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Inequality in health care utilization and equity: a cross-country comparision of low and middle income countries

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INEQUALITY IN HEALTH CARE UTILIZATION AND EQUITY: A CROSS-COUNTRY COMPARISON OF LOW AND MIDDLE INCOME COUNTRIES

by

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DEDICATION

To my parents

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Chapter 1

Introduction

This dissertation concentrates on income-related inequality in health care utilization and inequity in health care delivery systems of low and middle income (henceforth LMI) countries represented by Albania, Nepal, Tajikistan and Tanzania. Chapter 1 focuses on the introduction of research topics. Starting from the background of this research in section 1.1, this dissertation states the research problem in section 1.2 and defines research objectives in section 1.3. Section 1.4 explains why this study is important at this moment. After a brief discussion of the study design in section 1.5, this chapter notes some limitations of this research in section 1.6.

1.1 Background

Many have argued that in matters of health and health care, the public attaches greater importance to the achievement of equity than to efficiency (MacLachlan and Maynard, 1982). This statement may be debatable because achieving equity by reducing inequality and maintaining efficiency in health care are both important for policy makers and governments. However, maintaining equity and reducing inequality in health care utilization is certainly a goal of the health care system in all or most of the countries of the world. For example; the *World Health Report-1999* identifies six goals of health care systems for the development of its member states. One of these goals is to reduce health inequalities within and across the countries. Reducing inequality in health care utilization is therefore a matter of concern for policy makers and the government of low and middle-income countries and a matter of research for academicians and researchers of this field.

In the last two decades many have studied (van Doorslaer et al, 1997, 2000; van Doorslaer and Masseria, 2004; Wagstaff and van Doorslaer, 1993; Wagstaff and van Doorslaer,

1997; Wagstaff, 2002; Lu et al, 2007) income-related inequality in health care utilization (IRIHCU), equity in health care delivery, equity in health care finance, and inequalities in health. Most have focused on calculation and interpretation of inequalities for high-income industrial countries. Very little (van Doorslaer and O'Donnell, 2008) has been done for LMI countries. This paper describes approaches to the measurement and explanation of income-related inequality and inequity in health care financing, health care utilization and health.

Similarly, other researchers such as Deaton (2002), Marmot (2002), Subramanian and Kawachi (2004), and Glied and Lleras-Muney (2008) focused their study on the relationship between income and health and income and education. For example, Deaton (2002) studied the relationship between income and mortality of the male population in the United States using the National Longitudinal Mortality Study (NLMS) data and concluded that men in the upper 5 percent of the income distribution live 25 percent longer than those in the bottom 5 percent of the distribution. Proportional increases in income are associated with equal proportional decreases in mortality throughout the income distribution.

Marmot (2002) argued that, other things being equal, a population with more equal distribution of income will have better health than another with the same average income but greater income inequality. The effect of education on health is more productive than income because it enhances the person's health directly and indirectly by enhancing a person's efficiency and then income. Subramanian and Kawachi (2004) established the inverse relationship between income inequality and population health. Glied and Lleras-Muney (2008) studied whether more educated people in the US benefit more than the less educated from technological advances in medicine and concluded that the better educated people get more benefits from technological advances in medicine and maintain better health. These studies imply that there is some

relationship between population health, income and education. All of these studies are confined to US data.

My study, however, focuses on LMI countries and tests whether increases in average income and education reduce inequality in health care utilization. Results show that the redistribution of income in favor of poor and education in favor of less educated reduces the inequality in health care utilization sustainably from LMI countries. Thus, my study further focuses on how LMI countries reduce inequality in income and education?

The language of health disparities is varied, and different terms have been used in different parts of the world. The term "disparity" is most widely used throughout the US and a "variation" is used in Great Britain. Likewise, the term "inequality" is widely used in Europe and elsewhere. However, inequality and disparity are synonymously used throughout this dissertation.

The empirical literature in health care suffers from a lack of agreement about how to define disparities within and across groups. The dictionary defines disparity as a difference, which simply means two quantities are not equal. This provides a workable definition of health disparity. According to this simple definition, a disparity is just a difference. In this sense, the word disparity has the same meaning as the word inequality—two quantities are not equal. The Institute of Medicine (2002) defines disparity as: any difference in the use of health services after adjusting for preferences and health care needs. The National Institutes of Health (NIH) Strategic Plan to Reduce and Ultimately Eliminate Health Disparities 2001 defines health disparities in this way: "Health disparities are differences in the incidence, prevalence, mortality and burden of disease and other adverse health conditions that exist among specific population groups in the United States." This definition simply means a disparity is a difference.

By contrast, the Minority Health and Health Disparity Research and Education Act 2000 states: "A population is a health disparity population if there is a 'significant disparity' in the overall rate of disease incidence, prevalence, morbidity, mortality or survival rates in the population as compared to the health status of general population." The later definition, however, says that a disparity has to be significant when compared to the general population. Following these definitions, I define inequality in health care utilization as "any statistically significance differences in the use of health care services by the population," and this definition of inequality is used for further research in this study.

The term *inequality* in health is different than the term *inequity* in health. Actually, inequalities in health are based upon observed differences on disparities on health. An example is whether poor pregnant women visit gynecologists less than the rich women even though both have equal needs during their pregnancy. Then we compare whether they visit on equal number of times in a given time frame. If they are different and those differences are statistically significant, then inequality exists, and a disparity exists. Inequities in health, on the other hand, are based on ethical judgments about the fairness of the differences. Is it fair, for example, that poor pregnant women visit gynecologists less than the rich ones even though both have equal needs during their pregnancy?

Various methods such as range measures, unweighted regression-based measure, population-weighted regression-based measures, index of disparity, between group variance and disproportionality measures (Concentration Index, Theil Index, Mean Log Deviation and Gini Index) have been used for the measurement of inequality in health care utilization. Each of these methods has its relative strengths and weaknesses though all of those are legitimate methods for the calculation of inequality in health care utilization. I use the concentration index for the

measurement of income-related inequality in health care utilization (IRIHCU) and horizontal inequality index for the measurement of inequity proposed by Wagstaff and van Doorslaer (2000). Finally, I develop the relationship between IRIHCU and the covariates of health care use function to estimate the effect of increasing average value of each covariate on IRIHCU. Thus, my study is fundamentally different than the existing studies of this field on the following ground. My study proposes the measure — which can simply be defined as the policy effect of disparity in health care utilization — to estimate the effect of policy change on disparity in health care utilization. Accordingly, this study measures the effect of average increase in income and education on disparity in health care utilization.

1.2 Statement of Problem

Over the last three decades, most of the Organization for Economic Co-operation and Development (OECD) countries, except the United States, have achieved close to universal coverage of their population for the majority of health care services. However, they have often adopted very different mixes of public and private financing and delivery of services, and there is a growing body of evidence showing that, despite such universal coverage, not all population groups are treated equally even though they are in equal need (van Doorslaer, E., et al, 2000).

For example, the concentration indices which measure the inequality in health care utilization for visits to a general physician (GP) and a medical specialist combined are negative (pro-poor) for all countries except Sweden. When standardized for age, gender and the dummy or vector for chronic conditions the horizontal inequality indices are insignificant for most of the countries except Finland, East Germany, the Netherlands and the United States. For those four countries, delivery of health care services is pro-rich, (i.e., skewed toward the rich) (van

Doorslaer, E., et al, 2000). Despite having universal coverage, OECD countries have been facing inequalities in health care utilization and inequity in health care delivery.

However, the scenario of health care financing is quite different in LMI countries represented by Albania, Nepal, Tajikistan and Tanzania. The contribution of out-of-pocket expenditure on health in the year 2006 was 96.6 percent in Albania, 72.4 percent in Nepal, 95.1 percent in Tajikistan and 65.1 percent in Tanzania (see Table 3 in Chapter 2). The remainder is either funded by donors or by the respective governments of those countries. In such health care financing model, better income people get better access to health care services. There may be very high inequality in health care utilization and inequity in health care delivery systems in LMI countries. Thus, it is interesting to study whether there is inequality in health care utilization and inequity in health care delivery systems of LMI countries? If yes, what are the determinants of inequality in health care utilization?

In the economic growth literature, human capital is almost universally regarded as indispensible for growth. Sustained growth depends on levels of human capital whose stocks increase as a result of higher education, better health and new learning and training procedures. Mankiw, Romer and Weil (1992) raise the importance of considering health and nutrition in a broad analysis of human capital. Then Fogel (1994), Barro (1996) and Barro and Sala-i-Martin (2004) examines the relationship between economic growth and population health. The major message of each of these works is: good health raises levels of human capital and has a positive effect on individual productivity. That could ultimately enhance economic growth. Better health increases workforce productivity by reducing incapacity, debility, and the number of days lost to sick leave, and increases the opportunities an individual has of obtaining better paid work. Further, good health helps to forge improved levels of education by increasing levels of

schooling and scholastic performance. There is also an important positive spillover effect, (i.e., the resources that would otherwise be used for preventive health treatments are freed for alternative usages or in cushioning the effects of other negative externalities such as poverty within the nation).

Xavier Sala-i-Martin, (2005) examines the health-poverty trap and argues that low income tends to cause poor health and poor health, in turn, tends to cause low income. This two way causation generates a trap that one may well call the health-poverty trap. This trap has tragic consequences because poverty cannot be eradicated without dealing with the health issues of the poor, and these health problems, in turn, will not be fully solved until poverty is eradicated. In other words, health and poverty form a vicious circle from which it may be very difficult to escape. In that sense, good population health plays a very important role in the eradication of poverty in LMI countries.

As discussed in the previous two paragraphs, good health helps to reduce poverty and promote economic growth in LMI countries. To maintain good health of the population, LMI countries have to reduce inequity in the delivery of health care services and inequality in health care utilization among other things that affect human health. Thus, this research identifies the sustainable policy(s) to reduce disparity in health care utilization in LMI countries represented by Albania, Nepal, Tajikistan and Tanzania.

This dissertation answers the following research questions: (1) Is there inequality in health care utilization in LMI countries represented by Albania, Nepal, Tajikistan and Tanzania? (2) Is the principle of “Equal Treatment for Equal Need (ETEN)” fulfilled in those countries? (3) What are the determinants of inequality in health care utilization in those countries? and (4) Do the sectoral policies such as average increase in income and/or education reduce inequality in

health care utilization sustainably in LMI countries? (5) If not, have LMI countries implemented the integrated approach of development to overcome that problem?

1.3 Research Objectives

The major objective of this research is to identify the sustainable policy(s) to overcome the disparity in health care utilization in LMI countries represented by Albania, Nepal, Tajikistan and Tanzania. Other specific objectives are:

(1) to calculate the inequality in health care utilization in LMI countries represented by Albania, Nepal, Tajikistan and Tanzania.

(2) to calculate the horizontal inequality indices and test whether the principle of ETEN is fulfilled in those countries.

(3) to decompose the inequality into the covariates of health care use functions.

(4) to identify the sustainable policy(s) for the reduction of inequality in health care utilization in LMI countries.

1.4 Significance of Study

As stated in section 1.1, in the last two decades many have studied income-related inequality in health care utilization (IRIHCU), equity in health care delivery, equity in health care finance, and inequalities in health. Most have focused on calculation and interpretation of inequalities for high-income industrial countries. All of those studies proposed various methods of measurement of inequality in health care utilization, health care financing and health care delivery. Very little (van Doorslaer, E. and O'Donnell, O., 2008) has been done for LMI countries. Thus, a similar study of calculation and decomposition of income-related inequality in health care utilization is useful for the development of an appropriate health care system and formulation of health care policy of LMI countries.

In contrast, Wagstaff, van Doorslaer and Watanabe (2003), show that the total changes in income-related inequality in health care use are attributed to the changes in the means, inequalities and effects of the determinants of health care use. However, they do not discuss at all whether the average increase in the covariates of health care use function reduces income-related inequalities in health care utilization. Further, do increases sustainably reduce IRIHCU in LMI countries? In this regard, my study differs from the existing literature. Unlike the other literature of this field, I develop and propose a formula to estimate the effect of average increase in each covariate of health care use function on IRIHCU. I define that effect as "policy effect of health care inequality". Thus, this study clearly answers questions that are not answered by the existing literature of this field.

1.5 Study Design

As discussed in the previous sub-sections, Chapter 1 focuses on the background and precisely states the problems that have to be address by this research. It also establishes the significance of my research. Chapter 2 presents and compares the existing socio-economic conditions, health indicator variables, and existing growth and poverty situation of the countries under study represented by Albania, Nepal, Tajikistan and Tanzania. Chapter 3 briefly reviews the relevant literatures. Chapter 4 outlines the detail method used for this study. Chapter 5 calculates and decomposes the IRIHCU and measures the effect of average increase in income and education on IRIHCU. Likewise, Chapter 6 identifies the causes of inequality in income and education and recommends the appropriate policy measures to reduce those inequalities sustainably from LMI countries. Finally, Chapter 7 briefly discusses the conclusions and recommendations of this study.

1.6 Study Limitations

Despite the role of income, education, need-based factors and other factors that are considered in this study in utilization of health care services (physician services), we cannot ignore the effect of the out-of-pocket price paid for health care services on health care utilization because out-of-pocket financing is the major source of health care financing in all countries under my study. However, to measure the effect of price change on disparity on health care utilization, we need sufficient data and information related to the price paid for health care services and drugs. Lack of such data creates severe limitation in measuring the effect of pricing policy on disparity in health care utilization in LMI countries.

Likewise, the out-of-pocket financing for education has been a large proportion of the cost of education in the countries under study. This suggests that schooling is likely affected by the price of education services and the price of related goods such as health. Again, the limitation of data related to out-of-pocket price paid for schooling and other services such as health prevents studying the effect of price control on disparity on education.

Chapter 2

Country Profiles

Chapter 1 focuses on the background of the study and raises some serious questions that should be addressed to reduce inequality in health care utilization in LMI countries represented by Albania, Nepal, Tajikistan and Tanzania. However, Chapter 2 answers the question why my research selects only Albania, Nepal, Tajikistan and Tanzania to represent the LMI countries. Section 2.1 fundamentally focused on the modalities of the study area selection, and section 2.2 briefly discusses the health care systems and expenditure patterns of these countries.

2.1 Modalities of Study Area Selection

Albania is a middle income country and Nepal, Tajikistan, and Tanzania are low income countries. Some of the development indicators of those countries are depicted in Table 1.

Table 1: Some Development Indicators

Indicators	Albania	Nepal	Tajikistan	Tanzania	USA
GDP Growth (Annual %)	3.50	4.60	3.80	6.98	3.00
GDP per capita, PPP (constant 2005 international $)	$7667.40	$1075.40	$19401.00	$1285.60	$42297.07
Poverty headcount ratio at $1.25 a day (PPP) (% of population)	62.00%	55.12%	21.49%	67.87%	0.00%
Poverty headcount ratio at national poverty line (% of population)	12.40%	30.90%	53.10%	33.40%	0.00%
GNI per capita, PPP (current international $)	8640.00	1180.00	1950.00	1360.00	47360.00
Urban Population (% of total)	49.00%	17.00%	26.00%	25.00%	82.30%

Source: The World Bank, June, 5, 2011 and Kaiser Family Foundation, June 5, 2011.

Note: USA: United States of America.

Very Low Per Capita GDP and Low Growth: Comparing the GDP per capita measured at PPP constant 2005 international dollar, Albania has 5.67 times less GDP per capita than that of

the US whereas Nepal has 40.34 times less. Even though the GDP growth rate of Albania, Nepal, Tajikistan and Tanzania is better than that of the US, the US growth of 3 percent comes from a base of $12703.5, billion whereas the growths of other countries are from much smaller bases. Thus, the true growth amount in all countries under study is far less than that in the US. Further, other developing countries such as India and China have a much higher growth rate (9.1% in 2009) than that of the countries under study.

Very High Absolute Poverty: The poverty head count ratios at the national poverty line are highest in Tajikistan followed by Tanzania, Nepal and Albania (Table 1). Compared with the World Bank benchmark of $1.25 per person per day measured at PPP, we can note a hooping increase in poverty (Table 1) in all countries.

Distinct Dual Economy: Each of the countries has a distinct dual economy. In Albania approximately one half of the population (Table 1) lives in urban areas. Unlike the trends in Albania, almost one-fourth of the populations are urban in low income countries represented by Tajikistan and Tanzania (Table 1). Lowest among all, Nepal has only 17 percent of the population residing in cities. In contrast, more than 82 percent of the population lives in urban areas in the United States.

High Mortality, Low Life Expectancy and Poor Health Status: Table 2 depicts and compares the general health status of the population in LMI countries represented by Albania, Nepal, Tajikistan and Tanzania to that of the United States. Out of 1,000 live births, the death rate of each LMI country exceeds that of the United States in the year 2011 (Table 2). The highest and the lowest rate of life expectancy at birth for a male is 72 years in Albania and 53 years in Tanzania. Nepal and Tajikistan are in between. Likewise, the population growth rate of

all low income countries is higher than that of middle income and high income countries represented respectively by Albania and the United States (Table 2).

Latest Data Base is Available to Those Countries: Last but not least, recent data sets are available for these countries. This research uses the living standard and measurement survey (LSMS) data for Albania 2005, Nepal 2004, Tajikistan 2007 and Tanzania 2004. For other LMI countries, it is hard to find such a fresh data set.

Table 2: Demography and Population

Indicators	Date	Type of Data	Albania	Nepal	Tajik	Tanza	USA
Birth Rate	2011	Rate per 1,000	12.15	22.17	26.29	32.64	13.83
Total Fertility Rate	2011	Number	1.48	2.47	2.89	4.16	2.06
Death Rate	2011	Rate per 1,000	6.15	6.81	6.60	12.09	8.38
Infant Mortality Rate	2011	Rate per 1,000	14.61	44.54	38.54	66.93	6.06
Under-Age 5 Mortality Rate	2010	Rate per 1,000	18.00	50.00	63.00	76.00	8.00
Maternal Mortality Ratio	2008	Rate per 100,000	31.00	380.00	64.00	790.00	24.00
Life Expectancy - Female	2009	Number	75.00	69.00	69.00	58.00	81.00
Life Expectancy - Male	2009	Number	72.00	65.00	66.00	53.00	76.00
Population Growth Rate	2011	%	0.27%	1.60%	1.85%	2.00%	0.96%

Source: Kaiser Family Foundation, Country Data Downloaded on March 31, 2012.

Note: USA: United States of America, Tajik.: Tajikistan and Tanza.: Tanzania.

(URL: - http://www.globalhealthfacts.org/index.jsp)

Because of the existence of the above-stated similarities, Albania, Nepal, Tajikistan and Tanzania have some common comparable socio-economic and demographic status. In such circumstances, it could be interesting to compare and interpret the inequality in health care utilization in these countries. Thus, the current study calculates and interprets the inequality in health care utilization and identifies the determinants of those inequalities for each country by

using decomposition analysis proposed in Chapter 4. Finally, it designs some sustainable policies to reduce that disparity from the LMI countries under study.

2.2 Health Care System and Expenditures

Albania: Albania a middle-income country located in southeastern Europe on the Balkan Peninsula. The annual total health expenditure of the country was 6.8 percent of GDP in 2008 where public and private funding sources accounted for 39.4 percent and 60.6 percent respectively. About 96.6 percent of private health financing in Albania was through out-of pocket household expenditure. Social security contributes 38.2 percent of the expenditure, which is the highest among the four countries under study and higher than that of the United States (Table 3).

Table 3: Program Funding and Financing in 2008

Indicators	**Albania**	**Nepal**	**Tajikistan**	**Tanzania**	**U.S.**
Health Expenditure Per Capita at PPP	$569.00	$66.00	$95.00	$57.00	$7164.00
Total Expenditure on Health	6.80%	6.00%	5.00%	4.50%	15.20%
Government Health Expenditure as Percent of Total Government	8.20%	11.30%	5.00%	18.00%	18.70%
Government Health Expenditure as Percent of Total Health	39.40%	37.70%	27.70%	72.30%	47.80%
Private Expenditure on Health	60.60%	62.30%	72.30%	27.70%	52.20%
External Resources for Health	2.10%	11.00%	10.50%	59.50%	0.00%
Social Security Expenditure on Health	38.20%	0.00%	0.00%	3.30%	27.80%
Out-of-Pocket Expenditure on Health	96.60%	72.40%	95.10%	65.10%	24.40%

Source: - Kaiser Family Foundation, Country Data Downloaded in March 31, 2012.

Note: USA: United States of America, Tajik.: Tajikistan and Tanza.: Tanzania.

(URL:- http://www.globalhealthfacts.org/index.jsp)

The state is the major provider of health services, health promotion, prevention, diagnosis and treatment in Albania (Albania Demographic and Health Survey, 2008-09). The private sector, which is still developing, covers most of the pharmaceutical and dental services, as well as some clinics for highly specialized diagnosis, mostly in the capital of Tirana and one or two other major cities. Diagnostic and curative health services in Albania are organized in three levels: primary health care, secondary hospital services, and tertiary hospital services. The second level of health care is basically provided by hospitals. There are over forty public hospitals in the country, including 22 District Hospitals, 11 Regional Hospitals, 4 University Hospitals, 1 University Trauma Centre, 2 Psychiatric Hospitals, and 1 National Centre for Child Development and Growth. The number of physicians, nurses and midwives, and hospital beds available per 10,000 patients in the years 2000-2010 were respectively 12, 40 and 29 (Table 4). Other demographic and population indicators are presented in Table 2 above.

Nepal: Nepal is one of the low-income countries in South Asia. The total expenditure on health as percentage of GDP was 6.0 percent in 2008. Of the total, contribution of government health expenditure was 37.7 percent and private sectors contribution was 62.3 percent. About 72.4 percent of private health financing in Nepal was through out-of pocket household expenditure. However, the social security contribution to health expenditure was zero in 2008.

Health services in Nepal are basically provided by government and private sectors and quasi-public agencies such as non-governmental organizations (NGOs). There are 94 hospitals, 5 health centers, 699 health posts, 293 ayurvedic hospitals, 3104 sub-health posts and 201 primary health centers spread all over the country. The number of physicians, nurses and midwives, community health workers and hospital beds available per 10,000 patients in the years 2000-2010 are presented in Table 4. For example, the number of physicians available per 10,000

population in Nepal is 2 which is greater than that in Tanzania and far less than that in Albania, Tajikistan and the US (Table 4). Demographic and other health indicators of Nepal are presented in Table 2 above.

Table 4: Health Workforce and Capacity from 2000-2010

Indicators	Type of Data	Albania	Nepal	Tajik	Tanza.	USA
Physicians	Rate per 10,000	12.00	2.00	20.00	<1.00	27.00
Nurses and Midwives	Rate per 10,000	40.00	5.00	50.00	2.00	98.00
Community Health Workers	Rate per 10,000	NA	6.00	NA	NA	NA
Births Attended by Skilled Health Personnel	%	99.00%	19.00%	88.00%	51.00%	99.00%
Hospital Beds	Rate per 10,000	29.00	50.00	61.00	11.00	31.00

Source:- Kaiser Family Foundation, Country Data Downloaded on March 31, 2012.

Note: USA: United States of America, Tajik.: Tajikistan and Tanza.: Tanzania.

(URL:- http://www.globalhealthfacts.org/index.jsp)

Tajikistan: Tajikistan, one of the former Soviet republics, declared its independence in September 1991 after the breakup of the USSR. Total expenditure on health as percentage of GDP was 5.0 percent in 2008 where the share of public sources was 27.7 percent and that of private was 72.3 percent. Out-of-pocket expenditure contributes to 95.1 percent of the private health expenditure. The per capita health expenditure in 2008 was US$ 95 at PPP; this was greater than that of Nepal and Tanzania.

The delivery of health care services is divided among four administrative levels: national (republican), regional (oblast), district (rayon) and village. The Ministry of Health runs national-level institutions, and local administrations run other health care services. In rural areas, primary care is delivered through nurse posts, rural physician clinics, and small rural hospitals. In urban areas, primary and secondary care is delivered by polyclinics, basic secondary care by district

(rayon) hospitals, specialized secondary care in regional (oblast or city) hospitals, and more complex care in national hospitals. The health care system is hospital centered, and treatment in hospital with long inpatient stays is more common. There were 20 physicians, 50 nurses and midwives, and 61 hospital beds per 10,000 patients in the years 2000-2010 (Table 4). Demographic and population health indicators of Tajikistan are presented in Table 2 above.

Tanzania: The United Republic of Tanzania is the largest country in East Africa. The annual total health expenditure of the country was 4.5 percent of GDP in the year 2008. Of the total health expenditure, 72.3 percent was financed by public sources, and the remaining 27.7 percent was by private funding sources. About 65.1 percent of private health financing in Tanzania was through out-of pocket household expenditure, which is lowest among the countries under study. Social security contributed 3.3 percent of the expenditure. The external sources contribute 59.5 percent of the total health care expenditure, which was the highest among the four countries under study (Table 2).

There are five levels of facilities in the public health system: national referral hospitals, regional general hospitals, district hospitals, health centers, and dispensaries. In Zanzibar, the lowest level facilities are cottage hospitals referred to as primary health care units (PHCUs), rather than dispensaries. In 2006 there were 5,379 health facilities in Tanzania Mainland and 146 facilities in Zanzibar. Table 4 shows the number of physicians, nurses and midwifes and hospital beds available in Tanzania from 2000-2010. Demographic and population health indicators of Tanzania are presented in Table 2 above. Kagera, a major populous region in Tanzania, is assumed to have similar leading health indicators and health system.

Chapter 3

Literature Review

Chapter 2 answers the question why my research focused only on LMI countries represented by Albania, Nepal, Tajikistan and Tanzania and briefly discusses the profile of each country under study. Chapter 3 reviews the literature associated with this study. This chapter is classified into four sub-sections. Sub-section 3.1 briefly reviews the literature of income-related inequality in health and health care utilization, whereas the literature related to education and income inequality are reviewed respectively in sub-section 3.2 and 3.3. Finally, sub-section 3.4 briefly reviews the literature related to inequality and growth.

3.1 Inequality in Health and Health Care Utilization

In the last two decades many have studied income-related inequality in health care utilization (IRIHCU), equity in health care delivery, equity in health care finance and inequalities in health. Starting from 1991, some of the interesting literature that is related to the measurement and decomposition of income-related inequality in health care utilization are reviewed in chronological order in the following paragraphs.

Wagstaff A. et al (1991) published a paper on the measurement of inequalities in health. The primary objectives of this paper were: (1) to provide a critical review of the various measures of inequality that had been employed in the literature on inequalities in health to 1991 and (2) to identify which measures are best suited to measure health inequality. This paper identified the six measures of inequality, namely: (a) the range, (b) the Gini coefficient (and the associated Lorenz curve), (c) a pseudo-Gini coefficient (and an associated pseudo-Lorenz curve), (d) the index of dissimilarity, (e) the slope index of inequality (and the associated relative index of inequality) and (f) the concentration index (and the associated concentration curve). Finally, it

recommends the slope index of inequality and the concentration index for the study of socioeconomic inequality in health because those measures meet the minimal requirements of an inequality measure. It reflects the socioeconomic dimension of inequalities in health. Actually, it reflects the experiences of the entire population (rather than just, say, social classes I and III); and it is sensitive to changes in the distribution of the population across socioeconomic groups.

The secondary objective of this paper was to demonstrate the importance of having a reliable measure of inequality in comparative studies of inequalities in health. Comparing the results of the slope index of inequality and the concentration index with that of the range measure and pseudo-Lorenz curve for cross-country comparison, this paper concludes that the first two measures give more reliable and desirable results than the latter two. Following the conclusion of this paper, various researchers have been using the concentration index for the measurement and cross-country comparison of inequality in health. Indeed, my current research is also based on the same method for the calculation of income-related inequality in physician service utilization.

Kakwani N. et al (1997) clarified the relationship between two widely used indices of health inequality namely: the relative index of inequality (RII) and the concentration index (CI) and explained why these are superior to the other indices used in the literature. For example, the CI is sensitive to socioeconomic dimension of inequalities in health because its value lies between -1 to 1. A positive CI represents the pro-rich and a negative CI represents pro-poor inequality in health. However, this sensitivity to the socioeconomic dimension of inequalities in health is not a feature of several other indices used in the literature such as the Gini coefficient, the index of dissimilarity and the index of inequality.

As the indices of health inequalities are generally estimated from sample observations, it is useful to test whether any observed differences in their values are statistically significant. Accordingly, this paper developed an accurate distribution-free asymptotic estimator of the standard errors of both the RII and CI. There is extensive literature on the sampling properties of Gini index to which the concentration index is related (Nygord and Sanstom, 1981; Kakwani, 1990; Cowell, 1989). These sampling distributions were derived by applying Hoeffdyng's (1948) theorem on order statistics. However, the same methodology cannot be applied to derive the sampling distribution of CIs because they can be both negative and positive and, therefore, cannot be written in the form of order statistics. Thus, the derivations of the standard error formulae of this paper were new, providing more general results. My study uses the same method proposed by this paper for the calculation of CI and its 95 percent confidence interval.

Wagstaff A. et al (2003) used Vietnam Living Standards Surveys (VLSS) data in 1993 and 1998 and decomposed the inequalities in height-for-age in Vietnam into its covariates. Then, their study identified the causes of changes in those inequalities from 1993 to 1998. The authors showed that inequalities across the income distribution in a variable *y* can be decomposed into their causes, and changes in inequality in *y* can be decomposed into the effects of changes in the means and inequalities in the determinants of *y*, and changes in the effects of the determinants of *y*. Their study suggested that inequalities in height-for-age in Vietnam in 1993 and 1998 largely accounted for inequalities in consumption and unobserved commune-level influences. Rising inequalities largely accounted for increases in average consumption and its protective effect, and rising inequality and general improvements at the commune level.

For the decomposition of inequality in health care utilization, I use the method proposed by this study. However, unlike their measure of causes of changes in inequality, I propose a new

measure called policy effect of inequality to quantify the effect of policy change on income-related inequality in health care utilization.

Van Doorslaer E. et al (2004) updated and extended their previous study on equity in physician service utilization for a subset of the countries analyzed by van Doorslaer, Koolman and Puffer, (2002). This paper updated the results of 2000 for 13 countries and added new results for eight countries: Australia, Finland, France, Hungary, Mexico, Norway, Switzerland and Sweden. This study used the seventh wave of the European Community Household Panel (ECHP), Medical Expenditure Panel Survey (MEPS) for US and National Health Survey (ABS) for Australia. A list of data sources for other countries is given in Table 1 of their research paper.

To measure the extent to which adults in equal need for physician care appear to have equal rates of medical care utilization, the authors used both simple quintile distributions and concentration indices. Their result showed the pro-poor inequity in physician service utilization. However, after controlling for need a significant pro-rich inequity was noted in about half of the countries, both for the probability and the total number of physician visits. The degree of pro-rich inequity in doctor use is highest in the US, followed by Mexico, Finland, Portugal and Sweden.

Van Doorslaer E. et al (2006) studied the inequalities in access to medical care by income in developed countries for the OECD Health Equity Research Group. Using data from national surveys and European Community Household Panel, the authors generated the number of visits to a general practitioner or medical specialist over the recall period of one year. The inequity in doctor's service delivery was then calculated using horizontal inequity *(HI)* index. It is simply a concentration index of the need-standardized use. The doctor's visits were standardized for need differences using age, sex and reported health levels as proxies.

Their results showed the pro-rich inequity in physician service utilization in about half of the OECD countries. The degree of pro-rich inequity in doctor use was highest in the US and Mexico, followed by Finland, Portugal and Sweden. However, in other countries, evidence of inequity in the distribution of general practitioner visits across income groups was not apparent. In some cases the evidence of pro-poor inequity was also identified. After controlling for need differences, their result showed that people with higher incomes are significantly more likely to see a specialist than people with lower incomes and, in most countries, also more frequently. Pro-rich inequity was especially large in Portugal, Finland and Ireland.

Jui-fen R. Lu et al (2007) studied the horizontal inequity in the health care utilization for the health care delivery system of Hong Kong, South Korea and Taiwan. Using the Thematic Household Survey (2002) for Hong Kong, National Health and Nutrition Survey (1998) for South Korea and National Health Interview Survey (2001) for Taiwan, the authors compared the extent to which the principle of ‘‘equal treatment for equal need’’(ETEN) was maintained in the health care delivery systems of Hong Kong, South Korea and Taiwan. Deviations in the degree to which health care was distributed according to need were then measured by an index of horizontal inequity. Income-related inequality in utilization was then decomposed into four major sources: (i) direct effect of income; (ii) need indicators (self-assessed health status, activity limitation, and age and gender interaction terms); (iii) non-need variables (education, work status, private health insurance coverage, employer-provided medical benefits, Medicaid status (low-income medical assistance), geographic region and urban/rural residency and (iv) a residual term.

Their study calculated the inequality in western doctor visits, licensed traditional medicine practitioner (LTMP) visits, dental and emergency room (ER) visits, as well as inpatient

admissions. Their result identified that the principle of ETEN was violated for physician and dental services utilization in Hong Kong. Further, a pro-rich inequity was detected in western doctor visits. Unusually, this inequity existed for general practitioner but not specialist care. In contrast, South Korea appears to have almost comprehensively maintained ETEN although the better-off had preferential access to higher levels of outpatient care. Taiwan shows intermediate results in that the rich were marginally more likely to use outpatient services, but quantities of western doctor and dental visits were evenly distributed while there was modest pro-rich bias in the number of LTMP episodes. ER visits and inpatient admissions in Taiwan were either proportional or slightly pro-poor.

Sara Allian (2008) systematically investigates the equity in health care use across Canadian Provinces. Using Canadian Community Health Survey 2003 data, she calculated the income related inequality by using concentration index and inequity using indirect standardization approach for probability, total and conditional number of general practitioner (GP), specialist, hospital and dentist visits. Results of this research showed some variation in inequity across provinces; however national trends showed pro-rich inequity in the probability of a general practitioner, specialist and dentist visits, and no significant evidence of inequity in inpatient care. Further, the main socio-economic factors associated with inequity were education, complementary insurance for prescription drugs and dental care and, in some cases, region of residence.

Van Doorslaer E. and O'Donnell O. (2008) conducted research for United Nations University-World Institute for Development Economic Research. Their discussion paper-measurement and explanation of inequality in health and health care in low-income settings-described approaches to the measurement and explanation of income-related inequality and

inequity in health care financing, health care utilization and health. It considered the applicability and the feasibility of these methods in low-income countries. Like other studies that were done for industrial countries, this study as well used the concentration index for the measurement of inequality in health and health care utilization and horizontal inequity index for the measurement of inequity even though application of this method suffered from the sufficient data. Their next issue was the reliability issue of a self-access health measure in low-income countries. However, reliability issues could also be a problem in self reported date even in developed world. The only difference is on the degree of reliability due to the wide disparity that exists in education between the industrial and developing world.

Deaton (2002) studied the relationship between income and population health. This study is based on the National Longitudinal Mortality Study (NLMS) merged data from death records with responses from household surveys around 1980. The major finding of his study was: men in the United States with family incomes in the top 5 percent of the distribution in 1980 had about 25 percent longer to live than did those in the bottom 5 percent. Proportional increases in income were associated with equal proportional decreases in mortality throughout the income distribution. He discusses the possible reasons for this gradient and asked whether it calls for the redistribution of income in the interest of public health. In this paper Deaton argued that the existence of the gradient strengthens the case for income redistribution in favor of the poor but that targeting health inequalities would not be the sound policy.

He further argued that policy cannot be intelligently conducted without an understanding of mechanisms; correlations are not enough. Thus, a solid mechanism can clearly establish the relationship among inequality in health care utilization; income and education could be very useful for the appropriate policy formulation to reduce inequality in health care utilization. My

study thus proposes a measure of the policy effect of disparity in health care utilization. It establishes the mechanism of how policy change affects disparity in health care use and tests whether increase in average income and education reduce income-related inequality in health care use.

Some argue that the correlation of health with income is induced by the effects of education on income. Many economic models of health such as Grossman (1972) view education as enhancing a person's efficiency as a producer of health. Although this is suggestive, it is not explicit about the mechanisms involved. The empirical evidence, on the other hand, shows that education protects health. Evidence from a range of rich countries shows that an additional year of education reduces mortality rates (at all ages) around 8 percent (I. Elo and S.H. Preston, 1996).

From that evidence, it is clear that income and education either separately or jointly affect population health and health care use. To understand how the changes in income and education affect inequality in health and health care utilization, we need a well-defined mechanism to establish the relationship among three. Thus, a solid mechanism can clearly establish the relationship among inequality in health care utilization, income and education could be very useful for the appropriate policy formulation to reduce inequality in health care utilization.

Unlike the existing studies, my study thus proposes a measure of the policy effect of disparity in health care utilization. It establishes the mechanism of how policy change affects disparity in health care use and tests whether increase in average income and education reduce income related inequality in health care use (IRIHCU).

3.2 Inequality in Education

As education is the major source of human capital formation and the propeller of

economic growth, it helps to establish an egalitarian-based society and to reduce poverty. However, inequality in education contributes to inequalities in income, health care utilization and health that ultimately increases poverty, retards the rate of human capital formation and economic growth. Thus, the study of inequality in education for low and middle income (LMI) countries which have been suffering from low growth and wide spread poverty is very useful from policy and research perspectives.

Some studies have been done on the measurement of inequality in education. A few of them used the Gini coefficient for the measurement of educational inequality. Education Ginis, which are similar to the income Gini, is ranges from 0 to 1. A Gini coefficient with value zero implies perfect equality, and one implies perfect inequality. Education Gini coefficients can be calculated using enrollment, financing or attainment data.

Maas and Criel (1982) estimated Gini coefficients based on enrollment data for 16 East African countries. First, they found that the degree of inequality in education opportunity varied enormously from one country to another. Second, enrollment Gini coefficients were negatively related to the average enrollment rate in a country. In other words, the higher the average enrollment, the lower the inequality.

Ter Weele (1975) estimated Gini coefficients using education finance data for several East African countries. Rosthal (1978) summarized four indicators for the distribution of education estimated for the US and Gini index was one of them. Sheret (1982 and 1988) estimated the Gini coefficient of enrollment for Papua New Guinea. However, the above-mentioned Ginis were calculated based on enrollment or education financing, not on the distribution of school attainment.

Birdsall and Londoño (1997) used the standard deviation of years of education as an index for inequality in education. This study identified a negative correlation between the index and the rate of economic growth.

Thomas, Wang, and Fan (2001) calculated the Gini coefficient from educational panel data provided by Barro and Lee (1993) and compared inequalities in education in eighty-five countries. This study uses data that can be compared internationally, but the data for education levels lacks adequate specificity for making comparisons between countries. The strictness of this analysis is thus limited.

Filmer (2005) used the ratio of the average enrollment of males and females, and the ratio of the average enrollment of children from the richest 50% of households and the poorest 50% of households (with corresponding measures for attainment) for the measurement of gender and wealth disparity in schooling. Using ratios ensured a relative measure, and the comparison of the richest to poorest 50% ensured comparability between gender and wealth. He used Demographic and Health Survey (DHS) data for 44 developing countries. The major finding of the paper is that girls are at a great educational disadvantage in particular regions such as South Asia and North, Western, and Central Africa. There are two other new findings. First, while gender gaps are large in a subset of countries, wealth gaps are large in almost all of the countries studied and typically larger than corresponding gender gaps. Second, and of special concern is in particular countries where a large number of female disadvantage from enrollment; wealth interacts with gender to exacerbate the gap in educational outcomes. This paper thus identified the causes of disparities in education in 44 developing countries. No doubt the measure of disparity used by this paper is one of the legitimate measures; it cannot be used for the calculation of within group disparity. Actually, this measure requires some reference group for comparison.

Masakazu (2009) estimated inequality in education in Japan by using Gini coefficient, and considered factors that cause changes in the distribution of education as this orientation toward advanced education progresses. This study was fundamentally focused on Japanese economy and may not imply specific picture of LMI countries.

All of those measures cannot reflect the socioeconomic dimension on inequalities in health. However, the education concentration index meets the minimal requirements of an inequality measure in the sense that it reflects the socioeconomic dimension to inequalities in education. Actually, it reflects the experiences of the entire population (rather than just, say, social classes I and III); and it is sensitive to changes in the distribution of the population across socioeconomic groups (Adam Wagstaff et al 1991). Further, to illustrate the importance of having a reliable measure of inequality in comparative studies of inequalities in education, ECI gives more reliable measure of inequality than that provided by education Gini and other measures discuss in previous paragraphs. None of the previous studies check whether the principle of equal schooling for equal need (ESEN) was fulfilled in the respective countries of their study.

Unlike other studies reviewed in previous paragraphs, my study calculates the income-related inequality in education (IRIE) and compares whether the principle of equal schooling for equal need (ESEN) is fulfilled in LMI countries represented by Albania, Nepal, Tajikistan and Tanzania. Inequality in education is calculated by using an education concentration index, and an HI index is used to test whether the principle of ESEN is fulfilled in the countries under study. In addition, my study identifies the causes of educational inequality in those countries and decomposes the total inequalities among the determinants of education (years of schooling). Finally, it answers the question: could LMI countries reduce IRIE sustainably? But my research

does not attempt to find a causal relationship between inequality in education and growth even though they could be jointly determined and mutually underpinned.

3.3 Inequality in Income

This section summarizes some of the pertinent literature associated with calculation and interpretation of income inequality. Literature associated with the decomposition of income inequality is also reviewed. Different from the existing practice on decomposition of income Gini, my research uses the linear decomposition technique proposed by Wagstaff et al (2003) for the decomposition of income Gini among the determinants of income.

Simon Kuznets (1955) answers the following two questions: (a) does inequality in the distribution of income increase or decrease in the course of a country's economic growth? and (b) what factors determine the secular level and trends of income inequalities? Inequality in income distribution decreases with increase in economic growth in developed countries. That means the per capita income of the lower income quintile increases faster than that of upper income quintile, whereas inequality in income distribution is higher and per capita GDP growth is lower in developing countries. The factors responsible for high inequality are technological changes, concentration of savings and property, and the rate of industrialization and urbanization.

Robert J. Barro (1999) argued that inequality retards growth in poor countries but encourages growth in industrial or developed countries. Growth tends to fall with greater inequality when per capita GDP is below around $2000 (1985 U.S. dollars) and to rise with inequality when per capita GDP is above $2000.

Nancy Birdsall (2005) argued that in developing countries inequality is usually economically destructive. It interacts with underdeveloped markets and ineffective government programs to slow growth which in turn slows the progress of reducing poverty.

In that sense, the reduction of inequality in income in poor countries is urgent for the alleviation of poverty and achievement of higher economic growth. My research thus calculates and interprets the existing inequality in income for Albania, Nepal, Tajikistan and Tanzania. It will also identify the sustainable policies that could reduce inequality in income.

Bourguignon, F. (1979) decomposes the inequality in income by population subgroup. He defines the decomposable inequality measure as a measure that the total inequality of a population can be broken down into a weighted average of the inequality existing within subgroups of the population and the inequality existing between them. Thus, decomposable measures differ only by the weights given to the inequality within the subgroups of the population.

Shorrocks, A. F. (1982) proposed the inequality decomposition by factor components. In this paper, he disaggregates the income of individuals or households into different factor components, such as earnings, investment income, and transfer payments. This paper proposed the method to assess the contributions of these sources to total income inequality.

Basically, those conventional decomposition measures proposed by Bourguignon, F. (1979) and Shorrocks (1982) provide only limited information on the determinants of income inequality.

During the early 1970s, Blinder and Oaxaca (1973) proposed the regression-based decomposition method. However, this method did not achieve sufficient attention until the early 1990s. Later, Juhn et al (1993) calculates and decomposes the inequality in male wage earnings in the US between 1963 and 1989 using the technique proposed by Blinder-Oaxaca (B-O) method. In this paper, they decompose the inequality in wage into the determinants of wage. As per this paper, much of the increase in wage inequality for males over the period of study was

due to increased returns to the components of skill other than years of schooling and years of labor market experience. Further, Bourguignon et al (2001) extend the application of the B-O method for the decomposition of inequality in income among its determinants.

Guanghua Wan and Zhangyue Zhou (2005) studied income inequality in rural China: regression-based decomposition using household data. This paper uses household-level data and attempts to apply the regression-based decomposition framework to the study of inequality accounting in rural China. They find that capital input is the most significant determinant of income inequality in China. Further, farming structure is more important than labor and other inputs in contributing to income inequality across households. Geography has been the dominant factor but is becoming less important in recent years for explaining total inequality.

My research, however, calculates the income inequality using an income Gini. Then, it decomposes the income inequality into the covariates of the income equation using the total differential decomposition method proposed by Wagstaff, et al (2003). Thus, I decomposed the inequality of income into its determinants. The determinants of income are broadly classified into socio-economic, geographic and demographic factors. Finally, my work proposes the mechanism to measure the effect of policy change on inequality in income and recommends some sustainable policies to minimize that inequality in those countries.

3.4 Inequality and Growth

Because of the innovation of wide spread technology and its application in agriculture, industry and service sectors, economic activities and economic growth are widely knowledge-based. The latter is mainly determined by the general health status and the inequality in health and average years of schooling and inequalities in educational opportunities among the

population. Thus, inequality in health and education are the major impediments of equitable distribution of income and economic growth.

Endeavors to identify the determinants of economic growth have been made from the early 1990s. Many variables have been tested, but only a few have been identified as being statistically significant to explain economic growth. Human capital is now almost unanimously accepted as being an indispensible factor to determine economic growth. Further, sustained and continuous growth depends on the levels of human capital whose stock increases as a result of better education, better health, and new opportunities for learning and training facilities.

From the early 1990s, the role of human capital was mainly linked to education and then to health and nutrition. Mankiw, Romer and Weil (1992) raise the importance of considering health and nutrition in a broad analysis of human capital and then to economic growth. Fogel (1994), Barro (1996), and Barro and Sala-i-Martin (2004) examines the relationship between economic growth and population health. All of this literature raises the issues and importance of population health on economic growth. As the disparity in population health reduces the process of human capital formation and as human capital is one of the indispensible factors for sustained and continuous growth, disparity in population health reduces the rate of economic growth.

The relationship between the distribution of years of schooling in a population and the distribution of income has long been a fundamental issue in the literature of income inequality (Lam and Levison, 1992). A number of authors such as Chiswick (1971), Knight and Sabot (1987) and Marin and Pachoropoulos (1976) have focused their research on developing countries on the issues of how increase in the level of schooling over time affects earning inequality. Their studies have pointed out that the effect of educational expansion on earning inequality is difficult to predict a priori.

Even though there are conflicting results for developing countries, there should be some causal relationship among economic growth, income redistribution, and years of schooling or education level of the general population. Theoretically, an average increase in educational attainment results in a relative increase in the supply of skilled workforce, which in turn enhances average labor productivity and increases the rate of economic growth (Barro, 1991; Barro and Lee, 1993, 1997; Barro and Sala- i -Martin, 1995; Aghion and Howitt, 1998). If educational inequality is higher in a society, the resulting higher levels of output tend to represent a higher inequality in the redistribution of incomes, and therefore induce more poverty (Glomm and Ravikumar, 1992; Benabou, 1996a; Thomas, Wang and Fan, 2001; Lopez, Thomas and Wang, 2002). Thus, equitable distribution of education could be imperative for poverty-reducing growth strategy. It is interesting to see the relationship among inequalities in education and income, and economic growth with this conflicting finding.

In addition, education is important from various standpoints. It is the key for the establishment of a democratized, responsible, decentralized and civilized society. Education is imperative to improve general health conditions and to reduce the social, cultural and ethnic disparities in the society. The positive externalities thus created through education provision further enhance the processes of economic growth and development. Likewise, income and population health are very important factors to have better education, and better education and better health are indispensible factors for sustained growth**.** My research thus studied the relationship among the inequality of income, education and health and concludes that the integrated approach of development sustainably reduces inequality in income, education and health. A sustainable reduction of inequality in those factors in LMI countries should enhance

the human capital that ultimately promotes the economic growth and helps to establish the egalitarian-based society in LMI countries.

Chapter 4

Data and Methods

Chapter 3 fundamentally focused on the review of literature that is associated with this research. Chapter 4, however, concentrates on the data and method used for this research. Section 4.1 of this chapter briefly discusses the sources and nature of data used for this research. Likewise, section 4.2 discusses the detail of the methodology used for the current research. The generalized version of the methodology proposed in this chapter is applied for the specific research of inequality in health care utilization, education and income in Chapters 5 and 6, respectively.

4.1 Sources of Data

This study is primarily based on the household survey data collected by the statistical office of the respective governments of Albania, Nepal, Tajikistan and Tanzania. These data were collected under the guidelines of Living Standards Measurement Study (LSMS) project of the World Bank. The LSMS was established by the Development Economics Research Group (DECRG) to explore ways of improving the type and quality of household data collected by statistical offices in developing countries. Table 5 describes the survey of the four non-institutional populations on which the current set of analysis is based. The methodologies of the survey are comparable because all four surveys were carried out according to the LSMS guideline. To ensure the representativeness of all types of households in the survey, stratified sampling designs were employed with appropriate application of sampling weights.

LSMS surveys collect data on many dimensions of household well-being, including consumption, income, savings, employment, health, education, fertility, nutrition, housing and migration. From this wide range of common comparable variables, I selected income to measure

the socioeconomic status of representative households and for ranking purpose. Other variables used in the study are health indicators variables such as number and probability of doctor visits; self-access health measure (measured in a 5-point scale); demographic variables such as age and sex; socio-economic variables such as education, land-holding and poverty; and geographic location. Data for leading health indicator variables such as health sector expenditure as a percentage of GDP, public and private share of health sector expenditure, and other variables that are presented in Tables 1 to 4 above, are downloaded from the websites of Kaiser Family Foundation and the World Bank.

Table 5: Description of Surveys

Territory	Year	Survey	Survey Institution	National Coverage	Survey Design	Sampling Unit	Household Size	Recall Period
Albania	2005	Albania Living Standard Measurement Survey	Institute of Statistics	Nationally Representative	Stratified two stage cluster sampling	Household	3,638	4 Weeks
Nepal	2004	Nepal Living Standard Survey	Central Bureau of Statistics	Nationally Representative	Two stage stratified	Household	3,912	1 Year
Tajikistan	2007	Tajikistan Living Standards Measurement Survey	State Statistical Agency	Nationally Representative	Stratified random probability sampling	Household	4,860	4 Weeks
Tanzania-Kagera	2004	Kagera Health and Development Survey 2004	Economic Development Initiatives	Kagera Area Representative	Two stage stratified random sampling	Household	900	4 Weeks

4.2 Method

This section first explains how demand function can be derived using the static utility maximization framework. This generalized version of the derivation of demand curve using the static utility maximization framework is available elsewhere. The framework developed in this generalized version is used to derive the specific demand curves in health care utilization and education later in Chapters 5 and 6, respectively.

Estimation of the Demand Function: Demand for any goods and services can be derived in a static one-period utility maximization framework. Let us suppose that an individual consumes only two goods *X* and *Y*. The consumer then derived his/her utility from consuming units of some composite goods *(X)* and units of some services such as health care or education *(Y)* that flow from his/her initial stock of human capital (h_0). Then the total utility function for this individual is:

$$U = U(X, Y, E) \tag{1}$$

where *E* represents the exogenous tests and preferences of the individual.

Utility is assumed to increase at a decreasing rate with respect to *X* and *Y*.

The consumer's optimization problem is then:

$$\begin{aligned} &\text{Maximize}_{(C, y_1, y_2)} U = U[X, Y(y_1, y_2, h_0, T, s_1, s_2, d_1, d_2), E] \\ &\text{Subject to } M = P_x X + P_{y_1} y_1 + P_{y_2} y_2 \end{aligned} \tag{2}$$

where $Y = Y(y_1, y_2, h_0, T, s_1, s_2, \ldots \ldots, d_1, d_2, \ldots \ldots, t)$ is the production function for services; y_1 and y_2 are the inputs of production other than the consumer's initial endowment of human capital (h_0), current state of production technology *(T)* and other socio-economic $(s_1, s_2, \ldots, s_n)$, demographic and geographic $(d_1, d_2, \ldots\ldots, d_n)$ characteristics and time cost *(t)* to achieve the service *Y*. Further, I assume that *Y* is concave with respect to both y_1 and y_2.

The solution of this problem gives the typical demand function for an individual consumer. The demand function can be written as:

$$y_1 = y_1\left(\frac{P_{y1}}{P_x}, \frac{P_{y2}}{P_x}, \frac{Y}{P_x}, E, h_0, T, s_1, s_2, \ldots \ldots, s_n, d_1, d_2, \ldots \ldots, d_n, t\right) \tag{3}$$

For the given price of composite commodity P_x, demand for y_1 is determined by the out-of-pocket price for y_1, relative out-of-pocket prices for y_2, consumer's net income, and other

factors listed in the equation (3) above. That is:

$$y_1 = y_1(P_{y1}, P_{y2}, Y, E, h_0, T, s_1, s_2, \ldots \ldots, s_n, d_1, d_2, \ldots \ldots, d_n, t) \quad (4)$$

Assuming a linear relationship between the dependent and independent variables, the service *(y_1)* used is computed from a regression of all individuals in the sample, explaining y_1 with a set of explanatory variables. So, I run the following linear regression to estimate the service *(y_1)* used by individual *i*.

$$y_{1i} = \beta_0 + \sum_{j=1}^{m} \beta_j \, x_{ji} + \varepsilon_i \quad (5)$$

where y_i denotes the dependent variable (service y_1 used by individual *(i)*, x_{ji} is a set of explanatory variables of individual *i* listed in equation (4) above and ε_i is an error term. Then equation (5) is estimated using appropriate regression techniques. The estimated $\beta-$coefficients are used for the decomposition of concentration index among the determinants of y_1 and for the calculation of the effect of policy change on disparity in y_1.

Calculation of Income Related Inequality: To measure the income-related inequality in the utilization of service *(y_1)*. I use a concentration index (CI) proposed by Wagstaff, et al. (1991). CI lies in the range of (-1, 1), with a positive (negative) sign indicating pro-rich (pro-poor) inequality. However, testing for differences between concentration indices requires confidence intervals. Thus, robust estimates for *CI* and its standard error are obtained by running the following convenient (weighted least squares) regression of (transformed) y_i on relative rank (Kakwani et al, 1997):

$$\frac{2\sigma^2{}_R}{\mu} y_i = \alpha_1 + \beta_1 R_i + \varepsilon_{1,i} \quad (6)$$

where $\mu =$ mean of y_i series as defined in equation (5) above, $R_i =$ Rank of i^{th} individual on the

basis of his or her household income after they are arranged in non-descending order. To calculate rank, I use the following formula: $R_i = \left(1/n\right)\sum_{j=1}^{i-1} w_j + \frac{1}{2} w_i$. Similarly, σ_R^2 is the variance of R_i, and $\hat{\beta}_1$ is equal to CI . The estimated standard error of $\hat{\beta}_1$ provides the estimated standard error of CI .

Hypothesis 1: The following hypothesis is tested.

Null Hypothesis $(H_0): \beta_1 = 0$.

If the null hypothesis is rejected at 5% significance level, then we can argue that there is inequality in the utilization of service (y_1).

Following Wagstaff et al (2003), I use the following formula for the decomposition of income-related inequality in the utilization of service *(y_1).*

$$CI = \sum_{j=1}^{m} \eta_j CI_j + \frac{GC_\varepsilon}{\mu} \qquad (7)$$

where CI_j is the concentration index of respective variables as defined in the equation (6) above, and η_j is the estimated partial demand elasticity of the corresponding variables and $\eta_j = \beta_j \frac{\overline{x_j}}{\mu}$. Further, GC_ε is the generalized concentration index which measures the inequality in error term (Shorrocks, 1983). That means inequality in the utilization of service *(y_1)* is the weighted sum of the disparities of the determinants of demand equation defined in equation (5) above with weights equal to corresponding partial demand elasticity.

Controlling for the need, whether the distribution of the facility of service y_1 is equal to all, is then measured by the horizontal inequity *(HI)* index proposed by Wagstaff and van Doorslaer (2000), which is given in equation (8) below. Its value lies between (-2, 2), with a

positive (negative) sign indicating pro-rich (pro-poor) inequity. A zero *HI* for a country represents the principle of ETEN is fulfilled for that country.

$$HI = CI - \sum_{j=1}^{k} \eta_j CI_j \tag{8}$$

where the second term in equation (8) is the weighted sum of the disparities due to need factors.

Measurement of the Policy Effect: To measure the effect of change in (increasing or decreasing as per requirement) average x_j on income related inequality of y_1, I use the following comparative statistic derivatives. Partially differentiating equation (8) with respect to average x_j we get:

$$\frac{dCI}{d\bar{x}_j} = \underbrace{\left[\frac{\partial CI}{\partial \bar{x}_j}\right]}_{Term\ 1} + \underbrace{\left[\frac{dCI}{d\mu} \times \frac{d\mu}{d\bar{x}_j}\right]}_{Term\ 2} + \underbrace{\left[\frac{dCI}{dCI_j} \times \frac{dCI_j}{d\bar{x}_j}\right]}_{Term\ 3} \tag{9}$$

Term 3 in equation (9) equals zero because a proportionate increase in x_j does not change the inequality in x_j. Solving term 1 and 2 of equation (9) gives the following result.

$$\frac{dCI}{d\ \bar{x}_j} = \frac{\beta_j}{\mu.\bar{x}_j} \times (CI_j - CI) \tag{10}$$

where β_j = coefficient of x_j, $\bar{x}_j$ = mean of variable x_j, μ = mean of dependent variable y_1 in equation (5) above, CI_j = inequality of x_j and CI = inequality in utilization of service y_1. Then, equation (10) is reduced to:

$$\frac{dCI}{d\ \bar{x}_j} = e_j \left[\frac{CI_j - CI}{\bar{x}_j}\right] \tag{11}$$

where e_j is the elasticity of demand for the utilization of service y_1. A detailed solution of equation (9) to get equations (10) and (11) is given in appendix 1.

Hypothesis 2: Whether the increase in mean x_j significantly increases or decreases the inequality in the utilization of service y_1 is tested by using following hypothesis.

Null Hypothesis (H_0): Right hand side term of equation (11) = 0.

If the null hypothesis is rejected at the 5% significance level, then we can argue that the average change in x_j can significantly change income related inequality in the utilization of service y_1. To test this hypothesis, the bootstrapping technique proposed by Efron (1997) and Mills and Zandvakili (1997) is used.

The increase in mean x_j has two effects (Wagestaff, et al. 2003):

The Direct Effect: through elasticity, mean of x_j and CI_j.

Let $\bar{x}_j > 0$. Increase in average x_j further increases inequality in the utilization of service y_1 if $e_j > 0$ and decreases inequality if $e_j < 0$. The sign of e_j depends on the sign of estimated β_j in equation (5). The direct effect also appears through $(CI_j - CI)$. If $(CI_j - CI) < 0$, an increase in x_j directly reduces inequality in the utilization of service y_1 by an individual. However, if $(CI_j - CI) > 0$, an increase in x_j cannot reduce inequality in the utilization of service y_1 by an individual. That leads to the following two propositions.

Proposition 1: *Increase in average x_j does not always decrease income-related inequality in the utilization of service y_1 even though it increases the amount of y_1 utilization.*

Proof: Suppose $\beta_j > 0$ in equation (5). Then, increase in average x_j increases the amount of the utilization of service y_1. In this case, $e_j > 0$. Let $\bar{x}_j > 0$. So, whether the increase in average x_j decreases income-related inequality, the utilization of service y_1 is based on whether $(CI_j - CI) < 0$. As CI_j is income-related inequality in x_j, it may be positive or negative. Positive/negative CI_j represents the pro-rich/pro-poor income-related inequality in x_j. When

$CI_j > 0$ and *CI < 0*, then $\left(CI_j - CI\right) > 0$. Then, an equi-proportionate increase in x_j holding CI_j constant increases CI towards pro-poor such that $(CI_j - CI) > 0$ and is larger than its previous value. In this case, an increase in average x_j instead of reducing income-related inequality in the utilization of service y_1, increases it.

When $CI_j > 0$ and *CI > 0* such that $(CI_j - CI) > 0$, then equi-proportionate increase in the average x_j holding CI_j constant increases income-related inequality in the utilization of services y_1 towards pro-rich. In this situation, increase in average x_j cannot reduce income related inequality in the utilization of services y_1 until $(CI_j - CI) < 0$. Similarly, we can analyze the case of $CI_j < 0$ and $CI > 0$ and $CI_j < 0$ and $CI < 0$.

2. ***The Indirect Effect:*** Through concentration indices via average level of utilization of service y_1. A rise in average x_j increases average level of utilization of service y_1 if $\beta_j > 0$ and decreases if $\beta_j < 0$. If $\beta_j > 0$, an increase in mean x_j increases CI towards pro-rich and if $\beta_j < 0$, an increase in mean x_j decreases CI towards pro-poor. This effect is indirect.

3. ***Total Effect:*** The total effect of increase in mean x_j is thus the sum of direct and indirect effects. Hence, the net effect of the rise in average level of x_j on income-related inequality in the utilization of service y_1 depends upon whether the x_j is more unequally distributed than the utilization of service y_1, (i.e., whether $(CI_j - CI)$ is positive or negative). Thus, an increase in average x_j can reduce inequality in the utilization of service y_1 if and only if that could reduce inequality in x_j.

Proposition 2: *An integrated approach of development is always stronger than the sectoral development policy for the reduction of income-related inequality in the utilization of service y_1 if increase in average x_j reduces inequalities in x_j.*

Proof: By assumption, $(CI_j - CI)$ decreases when x_j increases. So, integrated efforts of increasing average x_j are always stronger than the sectoral policy effect because the absolute value of $\sum_{i=1}^{m}\left(CI_j - CI\right)$ is always greater than the absolute value of $(CI_j - CI)$. Even if some of these terms are increasing and the others are decreasing, then an integrated effect helps to minimize the total effect if the total effect is increasing and maximize the total effect if it is decreasing. Hope (1982) also discuss the idea of integrated approach of development.

Chapter 5

Inequality in Health Care Utilization

This chapter fundamentally concentrates on the measurement and interpretation of inequality in health care utilization in LMI countries represented by Albania, Nepal, Tajikistan and Tanzania. Based on the generalized version of the methodology developed in Chapter 4, specific methodology used for the calculation of IRIHCU is discussed in detail in section 5.3 of this chapter. Based on this methodology, this chapter calculates the income-related inequality in health care utilization and inequity in health care delivery. Finally, it decomposes the inequality among the determinants of health care demand function and proposes a measure to estimate the effect of policy change on disparity in health care utilization. This measure is simply defined as the policy effect of disparity in health care utilization.

5.1 Data

As explained in section 4.1 of Chapter 4, this study is primarily based on household survey data collected by the statistical office of the respective governments of Albania, Nepal, Tajikistan and Tanzania. However, descriptive statistics of all the variables used for the study of inequality in health care utilization is presented in Table 6.

As a proxy for health care demand, my study uses the probability and total number of physician service use by ill health patients in a given recall period in all countries under study. First is the answer to the question: Did you visit the doctor in the recall period? The second is the answer of the question: How many times did you visit the doctor in the recall period? The probability of physician service used by ill health patients is a binary variable. It takes the value 0 for no doctor visits or 1 otherwise.

Table 6: Definition of Variables with their Means and Standard Deviations

Variable and corresponding definition	Mean				Standard Deviation (SD)			
	Albania	Nepal	Tajikistan	Tanzania	Albania	Nepal	Tajikistan	Tanzania
Probability of Physician Use: Use of physician (general and specialist) service by ill health patient (0/1 dummy variable). Binary variable, if visited = 1, if not = 0 for a given recall period.	0.583 (0.564)	0.790 (0.647)	0.9093 (0.4322)	0.7213 (0.4404)	0.493 (------)	0.4074 (0.4778)	0.2872 (0.495)	0.4484 (0.496)
Total Number of Physician Use: Number of times physician (general and specialist) visited by ill health patient during the recall period. It may be 0 or any positive number.	0.8722 (1.065)	1.490 (0.926)	2.040 (------)	0.8768 (-----)	1.118 (1.658)	1.341 (1.253)	1.327 (-------)	0.6474 (--------)
LogIncome: Household income measured in terms of natural logarithm. Continuous variable.	9.917 (10.504)	11.106 (11.001)	7.764 (7.772)	12.052 (12.073)	4.342 (3.638)	1.212 (1.1950	2.024 (2.144)	2.394 (2.359)
Education: Continuous variable, measured in years of schooling. 0 for illiterate to 20 for PhD completed.	5.365 (5.150)	0.949 (2.033)	1.794 (1.812)	5.111 (5.245)	2.060 (2.30)	2.342 (3.491)	1.525 (1.501)	2.920 (2.933)
Distance to Doctors Services: Measured in minutes. Transferred to categorical variable by recoding: 0-15 min. = 1, 16-30 min. = 2, 31- 45 min. = 3, 46-60 min. = 4 and 60+ min = 5.	1.828 (1.848)	2.375 (2.787)	1.666 (1.670)	-	1.093 (1.07)	1.495 (1.501)	0.867 (0.895)	-
Rural vs. Urban: 0 / 1 dummy variables. Rural = 0 and Urban = 1.	0.545 (0.521)	0.7404 (0.763)	0.4837 (1.521)	-	0.497 (0.499)	0.4385 (0.425)	0.499 (0.499)	-
Poverty Index: Continuous variable. Takes any values between 0 and 1.	0.1401 (0.187)	0.1877 (0.1970	0.198 (0.175)	-	0.3472 (0.390)	0.3907 (0.398)	0.399 (0.38)	-

Wage: Calculated as total earnings for the month preceding the survey. Wage is imputed for those who did not report hours worked during the recall period.	12.045 (11.894)	-	5.465 (5.484)	-	0.5701 (0.674)	-	0.758 (0.727)	-
Land Holding: Continuous variable measured in natural logarithm in Nepal and categorical variable measured in 1 to 5 scales for Tanzania.	-	0.3787 (2.53)	-	2.5453 (1.484)	-	1.1503 (1.322)	-	1.278 (0.4997)
Ethnicity: Categorical variable measured in 1 to 5 scales.	-	2.512 (3.24)	1.224 (1.214)	1.417 (1.358)	-	1.404 (1.36)	0.4174 (0.4107)	0.4933 (0.4797)
Self Access Health (SAH) Measures:* Categorical variable measured in 1 to 5 scales.	3.365 (2.668)	2.109 (1.596)	2.707 (2.591)	3.394 (3.09)	0.845 (0.930)	0.5395 (0.615)	0.762 (0.765)	0.7575 (0.675)
Length of Illness:* Measured in days. Transferred to categorical variable measured in 1 to 5 scales based on number of days ill (length of illness).	3.034 (-----)	2.788 (3.15)	1.719 (------)	2.716 (------)	1.413 (-----)	1.438 (1.31)	1.156 (------)	1.5647 (-----)
Days Disturb in Work:* Categorical variable measured in 1 to 5 scales based on number of days disturb (length of illness).	2.045 (1.67)	2.507 (------)	-	-	1.436 (1.338)	1.450 (-----)	-	-
Sex*: Sex of the individual (0 = female; 1= male)	0.571 (0.556)	0.4765 (0.534)	0.4336 (0.4247)	0.4685 (0.4811)	0.495 (0.496)	0.4996 (0.498)	0.4957 (0.4945)	0.4991 (0.4996)
Age:* Age of the individual, in years	51.888 (34.38)	50.79 (26.06)	43.704 (27.06)	21.668 (21.67)	20.87 (25.22)	17.719 (21.75)	20.944 (22.94)	18.500 (18.21)
Age^2* *:* Square of age	3127.8 (1818.04)	2893.43 (1152.41)	2348.45 (1257.79)	810.969 (799.37)	1888.3 (1969.7)	1694.92 (1503.5)	1900.48 (1684.86)	1307.32 (1286.34)

Source: - Calculated by Author.

*Note: - * Represents the need variables.*

1. Numbers that are not inside the parentheses are the means and the standard deviations of chronic ill patients.

2. Numbers inside the parentheses are the means and the standard deviations of general ill patients.

However, the total number of doctor visits is the number of times an ill-health patient visited the doctor in a given recall period. It is a discrete variable that can take any non-negative values. The study is conducted for chronic ill and general ill health patients. To reduce the degree of heterogeneity, some of the variables such as: distance to doctor's service and length of illness are transferred from continuous to the categorical variables. Another goal of these transformations is to normalize the variables and reduce the degree of heterogeneity.

5.2 Method

Estimation of the Health Care Demand Function: Demand for health care can be derived in a static one-period utility maximization framework. This derivation is based upon the general framework developed for one-period utility maximization in Chapter 4. This simple utility maximization framework is complicated by the fact that a fraction of individuals in a given time period is either infected with chronic disease, such as diabetes and cancer, or suffers from general illness such as typhoid, cholera and fractures. Thus, all individuals perceive their health state in terms of being disease-free, or as having either chronic illness or general illness, in a particular time. The individual consumer then derived his/her utility from consuming units of some composite goods (C) and units of health care services (H) that flow from their initial stock of health capital (h_0). Mathematically, utility is:

$$U = U(C, H, E) \tag{12}$$

where E represents the exogenous testes and preferences of individual i.

Utility is assumed to increase at a decreasing rate with respect to C and H. Further assume that health care service can be produced with varying combinations of prescription drugs (Q) and medical services (M), such as office visits, inpatient days or a number of outpatient visits conditioned on the representative consumer's initial endowment of health capital (h_0),

current state of medical technology (T), distance to health care facility (D), education of the individual (e), individual's age (a), sex of the individual (s), depth of poverty index (p_v) and time cost of treatment (t). For each of the expositions, I ignore a set of other health care "goods" and "bads" such as exercise, diet, alcohol and tobacco use. Thus, the production function for units of health services can be written as:

$$H = H(Q, M, h_0, T, D, e, a, s, p_v, t) \tag{13}$$

where H is assumed to be concave with respect to both Q and M.

Assume that the consumer's income net of taxes and insurance premium (y) is fully utilized to purchase the composite goods (C), and the two inputs (Q) and (M) to produce health services. Thus, individual consumer income is:

$$y = P_c C + P_q Q + P_m M \tag{14}$$

where P_q is the out-of-pocket price for drugs, P_m is the out-of-pocket price for medical services, and P_c is the price for composite goods.

Then, the individual consumer optimization problem is to maximize utility: $U = U[C, H(Q, M, h_0, T, D, e, a, s, p_v, t), Ex]$ subject to $y = P_c C + P_q Q + P_m M$.

Solving this utility maximization problem yields the representative consumer demand function for prescription drugs (Q) and medical services (M) as a function of the relative out-of-pocket drug price, relative out-of-pocket price of medical services, and his/her real net income, and other determinants in the model such as initial endowment of health capital (h_0), current state of medical technology (T), distance to health care facility (D), education of the individual

(e), individual's age (a), sex of the individual (s) and time cost of treatment (t). The typical demand function for medical care use is thus:

$$M = M\left(\frac{P_q}{P_c}, \frac{P_m}{P_c}, \frac{y}{P_c}, E, h_0, T, D, e, a, s, t\right) \tag{15}$$

For the given price of composite commodity P_c, demand for medical services is determined by the out-of-pocket price of medical services, out-of-pocket drug price, his/her net income, and other factors listed in the equation (15) above. That is,

$$M = M(P_q, P_m, y, Ex, h_0, T, D, E, a, s, p_v, t) \tag{16}$$

Assuming a linear relationship between the dependent and independent variables, the physician service use is computed from a regression of all individuals in the sample, explaining number and probability of physician visits with a set of explanatory variables. So, under the assumptions of ordinary least squares (OLS)[1], I run the following linear regression to estimate physician service use by individual i.

$$M_i = \gamma_0 + \gamma_1 \ln y_i + \gamma_2 e_i + \sum_{k=3}^{j} \gamma_k x_{ki} + \sum_{p=j+1}^{n} \gamma_p z_{pi} + \varepsilon_i \tag{17}$$

where M_i denotes the dependent variable (probability and number of physician service use by individual i in a given recall period), $\ln y_i$ is the (logarithm of) the household income of individual i, e_i is the education measured in terms of years of schooling of individual i, x_k is a set of *k* need indicator variables such as age, sex, health status measured in terms of self access health; z_p is *p* set of non-need-related variables such as distance to health care facility, depth of

[1] Non linear models such as ordered probit for total number of physician service utilization and binery probit for probability of physician service utilization models are also tested. Outcomes of those models are not superior over the OLS model. Thus, I decided to use OLS for further analysis.

poverty of i^{th} households, time cost of treatment of individual i, and ε_i is an error term.

Measurement and Decomposition of Inequality: Income-related inequality in physician service utilization (IRIPSU) is calculated for the chronic ill health and general ill health patient and for the probability of physician service utilization model and total number of physician service utilization model.

To measure the IRIPSU, I use concentration index (CI) proposed by Wagstaff et al (1991). CI lies in the range of (-1, 1), with a positive (negative) sign indicating pro-rich (pro-poor) inequality. However, testing for differences between concentration indices requires confidence intervals. Thus, robust estimates for CI and its standard error are obtained by running the weighted least squares regression of (transformed) M_i on relative rank proposed by Kakwani (1997). The coefficient of relative rank (β_1) in the weighted regression equation measures CI.

Hypothesis 1: In all cases, the following hypothesis is tested.

Null Hypothesis $(H_0): \beta_1 = 0$.

If the null hypothesis is rejected at 5 percent significant level, then we can argue that there is inequality in health care utilization.

Following Wagstaff et al (2003), this paper uses the following equation for the decomposition of IRIPSU.

$$CI = \eta_y CI_y + \eta_e CI_e + \sum_{k=3}^{j} \eta_k CI_k + \sum_{p=j+1}^{n} \eta_p CI_p + \frac{GC_\varepsilon}{\mu} \qquad (18)$$

where μ is the mean of health care (physician service) use and (M_i), CI_y, CI_e, CI_k and CI_p are the concentration indices of respective variables as defined in equation (17) above, and η_y, η_e, η_k and η_p are the estimated partial demand elasticities of the corresponding variables and

$\eta_y = \gamma_1 \frac{\ln Y}{\mu}$, $\eta_e = \gamma_2 \frac{E}{\mu}$, where Y is the mean of income (y_i) series, and E is the mean of education (e_i) series, etc. GC_ε is the generalized concentration index which measures the inequality in error term.

Inequity in physician service delivery is then calculated by the horizontal inequity (HI) index proposed by Wagstaff and van Doorslaer (2000). Its value lies between (-2; 2), with a positive (negative) sign indicating pro-rich (pro-poor) inequity. A zero HI for a country represents that the principle of equal treatment for equal need is fulfilled for that country.

Measurement of the Policy Effect: The measure I propose in the following section explains the mechanism to quantify the policy effect on disparity in health care utilization. Here, the same measure is used to quantify the effect of increase in average income and education on reduction of IRIPSU. To my knowledge, this has not been done before.

To measure the effect of increasing average income and education on income-related inequality, I use the following comparative statistic derivatives. Partially differentiating equation (20) with respect to average income, we get:

$$\frac{dCI}{dY} = \left[\underbrace{\frac{\partial CI}{\partial \ln Y} \times \frac{d \ln Y}{dY}}_{Term\ 1} \right] + \left[\underbrace{\frac{dCI}{d\mu} \times \frac{d\mu}{d \ln Y} \times \frac{d \ln Y}{dY}}_{Term\ 2} \right] + \left[\underbrace{\frac{dCI}{dCI_y} \times \frac{dCI_y}{d \ln Y} \times \frac{d \ln Y}{dY}}_{Term\ 3} \right] \qquad (19)$$

Term 3 in equation (19) equals zero because a proportionate increase in income does not change inequality in income, as measured in relative terms. Solving term 1 and 2 of equation (19) gives the following result.

$$\frac{dCI}{dY} = \frac{\gamma_1}{\mu Y} \times (CI_y - CI) \qquad (20)$$

where γ_1 = coefficient of income in equation (17) above, CI_y = inequality in income (i.e., Gini Index) and CI = inequality in physician service utilization. Equation (20) is then reduced to:

$$\frac{dCI}{dY} = \omega_y \left[\frac{CI_y - CI}{Y} \right] \tag{21}$$

Here, ω_y is the income elasticity of demand for physician service utilization. A detailed solution of equation (19) to get equations (20) and (21) is given in Appendix 2. Here, the right hand side of equation (21) is defined as the policy effect of disparity in health care utilization with respect to income because a policy of increasing average income changes IRIPSU by this process or mechanism.

Similarly, partially differentiating equation (18) with respect to average education (E), we get:

$$\frac{dCI}{dE} = \omega_e \left[\frac{CI_e - CI}{E} \right] \tag{22}$$

where ω_e is the education elasticity of demand for physician service utilization and CI_e is education concentration index.

Equations (21) and (22) establish a good mechanism and give us meaningful policy implication for the reduction of inequality in physician service utilization for the countries under study.

Hypothesis 2: Whether the increase in mean income/education significantly increases/decreases the inequality in physician's service utilization is tested by using the following hypothesis.

Null Hypothesis (H_0): Right hand side term of equation (21) / (22) = 0.

If the null hypothesis is rejected at 5 percent significance level, then we can argue that the average increase in income/education can significantly reduce or increase IRIPSU. To test this hypothesis, the bootstrapping method proposed by Efron, (1997) and Mills and Zandvakili, (1997) is used.

The increase in mean income has two effects:

The direct effect: Through income elasticity, mean income and CI_y. As $Y > 0$, an increase in average income further increases inequality in physician service utilization if $\omega_y > 0$ and decrease inequality if $\omega_y < 0$. The sign of ω_y depends on the sign of the estimated coefficient of income (γ_1) in equation (17). The direct effect also appears through $(CI_y - CI)$. If $(CI_y - CI) < 0$; an increase in income directly reduces inequality in physician service utilization by ill health patients. However, if $(CI_y - CI) > 0$, increase in average income cannot reduce income-related inequality in health care utilization. Similar analysis of increasing average education leads to the following proposition.

Proposition 1: *An increase in average income/education may not decrease income-related inequality in health care utilization even though it increases the amount of health care utilization.*

Proof: Suppose $\gamma_1 > 0$ in equation (17). Then, increase in average income increases the amount of health care utilization. In this case, $\omega_y > 0$. $Y > 0$, (i.e., the average income of an individual is also positive). So, whether the increase in average income decreases income related inequality in health care utilization depends on whether $(CI_y - CI) < 0$. However, the income Gini is always non-negative, *(i.e.,* $CI_y \geq 0$*).*

If $CI < 0$, then $(CI_y - CI) > 0$. In this case, an equi-proportionate increase in income holding CI_y constant, increases CI because the existing inequality in income further increases inequality in physician service utilization to the pro-poor or disadvantaged. Similarly, assume $CI > 0$ such that $(CI_y - CI) > 0$. Then, an equi-proportionate increase in income holding CI_y constant increases CI because the existing inequality in income further increases inequality in physician service utilization to the pro-rich or well off. In both of these cases, increase in average income increases income-related inequality in health care utilization until that increase reduces CI_y. Similarly, we can explain the effect of increase in average education on IRIPSU.

The indirect effect: Through concentration indices via average level of physician service utilization. A rise in average income increases the average level of physician service utilization if $\gamma_1 > 0$ and decreases if $\gamma_1 < 0$. If $\gamma_1 > 0$, an increase in mean income increases CI towards pro-rich and if $\gamma_1 < 0$, it decreases CI towards pro-poor. This effect is indirect.

Total effect: The total effect of increase in mean income/education is thus the sum of direct and indirect effect. Hence, the net effect of the rise in average level of income/education on income related inequality in physician service utilization depends on whether the income/education is more or less unequally distributed than physician service utilization, (i.e., whether $(CI_k - CI)$ is positive or negative). Further, if increase in average income and education respectively reduces the inequalities in those variables, that could reduce $\left|CI_y - CI\right|$ term in equation (21) and $\left|CI_e - CI\right|$ term in equation (22) and hence the inequality in physician service utilization. Thus, increase in average income and education can reduce inequality in health care utilization sustainably if and only if that could reduce inequality in income and education, respectively.

Proposition 2: *An integrated approach of development is always stronger than the sectoral development policy for the reduction of IRIPSU if an increase in average income and education reduces inequalities in income and education.*

Proof: By assumption, when the average income and education increases, $(CI_y - CI)$ and $(CI_e - CI)$ decreases. So, integrated efforts of increasing average income and education are always stronger than the sectoral policy effect because the absolute value of $(CI_y - CI)$ + $(CI_e - CI)$ is always greater than the absolute value of either $(CI_y - CI)$ or $(CI_e - CI)$. Even if any one of these two is increasing and the other is decreasing, then an integrated effect helps to minimize the total effect if the total effect is increasing and to maximize the total effect if it is decreasing.

5.3 Results

Inequality and Inequity in Physician Service Utilization: The concentration indices calculated for patients with chronic illness and general illness in Albania, Nepal, Tajikistan, and Tanzania are reported in Table 7. These are calculated for the probability of physician service utilization and total number of physician service utilization. All of the concentration indices in the probability of use model are statistically significant at better than 1 percent for both cases (chronic and general illness) except for Tajikistan and Tanzania. Thus, the null hypothesis is rejected for Nepal and Albania. However, for the total number of physician service visits, the calculated concentration indices are statistically significant at better than 1 percent for Albania and Nepal in both cases (chronic and general illness) but insignificant for Tajikistan and Tanzania. Therefore, the null for Tajikistan and Tanzania cannot be rejected.

Although the CI numbers show substantial disparity across nations, the country from sub-Saharan Africa (Tanzania) displays more even distribution of physician service than the others—

Table 7: Income Related Inequality and Inequity

Countries	*Model I: Probability of Physician Service Utilization*				
	Chronic Illness				
	Prob.	CI	95% Confidence Interval	HI^{+}	95% Confidence Interval
Albania	0.596	-0.021*	-0.022 to -0.021	-0.012*	-0.013 to -0.012
Nepal	0.792	0.049*	0.048 to 0.050	0.053*	0.052 to 0.053
Tajikistan	0.916	0.011*	0.010 to 0.011	0.009*	0.009 to 0.009
Tanzania	0.700	0.002	0.001 to 0.002	0.002*	0.001 to 0.002
	General Illness				
Albania	0.491	-0.012	-0.013 to -0.011	0.016*	0.015 to 0.017
Nepal	0.657	0.026*	0.025 to 0.026	0.029*	0.028 to 0.030
Tajikistan	0.370	0.032	0.030 to 0.033	0.058*	0.056 to 0.059
Tanzania	0.412	0.006	0.005 to 0.007	-0.001**	-0.001 to 0.000
Countries	*Model II: Total Number of Physician Service Utilization*				
	Chronic Illness				
	TNo.	CI	95% Confidence Interval	HI^{+}	95% Confidence Interval
Albania	0.915	-0.045*	-0.046 to -0.044	-0.016*	-0.017 to -0.015
Nepal	1.462	0.114*	0.113 to 0.115	0.132*	0.131 to 0.133
Tajikistan	2.065	0.008	0.007 to 0.008	0.007*	0.006 to 0.008
Tanzania	0.997	-0.003	-0.003 to -0.002	-0.004*	-0.004 to -0.003
	General Illness				
Albania	0.910	-0.057*	-0.058 to -0.055	0.000	-0.002 to 0.002
Nepal	0.953	0.095*	0.094 to 0.096	0.099*	0.098 to 0.100
Tajikistan	NA	NA	NA	NA	NA
Tanzania	NA	NA	NA	NA	NA

Source:- Calculated by Author.

Prob.: probability of use of all type of physician for the relevant recall period as per Table 2.1.

TNo.: total number of physician visited per person per recall period as per Table 2.1.

* Statistically significant ($p < 0.01$). ** Statistically significant ($p < 0.10$).

+ All HI indices, their 95% confidence interval, t-stats and p-values are calculated by using bootstrapping.

East Europe (Albania), Central Asia (Tajikistan) and South Asia (Nepal). The CIs of Tanzania range from 0.002 for chronic ill patients in probability of physician service use model to -0.003 for the same patients in total number of physician use model are closer to zero. In contrast, the CIs for chronic ill patients in the probability of use model are 0.049 (pro-rich) in Nepal and -0.021 (pro-poor) in Albania. Tajikistan is an intermediate case with a CI of about 0.01. Similarly, we can compare the inequality in physician service utilization among Albania, Nepal, and Tajikistan in other models as well.

For chronic ill patients in total number of the physician service utilization model, the value of CI is 0.114 in Nepal (Table 7). This value is distinctly different and higher than the values of CIs in other cases of Nepal as well as the values of CIs in the three other countries of this study. This result though is not anomalous because specialist service in Nepal is concentrated in urban areas. Comparing this result with the result of the chronic ill patient in the probability of physician service utilization model, the chronic ill patient visits a physician for diagnoses and/or for prescription of medicine so that the value of CI in this model is less than that in total number of the physician service utilization model. However, the frequency of visit varied widely due to the inequitable distribution of specialist services in rural areas. Based on the results of CI for chronic ill patients in other countries, the specialist service is distributed more equitably than in Nepal (Table 7).

After eliminating the influence of "need" factor from CI, we can arrive at horizontal inequity in physician service delivery (HI) which reflects the effects of income, education and other non-need-related factors stated in equation (17). All of the HI indices reported in Table 7 are statistically significant at better than five percent significance level, indicating that there is patients in total number of the physician service utilization model in Albania. Following the

trend of *CIs*, a substantial variation in *HI* across countries is noted (Table 7). In the case of general ill patients, the positive *HI* indices imply pro-rich inequity in delivery of physician's services in all countries except Tanzania in probability of the physician service utilization mode. However, the value of *HI* index is almost zero in Tanzania and Albania compared with those of Nepal and Tajikistan. For chronically ill patients however, the *HI* indices are almost zero for Tajikistan and Tanzania. That indicates the most equitable distribution of specialist services in those countries. However, a pro-poor inequity is noted in Albania and a pro-rich in Nepal.

Decomposition Analysis: IRIPSU, as calculated in Table 7 for Albania, Nepal, Tajikistan and Tanzania, could be divided into different attributes, such as income, education, need-related-factor, non-need-related-factor and a residual term as indicated by equation (17). The inequality in physician service utilization due to those attributes may be positive or negative. It is possible that these contributions could cancel each other out leaving the inequality in physician service utilization as constant. Thus, if physician services were utilized equally across income groups, the bar segments above and below the zero line in Figure 1 would be mutually offsetting. However, the need bar appears only in the case of perfect equity. If there are discrepancies between actual and need-expected distribution of use, other bars appear which indicate either the direct contribution of income and education or its effect through non-need-factors associated with physician service utilization.

The decomposition analysis confirms that the utilization of physician service in all of the countries under study is extensively affected by income rather than need factors. This is quite obvious because the share of out-of-pocket finance for health care utilization is very high in all of the countries under study. After income, we can see the distinct role of non-need-related-factors such as education, geography, distance to the physician office and ethnicity. In both of

Figure 1a: Decomposition of Concentration Indices in Probability of Physician Service Use Model

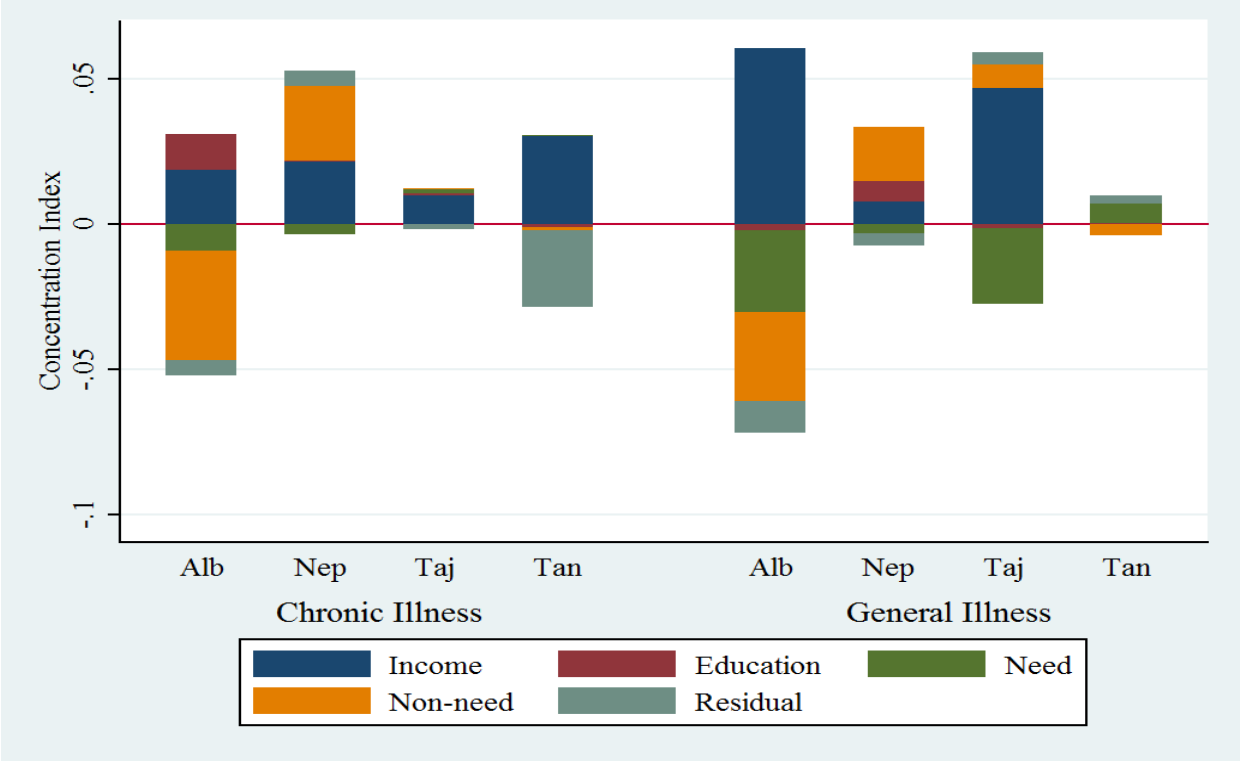
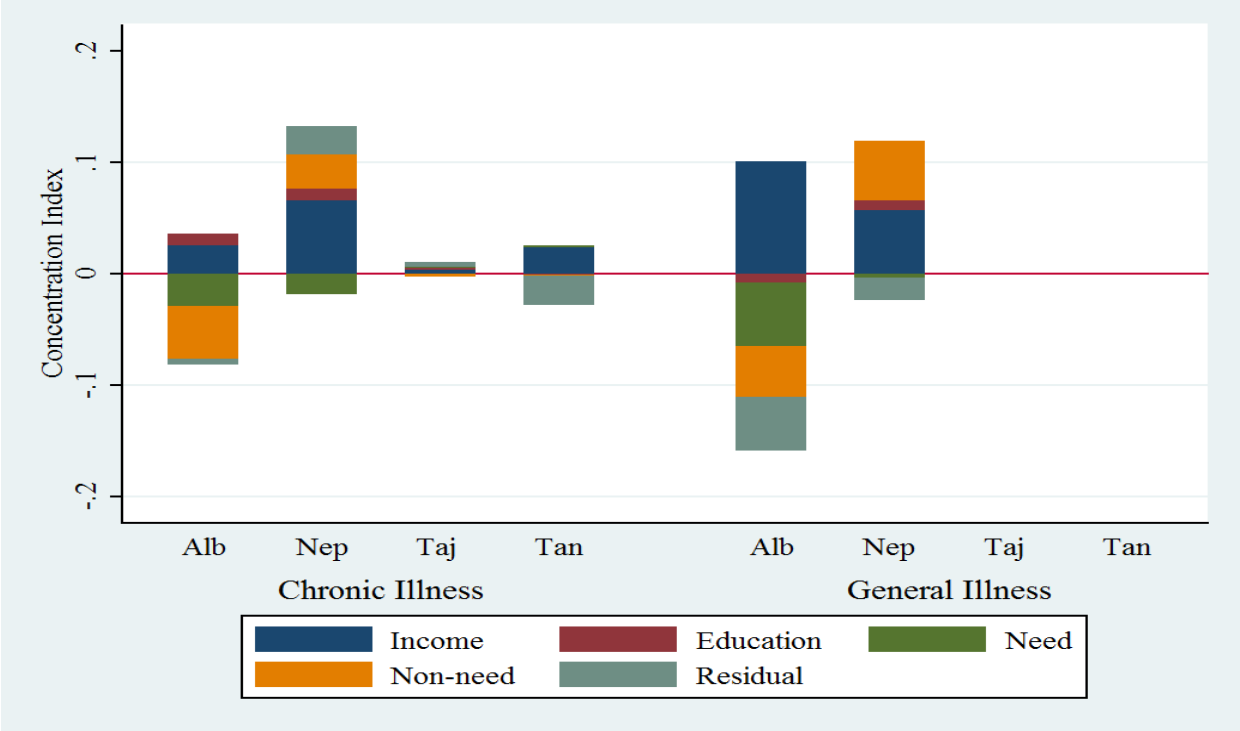


Figure 1b: Decomposition of Concentration Indices in Total Number of Physician Service Use Model



Alb.: Albania, Nep.: Nepal, Taj.: Tanzania and Tan.: Tanzania.

the cases presented in Figure 1a and 1b, the residual term is large for some countries such as Tanzania among chronic ill patients, attributable to the low explanatory power of the models.

Policy Effect: The bootstrapping technique (with 1000 iterations) is used to calculate income and education effects, their 95 percent confidence interval, t-stat and their p-values. The calculated values of effects of average increase in income by $100.00 and education by 1 grade are reported in Table 8. In most of the cases, effects are statistically significant at better than 5 percent significant level. However, for Tanzania the effect of education is statistically insignificant for chronic ill patient in total number of physician service use model and for general ill patient in probability of the physician service use model. Likewise, the education effect is statistically insignificant for general ill patients in Albania for probability of use model. Thus, the null hypothesis of zero impact is rejected in most of the cases, except some cases in Tanzania and Albania. That means the average increase in income/education can significantly reduce or increase the income-related inequality in physician service utilization.

For total number of the physician service utilization model, among chronic ill patients, a $100 increase in mean income reduces IRIPSU in Nepal and Tanzania by 0.031 and 0.001 respectively and increases inequality in Albania and Tajikistan by 0.025 and 0.014, respectively (Table 8). Similarly, an average increase in education (i.e., an average increase in years of schooling by 1 year), increases IRIPSU by 0.020, 0.009 and 0.001 in Albania, Nepal and Tajikistan, respectively, and decreases IRIPSU by 0.000 (insignificant) in Tanzania. We can make the similar interpretation for rest of the cases. Comparing these values with the corresponding values of concentration indices, impacts are scalable. This finding proves the statement of *Proposition 1*. However, if the redistribution of income and education respectively reduces inequality in income and education first, such a reduction in the covariate (income and

education)-specific inequality would in turn reduce inequality in physician service utilization through the mechanism proposed in equation (21) and (22).

Table 8: Effect of Increase in Average Income and Education on Concentration Index

Countries	Income Effect	95% Confidence Interval	Education Effect	95% Confidence Interval
Model I: Probability of Physician Service Utilization Model				
Chronic Illness				
Albania	0.050*	0.05 to 0.05	0.011*	0.011 to 0.011
Nepal	0.002*	0.001 to 0.002	0.004*	0.004 to 0.004
Tajikistan	0.019*	0.019 to 0.019	0.001*	0.001 to 0.001
Tanzania	0.011*	0.011 to 0.011	-0.000*	-0.000 to -0.000
General Illness				
Albania	0.026*	0.025 to 0.026	0.000	0.000 to 0.000
Nepal	-0.004*	-0.004 to -0.004	0.001*	0.001 to 0.001
Tajikistan	0.046*	0.046 to 0.046	-0.001*	-0.001 to -0.001
Tanzania	0.014*	0.014 to 0.014	-0.000	-0.000 to -0.000
Model II: Total Number of Physician Service Utilization Model				
Chronic Illness				
Albania	0.025*	0.025 to 0.025	0.020*	0.019 to 0.020
Nepal	-0.031*	-0.031 to -0.031	0.009*	0.008 to 0.009
Tajikistan	0.014*	0.014 to 0.014	0.0004*	0.001 to 0.001
Tanzania	-0.001*	-0.001 to -0.001	-0.000	-0.000 to -0.000
General Illness				
Albania	0.012*	0.012 to 0.012	0.008*	0.008 to 0.008
Nepal	-0.040*	-0.040 to -0.040	0.002*	0.002 to 0.002
Tajikistan	NA	NA	NA	NA
Tanzania	NA	NA	NA	NA

Source: - Calculated by Author.

** Statistically significant at (p < 0.01).* *** Statistically significant at (p < 0.10).*

Programs that enhance the efficiency of rural farmers and the productivity of urban poor will likely reduce inequality in physician service utilization by causing improvements in the income Gini. An improvement in income distribution improves the overall health situation in a

country (Subramanian and Kawachi, 2004). They have shown an inverse relationship between income inequality and population health. Further income is correlated positively with education and thus presumably alleviates disparity in education (Deaton, 2002). The income-specific inequality reduction could possibly be achieved by promoting the use of modern inputs, training rural farmers on scientific farming and by providing vocational training to both rural and urban poor. In the same way, some provision of micro credit could contribute to lowering income inequality (Kai and Hamori, 2009). The essence of this argument is that a reduction in outcome variable, inequality in physician service utilization, will necessitate a suitable redistribution of the contributing factors in health care demand function such that there is a reduction in inequality in those factors first (see equation (21) and (22)).

5.4 Discussion

My research proposes a clear mechanism to measure the effect of policy change on inequality called policy effect of inequality and examines how increased income and education reduce IRIPSU in LMI countries represented by Albania, Nepal, Tajikistan and Tanzania. In addition, it analyzes income-related inequality in physician service utilization and identifies its causes in those countries. In general, income is the major contributor followed by non-need-related factors such as education, geography, distance to the doctors and ethnicity and then need-related-factors to inequality in physician service utilization for chronic and general ill patients in all countries under study. In almost all cases, inequalities in needs are negative, thus implying that the impacts of treatment are pro-poor. However, the role of inequality due to residual term is mixed. The inequality due to residual is positive for chronically ill patient in Nepal in both models and is negative for Albania in all cases. Results for Tajikistan and Tanzania are mixed. Summing up these results, the income-related inequality is pro-poor in Albania and pro-rich in

other countries except in Tanzania for chronically ill patients in total volume of physician use model. That answers the first research question as to whether there is inequality in health care utilization in Albania, Nepal, Tajikistan and Tanzania.

Next, it is interesting to discuss the causes of the inequalities. For chronic ill patients in Albania, the pro-rich inequality due to income and education is dominated by the pro-poor inequality due to need, non-need and residual terms such that the overall inequality is negative (pro-poor). In Nepal, pro-poor inequality is detected for chronically and generally ill patients in need-related-factors, which is dominated by the pro-rich inequality in income, education and non-need-related factors such that the overall inequality in physician service utilization is pro-rich.

The role of disparity in residual term is also countable in overall inequality in both of those countries. Relatively different trends are noted in both models for Tajikistan and Tanzania. In Tajikistan, pro-rich inequality in income, education and need factors among chronic and general ill patients are the significant contributor of overall pro-rich inequality in total volume of physician service utilization, and the pro-rich inequality in income factor is the major contributor of overall pro-rich inequality among general ill patient in the probability of use model. In Tanzania again, income is the major contributor of pro-rich IRIPSU in probability of the physician service utilization model and the pro-poor disparity in education; non-need-related factors and residual terms are the major contributors of pro-poor inequality in total volume of the physician service utilization model for chronic ill patients.

The principle of ETEN is not fulfilled in all countries under study. The scope and content of the service coverage by all types of physicians as well as the uneven geographic distribution of health professionals (physicians) and the uneven distribution of income and education are the

major causes of the inequity in physician service utilization in these countries. At this point, it is interesting to compare the results of this paper with those of van Doorslaer et al (2000) who compare the results of horizontal equity in health care utilization in ten European countries and the US. In half of the countries of their study, significant pro-rich inequity was identified for physician contacts though most of those countries have universal coverage or almost universal coverage system in health care financing. Thus, it is not surprising to identify the inequity in physician service utilization in LMI countries represented by Albania, Nepal, Tajikistan and Tanzania where most of the health care is financed out-of-pocket and distribution of services is heavily skewed to the urban areas.

Finally, the results presented in Table 8 supports *Propositions 1 and 2*. In both models, increases in average income or education do not always decrease income-related inequality in health care utilization. For example, a $100 increase in average income increases IRIPSU in Albania by 0.025 and in Tajikistan by 0.014 and reduces it by 0.031 in Nepal and 0.001 in Tanzania among chronic ill patient in total number of physician service utilization model. However, if the increase in average income or education can reduce the inequality in income and education first (i.e., if the re-distribution of income and education is more equitable than before), that increases can reduce inequality in health care utilization by the mechanism developed in equation (21) and (22). It is again interesting to compare my findings for LMI countries with those of Deaton (2002) for United States. Unlike his findings the existence of the gradient[2] strengthens the case for income redistribution in favor of the poor, but targeting health inequalities would not be sound policy; my findings argue for re-distribution of income in favor

[2] Deaton (2002) defines gradient as "proportional increase in income is associated with equal proportional decrease in mortality throughout the income distribution".

of poor help to reduce IRIPSU in LMI countries.

The integrated approach of development is always stronger than the sectoral development policy for the reduction of IRIPSU if increases in average income and education reduce inequalities in income and education. For example, an average increase in income by $100 increases IRIPSU by 0.05 and an average increase in education (average years of schooling) by 1 year increases IRIPSU by 0.011 in Albania for chronic ill patients in probability of physician service utilization model (Table 8). However, if these increases first reduce the inequality in income and education, then that could reduce the gap $(CI_y - CI)$ and $(CI_e - CI)$. This could then automatically reduce CI as stated by the process in equations (21) and (22). As integrated effect is simply the additive effect of single sectoral policy effect, it is definitely more powerful than the sectoral policy effect.

5.5 Conclusion

People with equal need for physician service are not treated equally in all of the countries under study. The supply side distribution of physician services is also not equitable. To reduce that inequality, the *LMI* countries need to make some distributional changes. Such redistributions would be desirable in income and education in favor of the poor and people who have been poorly served in physician service utilization. In addition, an integrated approach toward development reduces inequality in physician service utilization faster than a sectoral policy approach even if a given policy change reduces inequality in that policy variable. Thus, findings of this study call for some redistribution of income and education in order to achieve a sustainable reduction of IRIPSU.

Utilization of physician services is not always determined by income, education, the need-based factors or the other factors considered in this study. The out-of-pocket financing for

physician service use has been a large portion of the cost of health care utilization in all countries. This suggests that health care use is likely affected by the price of health care services and the price of related goods, such as education and drugs. Identification of these factors (with sufficient data base) in health care use indicates directions for future research in this area.

Chapter 6

Inequality in Education and Income

Chapter 5 concludes that the inequality in health care utilization can be reduced by reducing inequality in education and income in LMI countries represented by Albania, Nepal, Tajikistan and Tanzania. This calls for the redistribution of income and education in favor of poor and less educated people. This chapter therefore concentrates on whether these countries can reduce inequality in income and education by redistributing income in favor of the poor and education in favor of less educated people. Indeed, this chapter calculates the inequality in income and education by using income Gini and education concentration indices respectively. Then, it identifies the causes of those inequalities by decomposition analysis. Finally, a measure is proposed to estimate the effect of policy change on disparity in income and education. This measure is simply defined as the policy effect of disparity in income and education, respectively.

Part A: Inequality in Education

6.1 Data

The study of education and income inequality are primarily based on the household survey data collected by the statistical office of the respective governments of Albania, Nepal, Tajikistan and Tanzania. Section 4.1 of Chapter 4 explains the sources and the nature of data. The descriptive statistics of the major variables used in the study of education and income inequality are presented in Table 9. Time taken to school is measured in minutes. This variable is converted to log scale for analysis. Religion or ethnicity is a categorical variable measured in 1 to 5 scales. Definition and features of other variables that are used for this study are presented in Table 9.

Table 9: Definition of Major Variables used with Means and Standard Deviations

Variable and corresponding definition	Statistics			
	Albania	Nepal	Tajikistan	Tanzania
Income: Household income measured in terms of natural logarithm. Continuous variable.	12.68 (3.22)	11.05 (1.11)	3.34 (0.98)	12.18 (2.38)
Education: Continuous variable, measured in years of schooling. 0 for illiterate to 20 for PhD completed.	4.95 (2.49)	6.86 (3.38)	1.43 (1.27)	5.33 (3.01)
Self Access Health (SAH):* Categorical variable measured in 1 to 5 scales. Excellent health = 1 and poor health = 5.	1.53 (0.73)	1.34 (0.49)	1.96 (0.49)	2.93 (0.64)
Sex:* Sex of the individual (0 = female; 1= male)	0.49 (0.50)	0.50 (0.49)	0.48 (0.49)	0.48 (0.49)
Age:* Age of the individual, in years.	15.53 (5.27)	14.76 (5.64)	15.15 (5.51)	21.25 (18.25)
Rural vs. Urban: 0 / 1 dummy variables. Rural = 0 and Urban = 1.	0.519 (0.499)	0.81 (0.39)	0.29 (0.45)	--------
Time to School: Time taken to school in minutes transferred in to natural logarithm. Continuous variable.	2.51 (0.83)	2.04 (1.25)	2.53 (0. .67)	2.09 (1.55)
Poverty Index: Continuous variable. Takes any values between 0 and 1.	0.18 (0.38)	0.27 (0.44)	0.148 (0.35)	--------
Religion or Ethnicity: Categorical variable measured in 1 to 5 scales.	1.50 (1.16)	2.52 (1.23)	1.22 (0.56)	2.09 (1.94)

Source:- Calculated by Author.

Note: - 1. * Represents the need variables.

2. Numbers outside the parentheses are means and inside the parentheses are the standard deviations.

6.2 Method

The Education Demand Function: Demand for education, measured in terms of years of schooling, can be derived in a static utility maximization framework. A segment of individual age 6 years and above is enrolled in school at any point in time. Thus, all individuals are assumed to perceive themselves as a student or non-student at a particular time. The

representative consumer derives her utility from consuming a composite consumption good (C) and education services (ξ) that flow from her stock of human capital (h_0). The utility function can be simply written as:

$$U = U(C, \xi, O) \tag{23}$$

where O represents the exogenous tastes and preferences of the individual consumer.

U in equation (23) increases at a decreasing rate with respect to C and ξ. Education services (ξ) can be produced with varying combinations of school supplies (Q) and teacher services (S). But the production of ξ also depends on a host of other factors including the consumer's initial endowment of human capital (h_0); household characteristics such as landholding (l_h), and the type and cost of dwelling (C_d); demographic characteristics such as age (a), sex (s), health status (h_s), the level of adult education in the household (e_a); social characteristics such as race (r), caste and ethnicity (e_t); geographic characteristics such as whether one lives in an urban or rural area (u_r) and how far the nearest school is from home (the distance D); and other factors such as opportunity cost of schooling measured in terms of wages (w) foregone and the current state of educational technology (T). Based on empirical considerations including data availability, I ignore a few "goods" and "bads" related to schooling such as school quality, school environment and peer effects. Assembling all the factors listed above leads to my production function for educational services, ξ:

$$\xi = \xi(Q, S, E, h_0, l_h, C_d, a, s, h_s, e_a, r, e_t, u_r, D, w, T) \tag{24}$$

where ξ is the education service production function and is assumed to be concave with respect to school supplies Q, years of education (E) of individual (i) and teacher services S. I assume that the consumer's income net of taxes B, is fully spent on the purchase of the composite good C, and the other inputs in education service, Q, E and S. Equation (25) show this budget constraint:

$$B = P_c C + P_q Q + P_e E + P_s S \tag{25}$$

where P_c is the price of the composite good, P_q is the out-of-pocket price of school supplies, and P_e and P_s are the out-of-pocket price paid to the school (tuition and fees).

The representative consumer's optimization problem is to maximize utility:

$$\begin{aligned} &\underset{\{C,Q,E,S\}}{Max}\ U = U\left[C, \xi(Q, S, E, h_0, B, l_h, C_d, a, s, h_s, e_a, r, e_t, u_r, D, w, T), O\right] \\ &subject\ \ to\ \ \mathrm{B} = P_c C + P_q Q + P_e E + P_s S \end{aligned} \tag{26}$$

Solving this utility maximization problem yields the consumer demand function for school supplies Q, and educational services, ξ. The typical demand for education can thus be identified as a function of real income B/P_c, the relative prices of Q, E and S (that is, P_q/P_c, P_e/P_c and P_s/P_c) and all other factors discussed above, where P_c is the price of the numeraire good. For notational simplicity, I drop the division by P_c from the relative price and income variables which appear together with other factors in my full specification of the demand for education (equation 29):

$$E = E(P_q, P_s, B, O, h_o, l_h, C_d, a, s, h_s, e_a, r, e_t, u_r, D, w, T) \tag{27}$$

where income and prices are real income and relative prices. The demand for education is determined by the out-of-pocket direct cost of school (tuition, fees and school supplies), the consumer's real income, and other factors. Redefining the demand for education E as y to make the notation for the dependent variable more intuitive, the function can be written for an econometric analysis in a compact form as in equation (28):

$$y_i = f(X_i\ \gamma) \tag{28}$$

where y_i is the demand for education and is measured in terms of the years of schooling for individual i, X_i is the vector of household characteristics, demographic characteristics, social

characteristics, geographic information, the opportunity cost of schooling and some interaction terms for individual i. Thus, X_i is the vector of covariates in the demand for education for individual i, and γ is the coefficient vector.

To determine the effects of the covariates on the years of schooling, I apply both the weighted least squares (WLS) and ordinary least squares (OLS) regressions. *WLS* helps by removing problems associated with some types of heteroscedasticity. Although the two methods yield similar results, I nevertheless report the results of each method for policy exercises. For analytical ease, I regroup the covariates into two broad categories in equation (29):

$$y_i = \gamma_0 + \underbrace{\sum_{k=1}^{j} \gamma_k X_{ki}}_{Term\ 1} + \underbrace{\sum_{k=j+1}^{m} \gamma_k X_{ki}}_{Term\ 2} + \varepsilon_i \qquad (29)$$

where y_i, the demand for education by individual *i*, can take any discrete values from 0 for no schooling to 20 for the highest degree such as a Ph.D. The covariates X_{ki} in *Term 1* represent the "need for education" variables such as age, sex and health status of individual *i*, and the covariates X_{ki} in *Term 2* represent other explanatory variables (referred to as "non-need" factors hereafter) appearing in equation (27) above[3]. The error term ε is assumed to follow a normal distribution and therefore the model can be estimated using both *OLS* and *WLS*.

Calculation and Decomposition of Education Inequality: The estimation of the education demand function permits the decomposition of the education concentration index (ECI) among the covariates of education demand. The calculation and decomposition of

[3] Thus the need for education would arise regardless of age, sex or health. For a person between, say, 6 and 18 years of age, there is need for education regardless of whether the person is male or female, or healthy or sick. This dissertation extends that age up to 25 years.

education inequality follows exactly the same method that is used for the calculation and decomposition of inequality in health care utilization in section 5.2 of chapter five.

Further, the current research examines whether the distribution of schooling facilities is equitable in the countries under study. Following Bourguignon et al (2007) definition of equity[4], I measure equity in education using the horizontal inequity (HI) index proposed by van Doorslaer et al (2000). The HI index is obtained by subtracting inequality due to the need factors from the overall concentration index in education.

Measurement of Policy Effect: Finally, the effect of change in policy variables on disparity in education is measured by the similar mechanism as that used to measure the effect of policy change on health care disparity. Likewise, we can state and test the exact same hypothesis too in this sub-section (for details see section 5.2 of Chapter 5).

Any change in the policy variable mean X_k has two effects:

The direct effect: This occurs through the elasticity of demand for education (e_k), the mean X_k and CI_k. Since $\bar{X}_k > 0$, inequality in education will increase with increase in $\bar{X}_k$ if e_k and $(CI_k - ECI)$ are either positive or both negative and decrease otherwise. The sign of the elasticity e_k depends on the sign of estimated γ_k, the coefficient of k^{th} covariate in equation (29). This result is stated in the first proposition:

Proposition 1: *An increase in average X_k does not always reduce IRIE even though it increases the average level of education, that is, even though $\gamma_k > 0$.*

Proof: It follows similar arguments and approaches that are applied to prove the proposition 1 of section 5.2 in chapter five.

[4] This encompasses two basic principles: (a) equal opportunities and (b) avoidance of extreme deprivation in outcomes.

Proposition 2: *A decrease in average* X_k *does not always reduce IRIE even though it increases the average level of education, that is, even though* $\gamma_k < 0$.

Proof: It follows similar arguments and approaches that are applied to prove the proposition 1 of section 5.2 in chapter five.

The indirect effect: The indirect effect of a change in average X_k occurs through the concentration index of education (*ECI*) via average level of education. A rise in average X_k increases education if $\gamma_k > 0$. In this case *ECI* increases and hence the effect is pro-rich. If $\gamma_k < 0$, however, an increase in mean X_k reduces *ECI* making the distribution pro-poor.

The total effect: The total effect of an increase in mean X_k is the sum of the direct and indirect effects. This depends on whether X_k is more unequally distributed than education (i.e., whether $(CI_k - ECI)$ is positive or negative). An increase in average X_k can reduce *IRIE* if and only if it reduces inequality in X_k. This leads to *Proposition 3*:

Proposition 3: *An integrated approach toward development is always stronger than the sectoral development policy for the reduction of IRIE, provided an increase in average* X_k *reduces inequality in* X_k.

Proof: It follows similar arguments and approaches that are applied to prove the proposition 1 of section 5.2 in Chapter 5.

6.3 Results

Inequality and Inequity in Education: The education concentration indices calculated for the population aged 6 to 25 years in Albania, Nepal, Tajikistan, and Tanzania are reported in Table 10. Since the calculation of horizontal inequity (*HI*) indices are associated with estimated

coefficients of the education demand function, the *ECI* and *HI* indices reported in Table 10 are calculated for *OLS* and *WLS* models separately. All of the concentration indices in both models are statistically significant at the 1 percent level, except for Albania where *ECI* is significant at the 5 percent level. Obviously, the null of zero *ECI* is rejected for all countries under study.

The *ECI* numbers, however, show substantial disparity across nations. The two countries from the Eastern Europe and sub-Saharan Africa display more even distribution of education than the two from the Central Asia and South Asia. The *ECIs* from Albania and Tanzania (about 0.01) are closer to zero, whereas the *ECI* from Nepal is 0.09 and hence pro-rich. Tajikistan is an intermediate case with an *ECI* of about 0.04. Note that, as explained in section 6.2, the measure of *ECI* is based on the income ordering of the households. A zero value for *ECI* signifies neutrality, whereas a positive (negative) value indicates a pro-rich (pro-poor) distribution.

Secondly, when we eliminate from *ECI* the influence of the "need" factors on education demand, we arrive at horizontal inequity in education (*HI*). This measure reflects the effects of income, time to school and urban or rural location of the household. The *HI* indices are all positive which suggests pro-rich inequity in the delivery of education services[5]. Hence, the principle of equal schooling for equal need (*ESEN*) does not find strong support in Albania, Nepal, Tajikistan or Tanzania.

As with *ECI*, I find a substantial variation in *HI* across countries. The non-need factors that determine *HI* essentially account for most of the inequity in Nepal and Tajikistan where *ECI*s are the highest. Nepal's share of the non-need factors in *ECI* exceeds 90 percent and in Tajikistan this share is over two-thirds. In contrast, the non-need factors are relatively inconsequential in Albania or Tanzania where these factors account for less than a quarter of *ECI*.

[5] The indices are all statistically significant at the 1 percent level in all countries.

Table 10: Inequality and Inequity in Education

Countries	ECI[+]	95% CI	HI[+]	95% CI
OLS Model				
Albania	0.0093	0.0092 to 0.0097	0.0016	0.0014 to 0.0019
Nepal	0.0905	0.0903 to 0.0910	0.0837	0.0834 to 0.0841
Tajikistan	0.0373	0.0370 to 0.0377	0.0252	0.0249 to 0.0255
Tanzania	0.0126	0.0124 to 0.0129	0.0029	0.0027 to 0.0032
WLS Model				
Albania	0.0093	0.0090 to 0.0095	0.0017	0.0014 to 0.0019
Nepal	0.0905	0.0902 to 0.909	0.0831	0.0827 to 0.0834
Tajikistan	0.0373	0.0370 to 0.0377	0.0254	0.0251 to 0.0258
Tanzania	0.0126	0.0123 to 0.0128	0.003	0.0028 to 0.0033

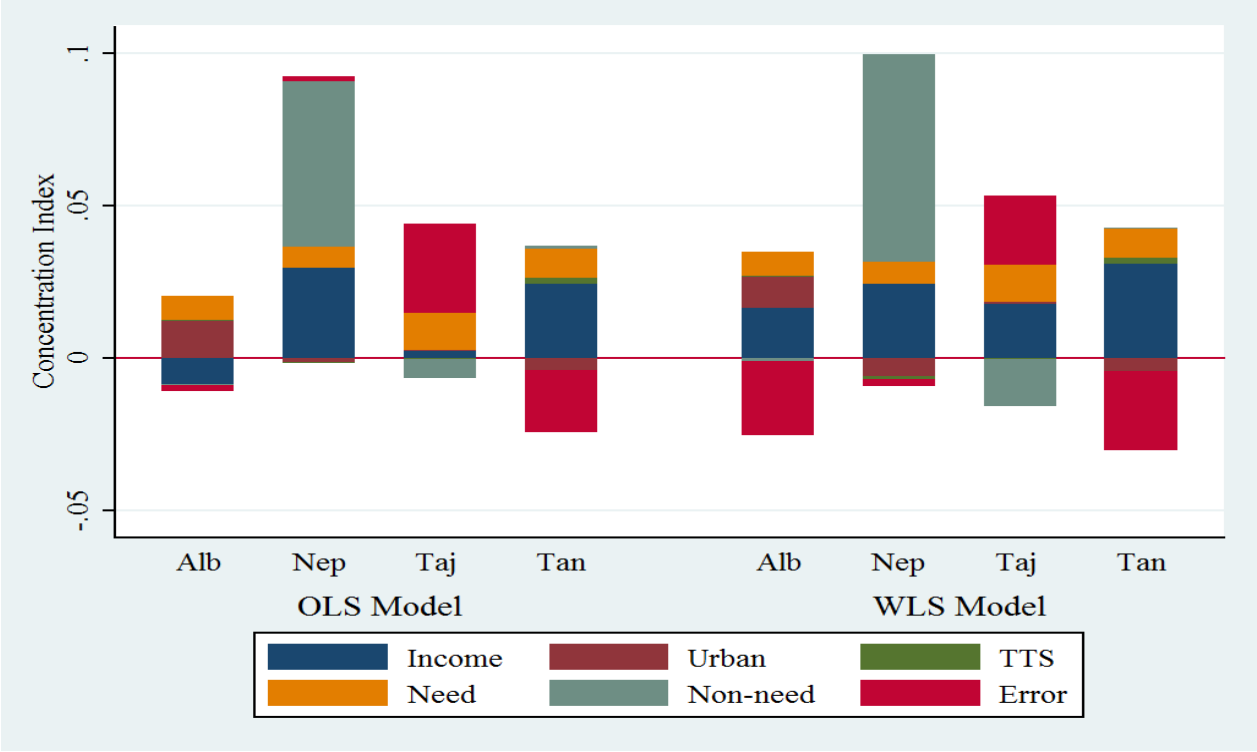
Source: - Calculated by Author.

[+] *All ECI and HI numbers are statistically significant.*

ECI: Education Concentration Index. HI: Horizontal Inequality Index.

Decomposition Analysis: Income-related inequality in education as calculated in Table 10 could be attributed to various factors indicated in equation (29). These effects can be positive or negative. It is possible that these contributions could cancel each other out leaving inequality constant. Thus, looking at Figure 2, if education services were utilized equally across income groups, the bar segments above and below the zero line would be mutually offsetting. Yet, even in the case of perfect equity, variations in the personal characteristics of households could generate a "need" segment in each of the bars. Since this paper considers inequality among households ranked by income, any discrepancy between actual and need-based distributions would indicate either a direct contribution of income (or distance to school or 'urban') or its effect through other non-need factors.

Figure 2: Decomposition of Education Inequality



Alb.: Albania, Nep.: Nepal, Taj.: Tajikistan, and Tan.: Tanzania.

The decomposition analysis confirms that income does play a significant role in affecting education inequality in all of the sample countries. In Albania, Tajikistan and Tanzania, income is followed by location factors and then by need factors. However, in the case of Tajikistan and Tanzania the role of the error term, possibly reflecting some missing variables, is substantial. In Nepal, *ECI* is mainly affected by non-need factors which are followed by income and then by need group. Non-need factors in Nepal, such as poverty, ethnicity and the housing cost, the last of which is a measure of socio-economic status of individual households, seem to have a significant impact on inequality in education.

Policy Effects: To determine the significance of the inequality effects of the policies undertaken on the *X*-variables, I applied a bootstrapping technique with 1000 iterations. I calculated the effects of income, location, time to school and self-access health (*SAH*), 95

percent confidence intervals, *t*-stats and *p*-values. The effects of these factors appear in Table 11. In all cases, the effects on education inequality are statistically significant at the 5 percent level for all countries under study.

Starting with income, I ask: What happens to educational inequality when the mean income increases by $100? I find that for the *OLS* model this increase reduces income-related inequality in education in Albania and Nepal by 0.05 and 0.022 respectively and increases such inequality by 0.0021 and 0.21 respectively in Tajikistan and Tanzania. The impact in Tanzania is apparently large, but that is because almost 40 percent of education inequality in that country is attributable to income. Thus, increasing the average income by $100 in Tanzania is a way that reduces income inequality which could also have a greater effect on reducing education inequality than in other countries.

Similarly, urbanization of a society significantly reduces inequality in all countries in both models except in Albania under *OLS*. Such a reduction is likely due to better access to schooling in urban areas even for the poor[6]. The effects of distance to school measured in terms of travel time are significant in all countries and both models. For example, under *OLS*, reducing the travel time to school by 10 minutes reduces inequality by 0.00, 0.013 and 0.014, respectively in Albania, Tajikistan and Tanzania, but increases inequality by 0.01 in Nepal[7]. However, in the *WLS* model this policy reduces inequality by 0.00, 0.01, 0.005 and 0.014, respectively in Albania, Nepal, Tajikistan and Tanzania. Another variable, self-access health (*SAH*), is a

[6] Again this is specific to my sample countries. Migration to cities in some countries (e.g., China) is highly discouraged by making it illegal for migrants to work without a permit or through a ban on school enrollment for children of migrant workers in cities where work permits are enforced. In those countries a reduction in education inequality due to urbanization may not occur.

[7] Note that Albania does not show any notable change.

categorical variable that takes values from 1 to 5 where 1 indicates 'excellent or very good' health and 5 indicates 'very poor' health. Thus, if countries can work to improve the general health conditions of the public, say by reducing *SAH* by one on average, inequality in education will likely decline in all countries except in Albania. This impact varies, according to the *WLS* model, from a low of 0.0002 in Tanzania to a high of 0.01 in Nepal.

These findings verify *Propositions 1 and 2* that a suitable change (increase/decrease) in the covariates of the education demand function does not always decrease income-related inequality in education. However, if a suitable redistribution of covariates of the education demand function reduces inequality in the same covariates first, such a reduction in the covariate-specific inequality would in turn reduce inequality in education through the mechanism proposed in section 6.2.

Taking income distribution first, programs that enhance the efficiency of rural farmers and the productivity of urban poor will likely reduce inequality in education by causing improvements in the income Gini. An improvement in income distribution tends to improve the overall health situation in a country (Subramanian, S. V., 2004)[8]. In turn, health is correlated positively with education and thus presumably alleviates disparity in education. In my model, the covariate-specific inequality reduction in income could possibly be achieved by promoting the use of modern inputs and by training rural farmers on some of the modern techniques of farming. In urban areas, some provision of vocational training and micro credit for poor residents could help them start a small family business and contribute to lowering inequality (Hisako, K., Hamori, S., 2009). The essence of this argument is that a reduction in outcome variable, education inequality, will necessitate a suitable redistribution of the contributing factors in such

[8] Their study shows an inverse relationship between income inequality and population health.

Table 11: Effect of Policy Change on Disparity in Education

Countries	Income	95% CI	UVR+	95% CI	TSM+	95% CI	SAH+	95% CI
OLS Model								
Albania	-0.00005	-0.00005 to 0.00005	0.026	0.0259 to 0.0261	0.000	0.000 to 0.000	-0.0008	-0.00077 to 0.0008
Nepal	-0.00022	-0.0002 to -0.00022	-0.0094	-0.0093 to -0.0094	-0.001	-0.001 to -0.001	0.0066	0.0066 to 0.00666
Tajikistan	0.00002	0.00002 to 0.00002	-0.0107	-0.0109 to -0.0105	0.0013	0.0013 to 0.0013	0.0019	0.0018 to 0.0019
Tanzania	0.0021	0.0021 to 0.0021	-0.0012	-0.0013 to -0.0012	0.0014	0.0013 to 0.0014	-0.00028	-0.00027 to -0.00029
WLS Model								
Albania	0.00012	0.00012 to 0.00012	0.0223	0.0222 to 0.0224	0.0000	0.0000 to 0.0000	-0.00067	-0.00066 to -0.00067
Nepal	-0.00006	-0.00006 to -0.00006	-0.0248	-0.0247 to -0.0249	0.001	0.001 to 0.001	0.01	0.0099 to 0.01
Tajikistan	0.0011	0.0011 to 0.0011	-0.0220	-0.0200 to -0.0207	0.0005	0.0005 to 0.0005	0.0045	0.0044 to 0.0045
Tanzania	0.00017	0.00017 to 0.00017	-0.0019	-0019 to -0019	0.0014	0.0014 to 0.0014	0.00021	0.0002 to 0.00022

Source: - Calculated by Author.

All the effects shown are statistically significant at the 5 percent level.

+ UVR: Urban vs. Rural; TSM: Time to School in Minutes; SAH: Self Access Health.

a way that there is a reduction in inequality in those factors. That could automatically reduce inequality in education.

6.4 Discussion

In Albania, Tajikistan and Tanzania, the major contributor to education inequality is income followed by urban vs. rural and need factors. However, in Tajikistan and Tanzania the role of factors not captured by my model and reflected in the error term is also substantial. In Nepal, the effect on *ECI* attributable to income and need is secondary to those other factors.

I find that inequalities in the need variables are positive implying that the distribution of the need factors is skewed toward the rich segment of the society and hence the inequality is pro-rich. Similarly, results indicate that inequality due to income is also pro-rich in all cases except under *OLS* for Albania. Summing up these results, the income-related inequality in education is found to be pro-rich in all countries, and this answers the first research question.

Second, the principle of equal schooling for equal need (*ESEN*) is not fulfilled in any of the countries under study. Limited coverage of teacher's services, uneven geographic distribution of schools, and generally low incomes of the public are the major causes of inequity in education in low and middle income (*LMI*) countries represented by Albania, Nepal, Tajikistan and Tanzania. I note, however, that the inequity is more severe in Nepal and is somewhat less in Tajikistan, whereas Albania and Tanzania exhibit only a mild degree of inequity.

Finally, the results presented in Table 11 support my *Propositions 1 and 2*. Changes in factors affecting inequality, particularly average income, urban vs. rural, time to school and self-access health measures do not always reduce income-related inequality in education. For example, a $100 increase in the average income under *OLS* decreases *IRIE* in Albania and Nepal

by 0.005 and 0.022 respectively. However, an equal increase in income increases *IRIE* in all other cases under study. Likewise, greater urbanization reduces *IRIE* in Nepal, Tajikistan and Tanzania in both models but increases *IRIE* in Albania. Even desirable changes in the covariates of education demand function do not always reduce *IRIE* in my sample countries. On the other hand, if a redistribution of a particular covariate in the education demand function reduces its own inequality, then a change in that covariate will be needed to reduce *IRIE*.

I find that an integrated approach toward development is always stronger than the sectoral development policy for the reduction of *IRIE*. For example, raising average incomes by $100, inducing greater urbanization by 0.2 (20 percentage points), and improving average *SAH* condition by 1 reduces *IRIE* by 0.006, 0.005 and 0.01 respectively in the *WLS* model for Nepal. However, an integrated effect of a simultaneous change in those factors will reduce inequality by 0.021 which turns out to be a large portion (23 percent) of *IRIE* in Nepal. This result supports my *Proposition 3*.

6.5 Conclusion

This paper proposes a clear method to determine what I call the policy effect of inequality and examines how changes in the determinants of the education demand function reduce educational inequality in the four countries under study. In addition, it identifies the causes of income-related inequality in education in those countries.

On the demand side, those with equal need for schooling are not found in the sample countries to have equal access to schooling. The supply side distribution of schools and education services is also not found to be equitable. To reduce that inequality, results indicate that the low to middle income countries that I study need to make some distributional changes. Such redistributions would be desirable in income and other non-need factors in favor of the

poor and in favor of those who have been poorly served in education. In addition, an integrated approach toward development reduces educational inequality faster than a sectoral policy approach even if a given sectoral policy change reduces inequality in the same policy variable. Thus, my findings call for some redistribution of income, a greater provision of urban amenities to rural areas, and a shortening of the distance to school in order to achieve a sustainable reduction of *IRIE* in a wide variety of regions that my sample countries represent.

Utilization of education services is not always determined by income, need-based factors and other factors considered in my model. Out-of-pocket financing for education has been a large fraction of the cost of education in my sample countries. This suggests that schooling is likely affected by the price of education services and the price of related goods such as health. Identification of those factors in schooling indicates one possible direction for future research in this area.

Part B: Inequality in Income

Chapter 5 concludes that the inequality in health care utilization can be reduced by reducing inequality in education and income in LMI countries represented by Albania, Nepal, Tajikistan and Tanzania. This calls for the redistribution of income and education in favor of poor and less educated people. This sub-chapter therefore concentrates on whether those countries can reduce inequality in income. Indeed, this sub-chapter calculates the inequality in income using income Gini. Then, it identifies the causes of inequality by decomposition analysis. Finally, it proposes a measure to estimate the effect of policy change to reduce disparity in income. This measure is simply defined as-the policy effect of disparity in income.

This section is classified into the four sub-sections. Section 6.6, discusses the data and method used for the calculation of income inequality in brief, its decomposition and the method

to measure the policy effect for the reduction of inequality in income. Research findings are briefly presented in section 6.7. Finally, section 6.8 concludes the findings.

6.6 Data and Method

As explained in Chapter 4 (section 4.1), this study is primarily based on the household survey data collected by the statistical office of the respective government of Albania, Nepal, Tajikistan and Tanzania. The details of the sources of data used for the analysis made in this chapter are discussed in Chapter 4 (section 4.1).

I calculate the income inequality by using Gini index. Inequality in income is then decomposed into the determinants of income using a broad list of classification: socio-economic, geographic and demographic. Finally, comparative statistic is used to develop the policy effect on disparity. The generalized version of the methodology used in this sub-section is detailed in section 4.2 of Chapter 4.

6.7 Results

Inequality in Income: The income Gini calculated for the populations aged 6 years and above in Albania, Nepal, Tajikistan, and Tanzania are reported in Table 12. The value of Gini lies between 0 to 1. A zero Gini implies for perfect equity and higher Gini implies for higher inequality. The Gini indices (GIs) reported in Table 12 are calculated for log (income) and then transferred into the income Gini. All of the Gini indices reported in Table 12 are statistically significant at better than 1 percent significance level. Thus, null hypothesis of zero GI is rejected for all countries under study.

Decomposition Analysis: Income inequality, as calculated in Table 12 for Albania, Nepal, Tajikistan and Tanzania, could be divided into different attributes, such as education, self access health (SAH) measures, land holding, occupation, urban vs. rural, age, sex,

ethnicity/religion and the error term as indicated by the determinants of income given in income equation. The decomposition equation shows that the income Gini is the weighted average of the concentration indices of these attributes. The weights are the respective semi-elasticities as defined in section 4.2 of Chapter 4. Thus, the contribution of those attributes on income inequality may be positive or negative. These positive and negative contributions could cancel each other so that the aggregate contribution could be positive for income Gini.

Table 12: Income Inequality

Countries	Gini Index of log(inc)	$p-$Value	95%$-$Confidence Interval	Transferred Gini (Income Gini)
Albania	0.0472	0.0000	0.0467 to 0.0477	0.5136
Nepal	0.0500	0.0000	0.0496 to 0.0504	0.4950
Tajikistan	0.0905	0.0000	0.0897 to 0.0913	0.4747
Tanzania	0.0864	0.0000	0.0857 to 0.0870	0.7384

Source: - Calculated by Author.

The decomposition analysis confirms that the inequality in income in all of the countries under study is extensively affected by the socio-economic factors, such as education, health status, occupation status and land holding followed by the geographic location of the individual (i.e., whether an individual is urban or rural residence and then by demographic factors, such as sex, age and ethnicity or religion). The influence of other factors those are not captured by the income equation of this study such as: wage, remittance, institutions, liberalization, globalization, etc, is very important for the reduction of inequality in income. Thus, the contribution of residual term in income inequality is very large for all countries under study. The details of the contribution of various factors are listed in Table 13. My study confirms that rather than the socio-economic, demographic and geographic factors, the contribution of other factors

in income inequality is prominent in low and middle income countries represented by Albania, Nepal, Tajikistan and Tanzania.

Table 13: Decomposition Results

Countries	Socio-economic	Geographic	Demographic	Other
Albania	0.0035	0.0016	0.0001	0.042
% Contribution	7.51	3.37	0.12	89.0
Nepal	0.0053	0.0013	0.0003	0.0432
% Contribution	10.55	2.52	0.61	86.31
Tajikistan	0.0008	0.0002	0.0003	0.1473
% Contribution	0.53	0.14	0.20	99.14
Tanzania	0.0054	0.0015	0.0003	0.0911
% Contribution	5.54	1.51	0.34	92.61

Source:- Calculated by Author.

Policy Effect: The bootstrapping technique (with 1000 iterations) is used to calculate the effect of education, self-access health (SAH), land holding, occupation and geographic location of an individual on inequality in income, their 95 percent confidence interval, t-stat and their p-values. The calculated values of effects of average changes (increase or decrease as is favorable) in the covariates of the income equation are presented in Table 14. In all of the cases, effects are statistically significant at better than 5 percent significant level. Thus, the null hypothesis of zero impact is rejected in all cases and all countries under study. This means an average change (favorable change) in education, SAH, land holding, occupation and geographic location can significantly reduce or increase income inequality.

Table 14: Policy Effect on Log (income) Gini and Income Gini

Countries	Education	Self Access Health	Land Holding	Occupation	Urban vs. Rural
Albania	0.0037* (0.0000 to 0.00007)	0.00049* (0.00034 to 0.00065)	-0.0061* (-0.0063 to -0.0059)	0.0021* (0.0019 to 0.0024)	0.0044* (0.0038 to 0.0052)
	0.0050*	0.0525*	0.0504*	-0.0133*	0.1612*
Nepal	0.00038* (0.0003 to 0.00035)	0.0005* (0.00028 to 0.00076)	0.1843* (0.1562 to 0.2146)	-0.00005 (-0.00001 to 0.0000)	0.0029* (0.0023 to 0.0035)
	-0.0275*	0.0430*	0.0224*	-0.0174*	-0.0071*
Tajikistan	-0.00025 (-0.00029 to 0.00024)	0.0012* (0.0003 to 0.0021)	-0.00035* (-0.00038 to -0.00032)	-0.00069* (-0.0010 to -0.0004)	-0.0018* (-0.0026 to -0.0011)
	0.0096	0.0835*	0.0813*	0.0015*	-0.1949*
Tanzania	-0.00034* (-0.00047 to -0.0002)	0.00064* (-0.0000 to 0.0013)	0.0176* (0.0128 to 0.0220)	0.0000 (-0.0005 to 0.0003)	0.0045* (0.0027 to 0.0067)
	-0.0320*	0.0703*	0.0553*	-0.0956*	-0.0250*

Source: - Calculated by Author.

Among the four countries under study, increase in average years of schooling by one or more years increases inequality in income by 0.005 in Albania and 0.0096 in Tajikistan, whereas it decrease inequality by 0.0275 and 0.032 respectively in Nepal and Tanzania. Unlike the effect of education, improving average health status of the individual (i.e., moving from 5 to 4 or from 4 to 3) decreases inequality in all countries under study significantly. The effects are reported in Table 14.

The effects of land holding, occupation and geographic locations are mixed. For example, increasing average land holdings of the individual by increasing cropping intensity (changing farming system from 1 time a year to 2-3 times a year) increases the inequality in income in all countries under study; however, increase in average employment status decreases inequality in income in Albania, Nepal, and Tanzania significantly. Increasing urbanization is another significant factor that can decrease inequality significantly in Nepal, Tajikistan and Tanzania.

However in all of these cases, if the countries under study significantly reduce inequality in each of the covariates of the income equation, then that could automatically reduce inequality in income. Thus, sustainable reduction of inequality in income requires the redistribution of education and land. It also calls for the improvement of self-access health condition of the poor health status population, increasing employment among unemployed and fast urbanization in poor countries.

These finding proves the statement of *Proposition 1: Increase in average value of covariates of income equation does not always decrease income inequality*. However, if the re-distribution of covariates of the income equation reduces the inequality in those covariates that could automatically reduce inequality in income by the process proposed in this research. The

integrated effect is the sum of education and other effects discussed above. Thus, it is always greater than the single sectoral policy effect in absolute terms. That justifies *Proposition 2.*

6.8 Discussion

This dissertation research proposes a clear mechanism to measure the policy effect on inequality, called policy effect of inequality, and examines how appropriate change in the covariates of the income equation reduce income Gini in LMI countries represented by Albania, Nepal, Tajikistan and Tanzania. In addition, it analyzes the causes of income inequality in those countries. In all of the countries under study, socio-economic factors are the major contributors to income inequality followed by urban vs. rural and demographic factors in Albania, Nepal, Tajikistan and Tanzania. However, in all cases the role of error term is prominent and implies that the other factors such as wage, remittance, liberalization, globalization, institutions, etc; should have a prominent impact on income inequality.

Finally, the result presented in Table 14 supports the *Propositions 1 and 2*. In all countries under study the results of policy effect is mixed. Simply an average increase in some of the policy variables reduces inequality in income while in other cases it increases inequality. For example, increase in average years of schooling by one year decreases inequality in income in all countries except in Albania, and all of the effects are statistically significant. We can make a similar interpretation for rest of the policy effects analysis. However, if the redistribution of the covariates of the income equation reduces the inequality within that covariate, then an appropriate change in that covariate could automatically reduce IG as explained by the process developed in equation (11) of Chapter 4. For example, if those countries reduce inequality in land holding by increasing the farming land by providing year-round irrigation facilities and enhancing cropping intensity, it could reduce inequality in land holding. Likewise, a focused

policy to reduce the school dropout rate of poor children in LMI countries would significantly reduce inequality in education. Such policies automatically reduce inequality in income.

These findings call for the redistribution of education in favor of less educated people, improvement of general health conditions of the poor health people, redistribution of the land in favor of poor farmers, increased access to employment to the unemployed and improvements of rural areas to urban for the sustainable reduction of income inequality in LMI countries.

The integrated approach of development is always stronger than the sectoral development policy for the reduction of income inequality if appropriate change in covariates of income equation reduces inequalities in those covariates. For example, an increase in average years of schooling by one year reduces the Gini index by 0.0275 in Nepal. However, the integrated policy of improving education, improving the average SAH condition by one, improving employment or occupation status by one and changing societies from rural to urban reduces GI by 0.0275, 0.043, 0.0174 and 0.0071 respectively in Nepal. The integrated effect is thus 0.095 which is significantly larger than the single sectoral policy effect. However, simply increasing land holding by 1 hectare in Nepal increases inequality in income. Thus, Nepal should redistribute land in such a way that could reduce inequality in land holding first. That policy could then automatically reduce inequality in income in this poor country by the mechanism proposed in equation (11) of Chapter 4.

6.9 Conclusion

Inequality in income exists in all of the four countries under study. To reduce that inequality, the LMI countries have to redistribute education and other covariates of the income equation in favor of poor and poorly-served people. This could automatically reduce inequality in income by the mechanism developed in equation (11) of Chapter 4. In addition, integrated

approaches of development reduce that inequality faster than the individual sectoral policy approach if the average effect of appropriate changes in sectoral policy variable reduces inequality in that variable. Thus, sustainable reduction requires redistribution of education and other policy variables in favor of poor and less-served people of the societies in LMI countries.

Income is not only determined by the socio-economic, geographic and demographic factors listed in the income equation. It is equally or more importantly affected by wage, remittance, institutions, liberalization, and globalization. Availability of systematic data on these variables helps to extend this paper to test the effect of average improvement of these variables on inequality in income. Thus, it could be an interesting area for exploration.

Chapter 7

Summary, Conclusion and Recommendations

7.1 Summary

Using the household survey data of LMI countries represented by Albania, Nepal, Tajikistan and Tanzania, my current research identifies sustainable policies that can reduce inequality in health care utilization, education and income. Among those four countries, Albania is a middle income country, and Nepal, Tajikistan and Tanzania are low income countries. Based upon the statement of the problems discussed in section 1.2, Chapter 1, fundamentally defines the research objectives. Chapter 2 basically established the fundamental reasoning of why this research focused on LMI countries represented by Albania, Nepal, Tajikistan and Tanzania. Brief reviews of literature associated with inequality in health, education, income, and inequality and growth are presented in Chapter 3. The current research develops the generalized version of methodology in Chapter 4. This is used for specific cases in Chapters 5 and 6 for the calculation and interpretation of inequality in health care utilization, and education and income respectively.

Chapter 5 identifies the sustainable policies to reduce disparity in health care utilization in LMI countries represented by Albania, Nepal, Tajikistan and Tanzania. It calculates the income-related inequality in physician service utilization and inequity in physician service delivery and then tests whether the increase in average income and education reduces those inequalities.

In the last two decades, many have studied income-related inequality in health care utilization, equity in health care delivery, equity in health care finance, and inequalities in health (for example, van Doorslaer et al, 1997, 2000, 2004; Wagstaff and van Doorslaer, 1993; Wagstaff and van Doorslaer, 1998; Wagstaff, 2002; Lu et al, 2007). Most have focused on

calculation and interpretation of inequalities for high-income industrial countries. Van Doorslaer and O'Donnell, (2008) did a similar study of LMI countries focusing fundamentally on inequality in health care financing. Thus, there are few studies that calculate and interpret the income-related inequalities in health care utilization focusing on LMI countries. In that sense, a similar study that calculates the inequality in health care utilization and inequity in health care delivery system that is focused on LMI countries is useful for policy perspective and for future researchers.

Further, Deaton (2002) argues that proportional increases in income are associated with equal proportional decreases in mortality throughout income distribution. Many economic models of health such as Grossman (1972) argued that education enhances a person's efficiency and produces better health. The empirical evidence such as that made by Elo and Preston (1996), on the other hand, shows that education protects health.

From this evidence, it is clear that income and education either separately or jointly affect population health and health care use. To understand how the changes in income and education affect inequality in health and health care utilization, we need a well-defined mechanism to establish the relationship among all three. Deaton (2002) also argues that "policy cannot be intelligently conducted without an understanding of mechanisms; correlations are not enough". To the best of my knowledge, there is no such mechanism yet proposed to quantify the effect of policy change on inequality in health. By developing a formula to quantify the effect of policy change on health care disparity, my study also fulfills that vacuum of the existing literature.

Likewise, parts A and B of Chapter 6 design the sustainable policies that can reduce inequality in education and income respectively. For the first time in the literature, part A of Chapter 6 applies a concentration index for the calculation of inequality in education measured in

terms of years of schooling and horizontal inequity index identify for the measurement of inequity in education. Finally, using the same formula that is proposed to measure the policy effect on disparity in health care utilization, the effect of policy change on disparity of education is calculated and analyzed for the policy perspective.

Unlike the existing practice of decomposition of income Gini, part B of this research in Chapter 6, for the first time in the literature, uses regression-based total differential decomposition of income inequality among the determinants of households income. However, this decomposition technique was proposed by Wagstaff et al (2003) and widely applied for the decomposition of income-related inequality in health. Finally, using the same formula proposed in Chapter 4 to measure the effect of policy change on disparity, I calculate the policy effect of inequality in income.

7.2 Conclusion

This section concludes the findings of Chapters 5 and 6. Chapter 5 concentrates on the calculation and interpretation of income-related inequality in physician service utilization. Based upon the results obtained in Chapter 5, I conclude that statistically significant inequality exists in all countries under study. Equals are not treated equally and the distribution of physician service is not equitable. Simply increasing income and education may not reduce inequality in health care utilization. However, if the low and middle income countries redistribute income and education in favor of poor and less educated people respectively, that could automatically reduce inequality in health care utilization by the mechanism proposed in equations (21) and (22) of section 5.2 in Chapter 5.

Likewise, Chapter 6 concludes that the education and income inequality are both significant in all countries under study. Further, the principal of equal schooling for equal need is not fulfilled. To reduce that inequality, results indicate that the low to middle income countries need to make

some distributional changes. Such redistributions would be desirable in income and other non-need factors in favor of the poor and those poorly served in education. Thus, my findings call for some redistribution of income, a greater provision of urban amenities to rural areas, and a shortening of the distance to school in order to achieve a sustainable reduction of *IRIE* in a wide variety of regions that my sample countries represent.

Finally, the result in part B of Chapter 6 shows significant inequality in income. To reduce that inequality, the LMI countries have to redistribute education and other covariates of the income equation in favor of poor and poorly served people. This could automatically reduce inequality in income by the mechanism proposed in equation (11) of Chapter 4.

For all cases, an integrated approach toward development reduces inequality faster than a sectoral policy approach if a given sectoral policy change reduces inequality in the same policy variable.

7.3 Recommendations

There exists a vicious vs. virtuous circle of inequality among health, education and income. For example, if an average increase in income and education reduce inequality in income and education respectively, it could automatically reduce inequality in health care utilization. A virtuous circle exists. However, if those increases enhance the inequality in income and education than it could automatically enhance inequality in health care utilization. A vicious circle exists.

My current research does not test whether the sustainable policies proposed in Chapter 5 and 6 to reduce inequality in health, education, and income are cost-effective. If it is cost-effective, the best channel for intervention could be selected. If not, the identification of next best alternative(s) could be a good extension of my work. Upon the availability of data, one can further answers those questions, which are highly useful for the cost-effective and sustainable policy formulation to reduce inequality in LIM countries.

The out-of-pocket financing for physician service use and schooling has been a large part of the cost of health care utilization and schooling in all countries. In such circumstances, the availability of price data would help to identify the effectiveness of a pricing policy in the reduction of disparity in health care utilization and education. This could be another extension of my work.

APPENDIX 1: DERIVATION OF POLICY EFFECT OF DISPARITY - GENERALIZED VERSION

We have from equation (9)

$$\frac{dCI}{d\bar{x}_j} = \underbrace{\left[\frac{\partial CI}{\partial \bar{x}_j}\right]}_{Term\ 1} + \underbrace{\left[\frac{dCI}{d\mu} \times \frac{d\mu}{d\bar{x}_j}\right]}_{Term\ 2} + \underbrace{\left[\frac{dCI}{dCI_j} \times \frac{dCI_j}{d\bar{x}_j}\right]}_{Term\ 3} \quad \text{(a)}$$

Term 3 in equation (a) is 0 because proportionate change in x_j does not change inequality on x_j.

Solving Term 1:-

Differentiating equation (7) with respect to $\bar{x}_j$ we get

$$\frac{\partial CI}{\partial \bar{x}_j} = \left[\frac{\gamma_j}{\mu}\right] \times CI_j \quad \text{(b)}$$

Solving Term 2:-

Since the estimated value of y_i (demand for education) at means is given by:

$$\mu = \gamma_0 + \sum_{j=1}^{m} \gamma_j \bar{x}_j \quad \text{(c)}$$

Differentiate equation (7) of the main text w.r.t. μ and get $\frac{dCI}{d\mu}$.Similarly, differentiating equation (c) w.r.t. $\bar{x}_j$ and get $\frac{d\mu}{d\bar{x}_j}$. That yields the following result:

$$\frac{dCI}{d\mu} \times \frac{d\mu}{d\bar{x}_j} = -\left[\sum_{j=1}^{m}\left[\frac{\gamma_j \bar{x}_j}{\mu^2}\right] \times CI_j + GC_\varepsilon \frac{1}{\mu^2}\right] \times \gamma_j \quad \text{(d)}$$

So, $Term\ 2 = -\frac{\gamma_j}{\mu}\left[\sum_{j=1}^{m}\left[\frac{\gamma_j \bar{x}_j}{\mu}\right] \times CI_j + GC_\varepsilon \frac{1}{\mu}\right] = -\frac{\gamma_j}{\mu} \times CI$

Thus, equation (a) becomes:

$$\frac{dCI}{d\bar{x}_j} = \left[\frac{\gamma_j}{\mu}\right] \times CI_j - \left[\frac{\gamma_j}{\mu}\right] \times CI$$

$$\frac{dCI}{d\bar{x}_j} = \frac{\gamma_j}{\mu}\left[CI_j - CI\right] \tag{e}$$

Since, $\frac{d\mu}{d\bar{x}_j} = \gamma_j$ by differentiating equation (c) w.r.t. $\bar{x}_j$. Also, multiplying RHS of equation (e) by $\frac{\bar{x}_j}{\bar{x}_j}$. Then, equation (e) can be written as:

$$\frac{dCI}{d\bar{x}_j} = \frac{\bar{x}_j}{\mu} \times \frac{d\mu}{d\bar{x}_j}\left[\frac{CI_j - CI}{\bar{x}_j}\right] = e_j\left[\frac{CI_j - CI}{\bar{x}_j}\right] \tag{f}$$

which is equation (11) in the text. As a special case of this generalized version, an application is derived for policy effect on disparity on health care utilization in Appendix 2.

APPENDIX 2: DERIVATION OF POLICY EFFECT OF DISPARITY ON HEALTH CARE UTILIZATION

Equation (19) is:

$$\frac{dCI}{dY}=\underbrace{\left[\frac{\partial CI}{\partial \ln Y}\times\frac{d\ln Y}{dY}\right]}_{Term\ 1}+\underbrace{\left[\frac{dCI}{d\mu}\times\frac{d\mu}{d\ln Y}\times\frac{d\ln Y}{dY}\right]}_{Term\ 2}+\underbrace{\left[\frac{dCI}{dCI_y}\times\frac{dCI_y}{d\ln Y}\times\frac{d\ln Y}{dY}\right]}_{Term\ 3} \quad \text{(a)}$$

Term (3) of equation (a) is zero because proportionate increase in income does not change the income inequality.

Solving Term 1:-

$$\frac{\partial CI}{\partial \ln Y}\times\frac{\partial \ln Y}{\partial Y}=\left[\frac{\gamma_1}{\mu Y}\right]CI_y$$

Solving Term 2:-

$$\frac{dCI}{d\mu}\times\frac{d\mu}{d\ln Y}\times\frac{d\ln Y}{dY}=-\left[\left[\frac{\gamma_1(\ln Y)}{\mu^2}\right]CI_y+\left[\frac{\gamma_2 E}{\mu^2}\right]CI_e+\sum_k\left[\frac{\gamma_k\overline{x_k}}{\mu^2}\right]CI_k+\sum_p\left[\frac{\gamma_p\overline{x_p}}{\mu^2}\right]CI_p\right]\times\gamma_1\times\frac{1}{Y}$$

Differentiate equation (18) w.r.t. μ and get $\frac{dCI}{d\mu}=\frac{dCI}{d\mu}$. Since the estimated value of M_i at means is given by: $\mu=\gamma_0+\gamma_1\ln Y+\gamma_2 E+\sum_k\gamma_k\overline{x_k}+\sum_p\gamma_p\overline{x_p}$, where $Y=$ mean of income and $E=$ mean of education. Differentiating this equation w.r.t. Y, we get $\frac{d\mu}{d\ln Y}$.

So, Term *2* = - $\frac{\gamma_1}{Y\mu}\left[\frac{\gamma_1\ln Y}{\mu}\times CI_y+\frac{\gamma_2 E}{\mu}\times CI_e+\frac{\sum_k\gamma_k\overline{x_k}}{\mu}\times CI_k+\frac{\sum_p\gamma_p\overline{x_p}}{\mu}\times CI_p\right]$. Solving, we get: Term 2 = - $\frac{\gamma_1}{Y\mu}\times CI$. Thus, equation (a) becomes: $\frac{dCI}{dY}=\frac{\gamma_1}{Y\mu}\left[CI_y-CI\right]$ -- (b). Since,

$\frac{d\mu}{dY} = \frac{\gamma_1}{Y}$, equation (b) becomes: $\frac{dCI}{dY} = \frac{Y}{\mu} \times \frac{d\mu}{dY}\left[\frac{CI_y - CI}{Y}\right] = \omega_y\left[\frac{CI_y - CI}{Y}\right]$ -- (c) which is the equation (21) of the text.

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ABSTRACT

INEQUALITY IN HEALTH CARE UTILIZATION AND EQUITY: A CROSS-COUNTRY COMPARISON OF LOW AND MIDDLE INCOME COUNTRIES

by

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Major: Economics

Degree: Doctor of Philosophy

This dissertation identifies the sustainable policies that can reduce disparity in health care utilization, education and income from the low and middle income countries represented by Albania, Nepal, Tajikistan and Tanzania. Concentration indices are used to calculate the income related inequality in health care utilization and education, and Gini index is used to calculate the inequality in income. Likewise, a horizontal inequity index is used to test whether the principle of equal treatment for equal need and equal schooling for equal need is maintained in all countries under study. Finally, a mechanism is proposed to quantify the effect of policy change on disparity. Then this tool is used to quantify the effect of policy change on disparity in health care utilization, education and income.

Major findings of this dissertation are: (1) Statistically significant inequality exists in all countries under study and the principle for equal treatment for equal need and equal schooling for equal need are also not fulfilled. (2) Vicious vs. virtuous circle of disparity exist among health care utilization, education and income. For example, an increase in education and income may not always decrease income related inequality in health care utilization. However, if those increases respectively decrease the inequality in education and income first then that could

automatically decrease inequality in health care utilization. This fact is equally applicable for the reduction of inequality in education and income. If the changes in policy variable increase the disparity in the same variable that could lead to the vicious circle of disparity among three whereas if that changes reduces disparity in the same variable that could leads to the virtuous circle of disparity among three. (3) Thus, integrated approach of development is sustainable and scalable than single sectoral development policy to eliminate disparity from low and middle income countries represented by Albania, Nepal, Tajikistan and Tanzania.

Keywords: Income related inequality, horizontal in(equity), concentration index, policy effect of disparity, bootstrapping, Africa, Asia and Eastern Europe; Nepal**.**

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