and unhealthy lifestyles and less access to health services. In areas where there are low resources, non communicable diseases take over all the available household resources, which include prolonged and non affordable treatments and death of the bread earners under treatment. This increases poverty on annual basis and strangle development (WHO media center website 2017)

1.5 Non-Communicable Diseases in Lower, Middle and High Income Countries

The non-communicable diseases has raised manifold and their collision in low- and middle-income countries has obtained increased attention recently. This rise can be explained and understood by the developmental histories of the countries with high income which had a different practice for development than the countries with low and middle income to know about the outbreak of such diseases in these countries. To provide a powerful evidence for an approach to prevention, different aspects of such determinants of NCDs should be discussed which are related to development and degeneration. In order to decrease population risk and individual vulnerability, different health policies should be taken into account as an intervention.

Strengthening of primary care as a health system agenda is the most important policy in effort to decrease the charge of this increasing outbreak. (Miranda, 2008)

Although NCDs have a high burden on mortality and morbidity in LMICs but very little is known about the impact on households of these countries. Taking a look at the medical cost forced by NCDs on households and being incapable to work cause a deep financial burden on poor households while they look for medical care. The cost's major portion includes medicines and the use of branded medicines which is only tip of the iceberg, including the treatment of diabetes, represents a significant source of payments for patients. These monetary expenses discourage majority of these people tormenting from Non communicable diseases from searching health care which they require. The opportunity cost of "being unable to work" pose a threat to their financial constraints and their lives as well. Therefore, NCDs impose a substantial financial burden on many households, including the poor in low-income countries. (Kankeu, H. T 2013)

The burden of disease and loss of economic output associated with chronic diseases chiefly cardiovascular diseases, cancer, chronic respiratory diseases, and diabetes account for around 80% of the total burden of chronic disease mortality in developing countries. In these low-income and middle-income countries, chronic diseases were responsible for 50% of the total disease burden in 2005. If nothing is done to reduce the risk of chronic diseases, an estimated US$84 billion of economic production will be lost from heart disease, stroke, and diabetes alone in these countries between 2006 and 2015. (Abegunde 2007)

1.6 Research Gap

Numerous empirical studies are available, that investigate the macro determinants of non communicable diseases; however, most of these studies followed secondary data analysis by conducting interviews or gathering information. (killiari 2012), Ahmad et.al (2012) Some studies have also used secondary data sets but they are limited to specific countries or regions. David. E. Bloom et.al. (2014)

The proposed study is going outside the framework of these studies. Most of the studies follow social determinants of NCDs. The present study contributes to the literature by exploring the macro determinants of non communicable diseases at the world representative sample by utilizing dynamic panel data. Furthermore, the proposed study also contributes by splitting the sample into Low, Middle and Higher Income countries to also investigate the determinants at country's development level.

1.7 Objectives of the Study

- To examine the trend of non-communicable diseases in sample countries overtime.
- To identify the macroeconomic determinants of non-communicable diseases.
- To examine the magnitude of each included variable on non-communicable diseases and a disaggregate analysis of each group; developing, developed and under-developed countries.

1.8 Research Questions

1. Is there any variation in the macro-economic determinants of non communicable diseases among low, middle and high income nations?
2. Is there any association between health expenditure and non communicable diseases?
3. Situation analysis of NCD's by income grouping of countries

1.9 Organization of the Study

The structure of the proposed study is followed in such a manner that the first section gives the introduction presenting a clear view of non communicable diseases and its related determinants inside different income groups, further showing the divergence of non communicable diseases among different income groups i.e., high, middle and low income countries, also showing, trends in developed and less developed countries. The

second chapter is based on the prior theoretical as well as empirical works. In the theoretical model, justification for independent variables are discussed that how these variables link and affect the dependent variable. The third chapter consists of methodological structure which shelters the economic models, econometric models, estimation technique and variables defined in detail. Chapter four consists of descriptive statistics of the data for full and sub samples, result and discussion for aggregated and disaggregated samples. The last Chapter 5 is based on conclusion and policy implications.

CHAPTER 2

LITERATURE REVIEW

Cancer, diabetes, and heart diseases are no longer the diseases of the wealthy. Today, they hamper the people and the economies of the poorest populations' even more than infectious diseases. This represents a public health emergency in slow motion (Ban Ki Moon2009). Apart from macroeconomic determinants, the global and socioeconomic determinants of non communicable diseases also influence the economy.

2.1 Global Factor

Layal et.al (2014) studied the global impact of non communicable diseases on macroeconomic productivity by the usage of modeling techniques applied on adults. Several other techniques were also used like cohort and case control studies and RCTs (Randomized Controlled Trials). The study concluded that the NCDs generate a large impact on macro-economic productivity in the WHO regions. However, this evidence found was heterogeneous, of varying quality and not evenly geographically distributed.

2.2 Socio Economic Factor

A study published by World Health Organization (WHO) (2014) studied the social determinants of non communicable diseases and other public health issues in Seychelles. The purpose of the study was to identify social and economic factors which disadvantage certain population groups from realizing their potential life years. By using traditional methods and secondary data, the report concluded that Seychelles is at the end of both the demographic and epidemiologic transition and has undergone nutrition and development transitions that have exposed Seychelles to non-communicable diseases.

(Kira fortune, et.al) discussed the social determinants of non communicable diseases in a working paper. The study stated that Middle and lower-middle income countries are also seeing a shift in their disease profiles as they experience economic growth and health system development aside from the high income countries which are historically considered as most effected by non communicable diseases.

Ahmad et.al (2012) studied the socioeconomic inequalities in risk factors for non-communicable diseases in low-income and middle-income countries. This study included self-reported data derived from the2002–2004 World Health Survey. The results showed Smoking and low fruit and vegetable consumption were significantly higher among lower socioeconomic groups. The highest wealth-related absolute inequality was seen in smoking among men of low- income country group.

Kiliari et.al (2012) studied socioeconomic determinants of non-communicable-diseases among the Cypriot population. A nationally based survey conducted through personal interviews, using a structured questionnaire design has provided initial evidence for the existence of a socioeconomic element in the lifetime prevalence of chronic disease in Cyprus.

2.3 Macro Economic Factor

Another study by David Mayer et.al (2012) discussing the macroeconomics of NCD policy objectified to examine the macroeconomic dimensions of public, evidence-based health policies for reducing the prevalence of non-communicable chronic diseases (NCDs) and their risk factors in the Region of the Americas. The aim was to give a broad outline of the macroeconomics of NCDs, ranging from risk factor management and health costs to long-term economic growth and human development. The study concluded that NCDs are a costly, lifelong phenomenon.

Bloom et.al. (2014) studied the macroeconomic impact of non-communicable diseases in China and India. Several methods have been used but a common methodology used is the cost-of-illness or human capital approach, which combines direct costs (medical care, travel costs, etc.) and indirect costs (the value of lost production because of reduced working time) into an overall estimate of economic impact on society, often expressed as a percentage of current GDP. The study concluded that the costs associated with NCDs in both China and India was substantial, both in absolute terms and relative to other indicators such as the flow of expenditure on health care in a given year in each country. China had more expenditure so it was inferred that an economy with higher GDP has higher losses.

2.4 Non-Communicable Diseases in different Countries:

Customarily chronic NCDs were always considered to be diseases of rich people but as of today, the increasing facts tell that these diseases are now socially distributed among all kinds of income. Fernando (2011) reviewed the burden of chronic non-communicable diseases in the region and examined key mythology adjoining their occurrence and allotment. It argues that a social justice approach embedded in the idea of health inequity needs to be at the heart of research in this area, and concludes with discussion of a new approach to guide empirical research, the 'average/deprivation/inequality' framework.

(Justin B et al., 2011) reviewed the evidence on the frequency, determinants and consequences of NCDs in Cameroon, in which the burden of NCDs has increased accounting for 43% of all deaths in 2002. It has been observed that there is an increasing trend in the prevalence of hypertension as well as diabetes between 1994 and 2003. Intensity of increased occurrence of obesity has been observed in urban settings over the same period by 54-82% higher. Such changes occur from taking up poor dietary

habits, no physical activity for longer periods and excessive use of tobacco. The economic progress of any country and its social mobility determine such behavioral changes. (Justin B et al., 2011)

Syed Masud Ahmed at al., (2009) studied the risk factors for major NCDs and its determinants in HDSS sites of five Asian countries which are Bangladesh, India, Indonesia, Thailand, and Vietnam. The most cost efficient approach to reduce the outbreak of NCDs is Primary prevention by improving risk factors through population based programs. Data was taken from a multi-site chronic NCD risk factor prevalence survey conducted in 2005. This cross-sectional survey used a standardized questionnaire developed by the WHO to collect core data on common risk factors such as tobacco use, intake of fruits and vegetables, physical inactivity, blood pressure levels, and body mass index. Respondents incorporated randomly selected sample of adults 25 to 64 years living in nine rural HDSS sites in Bangladesh, India, Indonesia, Thailand, and Vietnam. Findings revealed a considerable percentage of these mainly rural populations having three or more risk factors for chronic NCDs. Chronic NCD risk factors were linked with increasing age, being male, and higher education.

(Mirza Balaj et al., 2017) examined the allocation of social and behavioral determinants of health and of physical and mental in Nordic countries (Denmark, Finland, Norway and Sweden) as resources in those countries are limited. Gender differences for 17 health outcomes and 20 determinants of health were examined on regional and country level. Data was collected from the 7th wave of the European Social Survey. Generally, the population of the Nordic region reported along with the maximum prevalence for one or both genders in 10 out of 17 health outcomes. Despite that overall self-rated health levels tend to be better in the Nordic region. Nordic countries also hold on to a healthier lifestyle and have better access to health care.

J Bousquet et al., 2015 studied developmental determinants in NCDs and ageing and infers that prenatal measures play an essential part in health, growth of diseases and getting old (Developmental Origins of Diseases and Health). The main idea of the research is to determine the facts which help in healthy ageing actively. This will help to update strategies for the ageing population to reduce the individual as well as the cost of overall society and also expand useful strategies of its prevention. The study compared the flow of diseases caused by respiratory problems with other chronic diseases considering it a major problem.

Reddy, K. S. (2002) studied the CVDs in developing countries summarized that the global burden of disease due to cardiovascular diseases (CVDs) is rising, predominantly due to a sharp rise in the developing countries which are experiencing quick health changeover due to demographic shifts with altered population age profiles, lifestyle changes due to urbanization, delayed industrialization and globalization. Distorted diets and less physical activity are serious factors which contribute to the increase of rate of CVD epidemics, along with tobacco use. The author suggested that a complete public health response must incorporate policies that effectively impact on the multiple determinants of these diseases and supply defense over the life span through primitive, primary and secondary prevention.

Non-communicable diseases (NCDs) have developed into a major public health problem in India accounting for 62% of the total burden of foregone DALYs and 53% of total deaths. In this paper, (JS Thakur, et al., 2011) reviewed the social and economic impact of NCDs in India to outline this impact at household, health system and the macroeconomic level. Out-of-pocket expenditure linked with the delicate and long-term effects of NCDs is high resulting in catastrophic health expenditure for the households which ultimately results in poverty. In macroeconomic term, most of the estimates

propose that the NCDs in India report for an economic burden in the range of 5–10% of GDP, which is considerable and hampering GDP thus making development stagnant. While India is all together experiencing several disease burdens due to old and new infections, nutritional deficiencies, chronic diseases, and injuries, it has to be powerfully supplemented with population-based services and action on social determinants of health next to individual services. Since health sector alone cannot deal with the chronic emergency of NCDs, a multi-sectoral action for universal coverage to population and individual is required. (JS Thakur**,** 2011)

Eric Maimela at al., 2016 studied the prevalence and determinants of chronic non-communicable disease (NCD) risk factors in a rural community in the Limpopo Province of South Africa. This survey was conducted using the WHO "STEPWISE" approach to the examination of non-communicable diseases" (STEPS) methodology. Participants were residents of the Dikgale HDSS site and standardized international protocols were used to measure behavioral risk factors (smoking, alcohol consumption, fruit and vegetable intake and, physical activity) and physical characteristics (weight, height, waist and hip circumferences and blood pressure– BP). The study results indicated people were expected to be hypertensive if they were consuming alcohol, obese and also older than 40 years. The Smoking habit was seen considerably in people who were either not married or divorced, particularly in older age male people, whereas the older age male people were also linked with alcohol consumption but with the exception of low educational and income status.

CHAPTER 3

METHODOLOGY

3.1 Introduction

To obtain the objectives of this empirical study, a theoretical and methodological structure have been specified. First section discuses theoretical framework while second section discusses variables whereas last part of this chapter is about methodological framework.

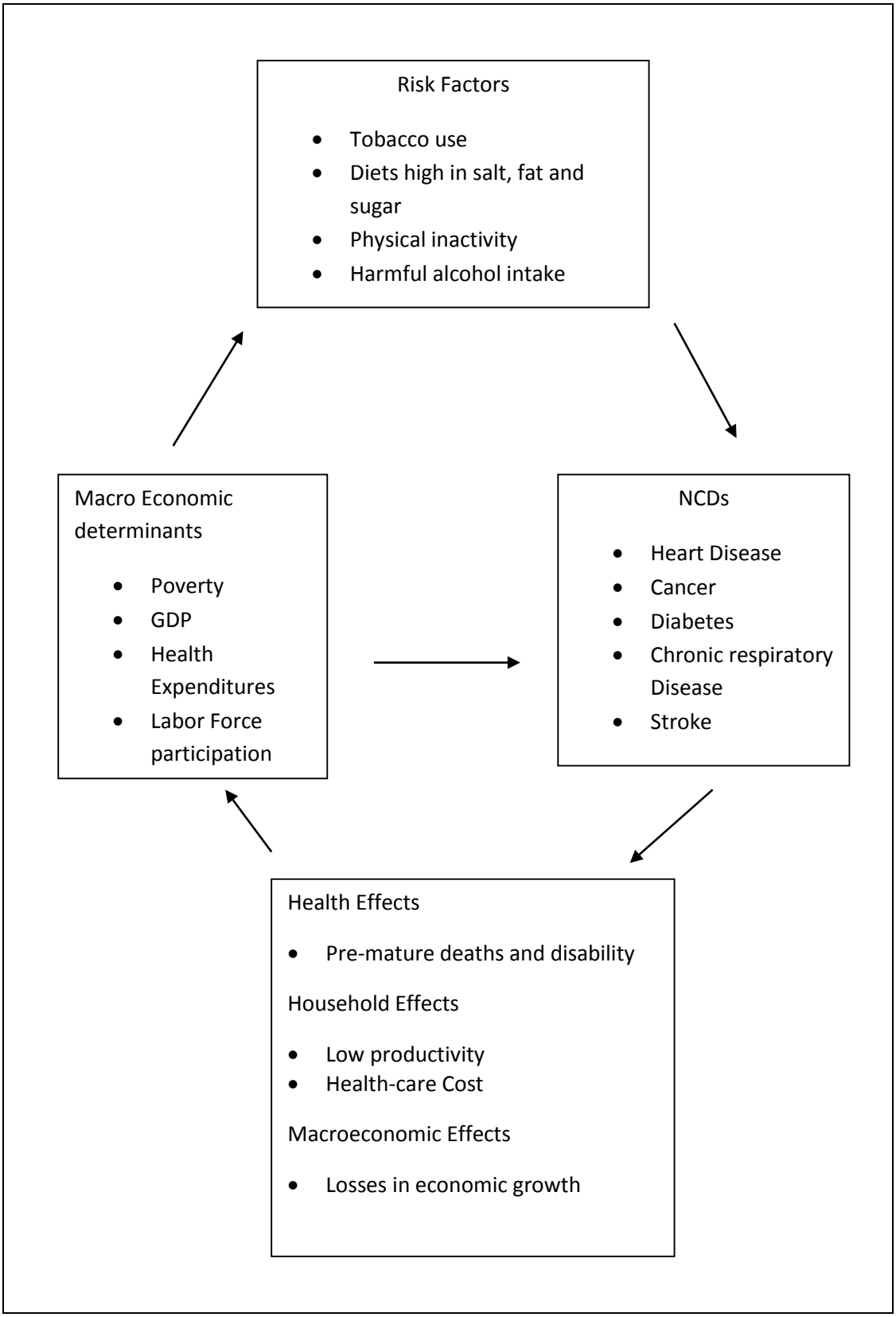
3.2 Theoretical Model

In this section, the theoretical framework of the study has been presented to analyze the possible theoretical channels and links through which explanatory variables like (per-capita income, health expenditure, population growth and disasters can affect the dependent variable, Non Communicable disease) can be explained.

As shown in the figure below, the risk factors earlier discussed like tobacco and alcohol use, physical inactivity, poor dietary habits trigger Non communicable diseases mainly CVDs, CRDs, diabetes and cancers. The non communicable diseases ultimately affect the individuals on various levels i.e., health, household and macroeconomic level in terms of economic loss which produces the macroeconomic determinants of NCDs like poverty, GDP, health expenditure and labor force participation. These determinants will affect the non communicable diseases and also aid in the generation of the risk factors of these NCDs hence this cycle can be a sort of vicious circle from which it is not easy to get out.

Figure 3.1: *Adapted from The lancet: Priority actions for NCDs crises*

Basic model of non-communicable diseases depends on different variables including per-capita income, health expenditure, and secondary school enrollment and labor force



participation which are to be dealt in this research. Different theories exist with different dimensions and arguments. According to life-course theory people are influenced by different factors at every stage of life but the tendency of developing NCD grows as age

increases. It is hence significant to obtain a healthy growth in the early years of life and to preserve the ability to function at adulthood. This will help in the prevention of disability in older life. The productivity of an individual is higher at early and adult age, so if he retains it by having access to safe drinking water and food, and also by getting education, the overall productivity and GDP will increase, while reducing the risk of non communicable diseases.

As the risk of NCDs decreases, life expectancy of an individual increases, a part from the different factors which contribute to this increment of life expectancy, there can be other factors as well. It is important to consider this factor in our study as a decreased NCD increases life expectancy. According to Preston curve apart from changes in income other factors like better education, nutrition and services of health sector like vaccinations contribute to a higher life. A decline in life expectancy has been observed in several countries of Sub Saharan Africa due to some communicable and non communicable diseases.

Empirical information show that public health care expenditures, education, environmental pollution and financial gain gift are the important health determinants and have a major impact on the life expectancy and decline of premature mortality.

3.3 Data and Methodological Frameworks

In order to identify the Macro Economic determinants of Non communicable disease this empirical study will use panel data for 35 countries over the period 1990 to 2015 for independent variables whereas for dependent variable (Non communicable disease), the data for 2000, 2005, 2010 and 2015 has been taken. It mainly includes developed and less developed countries. The division of the countries is based on their respective GNI (Gross National Product) per capita. These countries are divided into three main categories; high, middle, and low income countries, according to their respective GNI

per-capita income US dollar. The lists of countries which will be sampled for this study are as under:

High income countries[1]: Norway, Switzerland, Australia, United States ,Singapore, Canada, Austria, Germany, , France, United Kingdom, Japan, New Zealand, Italy, Spain, , and Russia.

Middle income countries[2]:

Upper middle income countries: Brazil, Turkey, Malaysia, China, Iran, South Africa, and Paraguay

Lower middle income countries:, Indonesia, Ukraine, Sri Lanka, Nigeria, India and Pakistan.

Low income countries[3]: Tanzania, Zimbabwe, Ethiopia, Nepal, Malawi, and Uganda.

The proposed model is as below;

$$\boldsymbol{NCD_{it} = \propto_0 + \propto_1 GDPPC_{it} + \propto_2 HE_{it} + \propto_3 SSE_{it} + \propto_4 LFP_{it} + \propto_5 UPOP_{it} + \mu_{it}}$$

Where "i" represent country index, and "t" represent time index, NCD represents non-communicable diseases,$GDPPC_{it}$ is GDP per-capita, HE_{it} health expenditure,SSE_{it} is Secondary School enrollment whereas $UPOP_{it}$is urban population growth.

3.4 Variables and Description

Variables	Description	Date Sources

[1]High income countries are those with a GNI per capita of $ 12,746and above.

[2] Middle income countries are those with a GNI per capita of more than $ 1,045 and less than $ 12,746

[3] Low income countries are defined as those with a GNI per capita of $ 1,045 or below.

Source (world Bank Atlas method 1 July, 2014)

Non-communicable diseases	Non-communicable diseases (NCD) are the kind of diseases which prolong for long durations and are not infectious, which means they cannot be transmitted to one another. NCDs can be referred as chronic diseases because of their long durations and slow progression	WHO 2016
Real Gross Domestic Product, Per Worker (GDP per Worker)	Per worker gross domestic product ($RGDPPC_{it}$) is an indicator measure of the average wage rate in a given country. Worker status was determined by whether one reported himself as "economically active".	WDI (2015)
Health Expenditures, Per Capita (Health Ex)	Per capita health expenditures (HE_{it}) is defined as the per capita dollar amount of a country's public and private health expenditures in current. Health expenditures include provision of preventative and curative health services, activities related to family planning, nutrition and emergency aid	WDI (2015)
Secondary School Enrollment	Secondary School Enrollment SSE_{it} is the total number of students who are enrolled at either public or private secondary education institutions despite of age in a time of one year. It includes enrollment from class 8thto class 12th.	WDI (2015)
Urban Population Growth	This Variable includes people who are living in urban areas as defined by national statistical offices. It is calculated using World Bank population estimates.	WDI (2015)
Labor Force Participation	LFP is the part of the population who is economically active and ages 15 and older people who supply labor for the production of goods and services during a specified period (per year).	WDI(2015)

3.5 Operationalization of Variables

3.5.1Dependent Variables

Non- Communicable Diseases

The dependent variable (NCD_{it})for this study is non communicable diseases are the kind of diseases which prolong for long durations and are not infectious, which means they cannot be transmitted to one another. NCDs can be referred as chronic diseases because of their long durations and slow progression

Here four main non communicable diseases are taken cancer, diabetics, cardio vascular diseases (CVD) and chronic respiratory disease (CRD).The Data source for NCDs is the World Health Organization report for 2016

3.5.2 Independent variables

Gross Domestic Product, Per Worker (GDP per Worker)

Per worker gross domestic product ($GDPPC_{it}$) is the average wage rate in a given country. Worker status was determined by whether one reported himself as "economically active". The Data source for GDP/worker is the World Bank's "World Development Indicators" report for 2014-15.

Decrease in GDP per worker indicates that workers have ill health and has low productivity. They due to their health cannot give their full potential or output and hence will lose their daily wages due to absenteeism. So GDP will overall decrease due to non communicable diseases Thus, it is hypothesized that as per worker gross domestic product decrease, average non-communicable diseases will increase.

Health Expenditures, Per Capita (Health Ex)

Per capita health expenditures (HE_{it}) is defined as the per capita dollar amount of a country's public and private health expenditures in current. Health expenditures include provision of preventative and curative health services, activities related to family planning, nutrition and emergency aid. The Data source for health expenditures is the World Bank's "World Development Indicators" report for 2014-15.

Increases in health expenditures per capita mean that a country is devoting more of its resources towards the provision and enhancement of health services. In addition, greater health expenditures per capita would imply that advancements in medical technology are improving at a faster rate, due to the fact that more resources are being funneled towards health expenditures, and thus health research. Spending on health will increase one's life expectancy and then have a higher output and productivity. Lastly, greater health expenditures per capita may be a subtle indication that a country places a high value on health and long life, especially in richer countries. Thus, it is hypothesized that as health expenditures per capita increases, average non-communicable diseases will decrease.

Secondary School Enrollment

Secondary School Enrollment is the total number of students who are enrolled at either public or private secondary education institutions despite of age in a time of one year. It includes enrollment from class 8th to class 12th.The Data source for Secondary School Enrollment is the World Bank's "World Development Indicators" report for 2014-15.

It has been keenly observed that those individuals who are fortunately more educated have the opportunity of earning high real wages. Higher wages of individuals makes the overall household income higher (on average). This increase in wages will allow the people to attain better and more health care services. Also, by getting education, people can understand better about the food intake, dietary and physical habits, better preventative measures and hygiene Thus, it is assumed that as secondary school enrollment increases, non-communicable diseases decreases.

Urban Population Growth (UPG)

Urban Population Growth includes people who are living in urban areas as defined by national statistical offices. It is calculated using World Bank population estimates and

urban ratios from the United Nations World Urbanization Prospects. Data for this variable is obtained from the World Bank's "World Development Indicators report for 2014-15. Urban population is assumed to have a negative effect on the non communicable diseases, as urban population increases, non communicable diseases decrease, due to better lifestyle, hygiene of people, adoption of good food intake and prevention from different forms of illness prevailing.

Labor Force Participation (LFP)

LFP is the part of the population who is economically active and ages 15 and older people who supply labor for the production of goods and services during a specified period (per year). Data is obtained from "World Development Indicators" report for 2014-15.

Improved labor force can effectively increase the productivity of a country or total output, which further effect the income level of that specific country leading to a healthy and better environment thus reducing non-communicable diseases.

3.6 Econometric Methodology and Estimation Techniques:

Since Panel data will be used, therefore the proposed models to be applied are fixed effect and random effect model. Fixed effect assumes that cross-sectional differences are due to fixed reason that is the countries are chosen on some fixed basis, e.g. level of income (measured in GNI per capita).

Equation for Fixed effect Model:

The general form of fixed Effect model

$$NCD_{itj} = \propto_i + \propto_1 GDPPC_{it} + \propto_2 HE_{it} + \propto_3 AYS_{it} + \propto_4 ASD_{it} + \propto_5 LF_{it} + \mu_{it}$$

Another approach to check these differences is the random effect. It assumes that the cross-sectional differences in the panel of countries are just random.

Equation for Random effect:

This test consider constant for each section as random such as:

$$\propto_i = (\alpha + V_i)$$

Where V_i implies a zero mean standard random variable

$$NCD_{itj} = (\alpha + V_i) + \propto_1 GDPPC_{it} + \propto_2 HE_{it} + \propto_3 AYS_{it} + \propto_4 ASD_{it} + \propto_5 LF_{it}$$

Hausman Specification Test:

Hausman's specification test, or *m*-statistic, can be used to test hypotheses in terms of bias or inconsistency of an estimator. This test was also proposed by Wu (1973). Hausman's *m*-statistic is as follows.

Given two estimators, β_0 and, β_1 where under the null hypothesis both estimators are consistent but only β_0 is asymptotically efficient and under the alternative hypothesis only β_1 is consistent

The hausman test will tell about the preferable model, either the results of fixed effect model are applicable or the results of random effect model

CHAPTER 4

RESULTS AND IMPLICATIONS

The study will estimate the descriptive statistics of the all the sample first, and then descriptive of all the categories, that is high, middle and low income countries

Table 4.1: Statistical Descriptive Analysis of full sample

	Mean	Median	Maximum	Minimum	Std. Dev.
Non-communicable Disease (male and female)	419.8735	380.65	969.1	248	148.6019
Secondary School Enrollment	10547537	4214788	99460184	2.430466	20854533
Urban Population Growth	1.236246	1.175998	3.99941	-0.43208	0.966701
Labor Force Participation	61.72479	63.45	78.12	1.005732	9.635822
Health Expenditure	8.703289	8.747235	17.14075	2.901716	2.669228
Gross Domestic Product per capita	33025.62	32505.23	95442.71	827.1458	19607.95

4.1 Interpretation of statistics of complete sample:

As can be seen from the above table, the statistical analysis of full sample which shows that on average, out of every 100,000 population, the rate of deaths occurred by non communicable diseases between the ages of 30 to 70 for both male and female is 419.8735.The range of data spreads between 248 and 969.1 with a median of 380.65. Looking at the secondary school enrollment, it is inferred that on average 10547537 students are enrolled in a year despite of any age from grade 8^{th} to 12^{th}. The urban population growth on average per year is 1.2 percent of GDP. As seen in the table, the labor force participation (age 15 and above) rate on average is 61.7 percent in a year. The average health expenditure in a year in high, middle, and low income countries is

8.7 percent of GDP, whereas the average per capita income as shown in the table is 33025.

Dollars per year of these selected countries.

Table 4.2: Statistical Descriptive Analysis of High Income Countries

	Mean	Median	Maximum	Minimum	Std. Dev.
NCDB	399.84	369.8	969.1	248	145.009
GDPPC	36760.5	34854.12	95442.71	2063.728	17732.79
HE	9.047486	9.258869	17.14075	2.901716	2.592767
LFP	60.40076	62.3	68.08	1.005732	9.425174
SSE	5300187	3247822	24586546	211222.9	6121253
UPOP	1.032573	1.099411	3.59661	-0.43208	0.740116

4.2 Interpretation of Statistics of High Income Countries

The descriptive analysis of high income countries show a different picture as this only targets the high income countries, the average deaths occurred per year by non communicable diseases is 399.84, whereas the GDP per capita of such countries is as high as 36760.5 dollar on average which is a factual picture of them being high income countries. The average health expenditure incurred in a year shows a value of 9.04 percent of the GDP, which is pretty much high. The labor force participation rate (age 15 and above) shows a percentage of 60 on average. The secondary school enrollment as seen in the table is 5300187 students per year on average despite of age from grade 8 to 12. The urban population growth rate has an average of 1 percent in high income countries. There is less urban population growth in high income countries due to the fact that the rural areas in high income countries are fully resourceful and developed. They have almost as much facilities as any urban area in the developed countries, which

is why people migrate less. It is necessary to compare the means and averages of all sorts of income countries, which is why, the averages of middle and high income countries are also included.

Table 4.3: Statistical descriptive analysis of middle income countries (1990-2015)

	Mean	Median	Maximum	Minimum	Std. Dev.
NCDB	654.7558	643.35	916.2	451.5	112.2956
LFP	59.26846	57.86	78.12	43.48	8.641341
HE	5.055284	4.38921	9.833575	2.028393	1.991875
GDPPC	3402.87	2708.445	11507.12	315.9533	2907.754
SSE	1916813	6149732	1.15E+08	2.430466	30988875
UPOP	2.496003	2.662319	4.664878	-0.827209	1.347605

4.3 Interpretation of Statistics of Middle Income Countries

The descriptive analysis of middle income countries shows another picture as this targets not only upper but also the lower middle income countries, the average deaths occurred per year by non communicable diseases is 654.7558whereas the GDP per capita of such countries is 3402.87dollar on average which is very less than high income countries. The average health expenditure incurred in a year shows a value of 5.05 percent of the GDP, which is also less as compared to high income countries. The labor force participation rate (age 15 and above) shows a percentage of 59.2on average, which is almost equal to the high income counties, which shows that there is a high percentage of active labor in these countries. The secondary school enrollment is however as seen in the table is 1916813 students per year on average despite of age from grade 8 to 12. This shows that on average the secondary school enrollment of middle income countries is lower than high income countries which mean that there are fewer trends of higher

studies in these countries. The urban population growth rate has an average of 2.49 percent in middle income countries which is higher than high income countries due to the fact that people migrate for better lifestyles, better education and health systems.

Table 4.4: Statistical Descriptive Analysis of Low Income Countries

	Mean	Median	Maximum	Minimum	Std. Dev.
NCDB	625.1208	634.95	791.7	502.6	71.29386
SSE	1231396	914140.8	4514073	221160.8	1056928
UPOP	4.084932	4.195917	6.642635	1.02622	1.313186
HE	5.989613	5.856154	10.1593	2.756001	1.78329
LFP	83.20667	83.2	89.48	73.1	4.115217
GDPPC	423.1047	391.3382	869.2997	129.7593	210.3507

4.4 Interpretation of Statistics of Low Income Countries

The Low income countries show the average deaths occurred per year by non communicable diseases as 625.1208whereas the GDP per capita of such countries is 423.1047dollar on average which is even far too less than middle income countries. The average health expenditure incurred in a year shows a value of 5.98 percent of the GDP, which is also less as compared to high income countries, but a little higher than middle income countries. The labor force participation rate (age 15 and above) shows a percentage of 83.2on average, which is 20 percent more than high and middle income counties, may be due to the fact that there are more people doing labor work due to less education, and less availability of high income jobs. The secondary school enrollment is even less than high and middle income countries due to less affordability for higher education as seen in the table is 1231396 students per year on average despite of age from grade 8 to 12. The urban population growth rate has an average of 4 percent in low

income countries which is higher than high and middle income countries due to less education and job opportunities in rural areas, low resources, and improper lifestyles.

4.5 Comparison of Sampled Countries

The results of country-wise statistics or the disaggregated sample stats show differences at length. Firstly looking at the results of the average deaths occurred per year by non communicable diseases in high income countries which is 399.84, whereas it is 654.7in middle income countries and 625in low income countries, which shows that the deaths in high income countries is less and in middle and low income countries is higher, which could be due to the fact that high income countries have better health facilities, better suited policies, higher health expenditure and preventive services as well as better knowledge as to how to curtail with such diseases before hand, whereas middle and low income countries are deprived of such resources such as low per capita income to deal with the expenditures of diseases or to avail any preventive measures, unhealthy lifestyles and poor dietary habits so they are the most affected by the death toll of non-communicable diseases.

Comparing the average GDP per capita of high, middle and low income countries, it can be noted that high income countries have a very high GDP per capita which is 36760.5, whereas middle income countries is 3402.87 and low income countries have a GDP even lesser that is 423.1, which is an alarming and incomparable figure as compared to high income countries. Low GDP per capita tells that there is less productivity in these countries, which can be seen as it contains the total income of the working age population. It shows less employment opportunities, less production of goods and services in these countries and low living standards due to which the data shows huge differences in per capita GDP.

The average health expenditure incurred in a year shows a value of 9.04 percent of the GDP in high income countries, whereas middle income countries spend 5 percent of their GDP on health and low income countries spend almost 5.98 percent of their GDP on health. The difference in health expenditure is definitely due to higher GDP in high income countries, as they earn and produce more, they tend to spend more on the betterment of their people, which will in turn return back to the governments in the shape of better resource and better productivity, whereas middle and low income countries spend less on health due to low resources and less GDP per capita income, broken and weak political structure and infrastructure to accommodate such cases. The little difference of health expenditure of 0.98 in low income countries could be because of requirement, as low income countries have large populations with instability and poverty, they need more health facilities as compared to middle income countries.

Looking at the statistics of secondary school enrollment of high income countries which is 5300187 and that of middle income countries which is1916813 and low income countries which is1231396, it can be depicted that there are less aids and financing available for the health sector in these countries. Another reason for low secondary school education is low GDP which makes it difficult for these countries to manage their expenditures in education sector. People in low and middle income countries cannot afford secondary education apart from high income countries; the reason is that high income countries have free basic education system, whereas low and middle income countries not only have free basic education but they do not take any international aid in this matter which is universal health coverage(education for all). Secondary school education needs attention in low and middle income countries to not only boost the GDP but also overall productivity.

The labor force participation rate (age 15 and above) shows a percentage of 60 on average in high income countries whereas it is 59.2 percent in middle income countries and 83 percent in low income countries. The reason for a huge difference in labor force participation in high income countries which is 60 percent and low income countries which is 80 percent shows that high income countries have long term unemployment and women participation has been reduced in such countries due to an increase in unpaid household labor rather than paid labor as the household labor is pretty much expensive in developed countries, whereas in low income countries people strive to get a job or paid labor even if it is not sufficient to their needs. A big chunk of population strives on labor wages based on working hours. People try to get cheap labor to earn for their families as they have no proper and high education, so there seems to be a rising trend of labor force participation in low income countries, whereas the middle income countries are striving to become developed economies and have a rate of labor force participation almost near to developed countries which is 59 percent. They are increasing their living standards and productivity with an increase in their GDP just like developed countries and have a high paid labor.

The urban population growth in high income countries is very less that is 1 percent, whereas it is 2 percent in middle income countries and 4 percent in low income countries. This high percent of urban population growth in low income countries is due to more and more migration of people of rural areas towards urban areas for better employment opportunities, better standard of living, high labor wages, and access to education, health and other services, whereas the high income countries already have all these resources and opportunities in rural areas, which is why people do not like to migrate from rural areas, given the availability of almost anything at their door step. The middle income countries whereas has a mixed combination of urban population

growth, it is rather not too high like low income countries and rather not too low like in developed economies. People do migrate for better lifestyles for the betterment of their lifestyles but seems as if they want to live in their rural areas of the countries, they are really not deprived of good resources and they have sufficient resources at their disposal, the need to migrate from rural to urban areas in middle income countries is purely an individual's own choice of living and perception.

Table 4.5 Hausman Test of Specification

Test: Ho: difference in coefficients not systematic	
chi2	10.42
Probability	0.0642

Results of Fixed Effect

Probability>chi2 As Probability is greater than chi2, therefore we reject the null hypothesis and accept alternate hypothesis, which implies that Fixed Effect model is applicable. The selection criteria of results (hausman specification test) prefers fixed effect model over random effect model, so we will ignore the results obtained from the random effect model and only incorporate the results of fixed effect model which are shown below

Table 4.6: Determinants of Non Communicable Diseases (Fixed Effect Model of all income groups of countries)

FIXED EFFECT MODEL			
Explanatory Variables	**Coefficients**	**Standard Error**	**P- Value**
GDPPC	-0.091	.0215	0.000
SSE	-0.0066	.0060	0.272
LFP	.0054	.024	0.825
HE	-0.0360	0.011	.002
UPOP	-0.001	0.016	0.936

4.6 Interpretation of the Fixed Effect Model

The results of fixed effect model shows that 1 percent increase in GDP per capita decreases incidence of non communicable diseases by 0.091 means an increase in GDP per capita of any country will decrease the death toll of NCDs. P-value is significant at 1 percent. Looking at the secondary school education, a percent increase secondary school education will reduce the non communicable diseases by 0.0066, this can be due to the fact that the earning hands of the family get less affected by the diseases and due to more ability to earn, they let their children study in schools. Through more exposure of children towards information, they will be careful about the risk factors of NCDs, hence the reduction. If Labor Force participation increases by 1 percent, Non-communicable diseases increase by .0054, this might be due to the fact that more and more people when participate in earning real wages, they tend to make their lifestyle better and change their food intake which includes high consumption of sugar and all kinds of meat without any control in dietary habits, LFP can also increase the habit of smoking by sharing cigarettes with each other, such things promote the deaths occurred by non communicable diseases. Coming to health expenditures, the table shows that 0.036 units decrease in non communicable diseases if health expenditure increase by 1 percent, this can be due to the fact that when governments increase the spending on health for general public, the people's out of pocket spending decreases and they avail health spending, which is why the incidence of NCDs decrease. P-value is significant at 1 percent. Looking at the urban population growth and its relation with non communicable diseases, we see that 1 percent increase in urban population decrease NCD's by 0.001. Considering the statistics, it is assumed that when people migrate more and more form the rural areas towards urban areas, they tend to make their diets and

lifestyles clean and better which contributes in the reduction of a small amount of incidence of NCDs.

After fixed effect this study has also estimated the data using random effect model as well. The results obtained from random effect model are however not included in the study due to the preference of fixed effect model by hausman specification test.

CHAPTER 5

CONCLUSION & POLICY IMPLICATIONS

5.1 Conclusion

This study discusses the determinants of non communicable diseases at macro level in high, middle and low income countries through panel data which has incorporated 34 countries disaggregated on the basis of GNI per capita through 'Atlas Method' with a time of four years (with an average of 5 years each) that is: 2000,2005,2010 and 2015. The study has used fixed and random effect model to check the effects of explanatory variables which are basically the determinants of NCD's to conclude that the gross domestic product per capita either in high, middle or low income country. This reduces the deaths occurred by non communicable diseases which can be due to a multiple reasons for instance, when people earn higher wages, they tend to make their lifestyles better, their diets better than previous, they make good eating habits and physical habits, such people are also able to cure themselves whenever needed, as now being able to afford better living standards, thus this overall reduces non communicable diseases. Similar is the case with secondary school enrollment, higher the enrollment in any country, lesser the non communicable diseases due to the fact that people will have more etiquettes as to how to live a healthy life, and urban population growth which with an increase also shows a decline in non communicable diseases. The negative relation with urban population explains that although, the biological determinants of NCDs in LMICs are likely to be similar to those in affluent countries, the drivers of these determinants are likely to differ. For example, rural–urban migration may be an important factor in promoting the adoption of Western dietary habits and activity patterns, leading to an increased risk of NCDs but Considering the statistics, it is assumed that when people migrate more and more form the rural areas towards urban

areas, they tend to make their diets and lifestyles clean and better which contributes in the reduction of a small amount of incidence of NCDs.

Looking at the positive relation between NCDs and LFP explains that more and more labor force participation increases the risk of non-communicable diseases because people tend to increase their living standard by taking good food intake but their habits become unhealthy sooner or later like more sugar and protein consumption, also the amount of smoke the labor are exposed to is unavoidable, which makes them prone to such diseases, as there is not proper trainings and preventive measure strategies to avoid them and not much resources in LMICs like helmets and gloves etc to honor its prevention. LFP also triggers the use of tobacco in daily lives as not only in LMIC's but also in HICs and MICs. Hence an increase in LFP increases the NCDs. Coming to health expenditures, the table shows that 0.036 units decrease in non communicable diseases if health expenditure increase by 1 percent, this can be due to the fact that when governments increase the spending on health for general public, the people's out of pocket spending decreases and they avail health spending, which is why the incidence of NCDs decrease. P-value is significant at 1 percent

5.2 Policy Implications

The following policy options should be considered for all income countries

- As it can be seen that an increase in GDP per capita leads to a decrease in non communicable diseases shows that people when capable of spending, do spend on their health, which shows a funding gap in those countries which are incapable of producing a good per capita income, so there is a need to provide social safety nets like health insurance for such purposes

- Training and education programs should be made available keeping in view the fact that education/enrollment reduces NCDs as this distributes awareness among people.
- Governments which are under developing state should focus on taking aids from developed economies in the form of universal health and education coverage programs
- Primary Training programs for the labor community should be given importance as the labor force participation increases the risk of NCDs due to unavailability of safety nets like masks and long exposure to smokes which causes respiratory problems.

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