ESSAYS ON ILLNESS AND LABOR MARKET OUTCOMES IN KENYA

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other university

Signed é é é é é é é é é é é é é Date é é é é é é é é é é é .

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This thesis has been submitted for examination with our approval as university supervisors

Signed é é é é é é é é é é é é é Dateé é é é é é é é é é é é é é .

Dr. Anthony Wambugu

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Professor Jane Kabubo-Mariara

DEDICATION

This thesis is dedicated to my late father Samson Joe Machio, to my beloved mother Gladys Nakhumicha Machio, to my dear husband Paul Juma and to my little boy Phillip Juma.

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LIST OF ABBREVIATIONS

ADL	Activities of Daily Living
AERC	African Economic Research Consortium
BHPS	British Household Panel Survey
BMI	Body Mass Index
BFG	Bourguignon Fournier and Gurgand
CSAE	Centre for the Study of Africal Economies
EUPHA	European Public Health Association
HELB	Higher Education Loans Board
HILDA	Household, Income and Labor Dynamics in Australia
HIV/AIDS	Human immunodeficiency virus / acquired immunodeficiency syndrome
IIA	Independence of Irrelevant Alternatives
ITN	Insecticide Treated Nets
IPTp	Intermittent Prophylaxis Treatment
IRS	Inside Residual Spraying
KIHBS	Kenya Integrated Household Budget Survey
KNBS	Kenya National Bureau of Statistics
LFP	Labor Force Participation
NACC	National AIDS Control Council
NASCOP	National AIDS and STI control Program
NCD	Non Communicable Diseases
OLS	Ordinary Least Squares
SSA	Sub Saharan Africa
WHO	World Health Organization

ABSTRACT

Kenya faces a high and rising burden of disease with chronic illness becoming an important contributor to the disease burden. Health as a capital stock can be expected to affect positively individualôs labor supply and labor productivity, thereby generating economic benefits. High disease burden would erode such benefits yet like many SSA countries, Kenya is relying on its labor force to achieve the projected economic growth. Despite the potential negative labor market effect of illness and the rising disease burden in Kenya, there is limited empirical evidence on the relationship between self reported illness, labor supply and earnings. The purpose of this thesis was to investigate the relationship between illness and three labor market outcomes: labor force participation, employment status and earnings. The data are drawn from a nationally representative household survey conducted by the Government of Kenya.

In chapter one, the objective was to examine the effect of illness on individual labor force participation by gender. A standard probit model was estimated. To control for potential endogeneity of the health variable and unobserved individual heterogeneity, control function approach was employed. The results do not reveal evidence on endogeneity and unobserved heterogeneity bias. Standard probit estimates indicate that acute and chronic illnesses reduce the likelihood of labor force participation. The negative effect of chronic illness is larger than that of acute illness. Both illnesses reduce the likelihood of labor force participation among women by a larger magnitude than among men. The findings imply that illness is a major constraint to labor force participation in Kenya. Effective policies and interventions to reduce prevalence of chronic and acute illness would bring more Kenyans into the labor force. Moreover such policies and interventions should be targeted to women.

Chapter two examined the effect of chronic and acute illness on individualôs employment status. Multinomial probit model was estimated because the IIA assumption underlying the multinomial logit model did not hold in the data used in this thesis. The employment states considered were: wage employment, agricultural self-employment, non-agricultural self-employment and not working. The results indicated that chronically ill women were less likely than non ill women to be in wage employment and in agricultural self-employment. For men,

having chronic illness did not significantly influence employment status. The results also indicated that having an acute illness did not significantly influence employment status of either men or women. By affecting individualôs choice of type of employment, illness affects labor allocation and reallocation with implications for economic transformation and growth. The results imply that policies and interventions to reduce incidence of chronic illness would increase wage employment among women. This is important since relative to other forms of employment, wage employment is associated with higher earnings and benefits (such as job security and health insurance). Such policies and interventions would also increase participation in agricultural employment.

The objective in chapter three was to investigate the relationship between illness and earnings in wage employment, agricultural self-employment and non-agricultural self-employment. A control function approach was used to account for potential endogeneity and unobserved individual heterogeneity. Sample selection bias was controlled for using a two step approach suggested by Bourguignon, Fournier and Gurgand (here after BFG). The results reveal evidence of the three econometric problems, justifying use of control function approach and controlling for sample selection bias. Full sample results indicated that both acute and chronic illnesses have negative and significant effect on wage employment earnings. In contrast, both illnesses do not significantly affect earnings in self employment. When the analysis was done by gender, only chronic illness significantly affects wage employment earnings and the effect was larger for men than for women. Public policies and interventions that effectively reduce the incidence of chronic and acute illness would increase wage incomes and help in poverty reduction.

CHAPTER ONE: INTRODUCTION

1.1. Health as human capital

Discussions about the importance of human capital in economic growth were fuelled by research (e.g. Fabricant, 1959; Solow, 1957) that showed additions to labor and physical capital only explained a small part of increase in output. No clear definition of human capital exists in the literature. However, authors have referred to various activities as constituting investment in human capital. Schultz (1961) refers to direct expenditures on education, health and internal migration as investment in human capital. Becker refers to human capital as

> *"activities that influence future real income by imbedding resources in people such as schooling, on- job-training, medical care, consumption of vitamins and acquisition of information about the economic system as investment in human capital"(Becker,1962, p. 9).*

Health is therefore considered a component of human capital (Schultz, 1961; Becker, 1962). Studies distinguish health from education and refer to the health component of human capital as health human capital (Schultz, 1999; Lopez-Casasnovas et al., 2005; Mwabu, 2007a). The World Health Organization (WHO) defines health as ña *state of complete physical, mental and social well-being and not merely the absence of disease or infirmity*ò (World Health Organization, 1948, p.1).

Most of the early literature on human capital focused on the education and training components of human capital (Becker, 2007). However, the model of demand for health capital developed by Grossman (1972) spurred literature on the health component of human capital (Becker, 2007). According to the model, individuals are born with an initial stock of health. The initial stock depreciates with age but through investment, the stock of health can be increased. Individuals combine own time with medical care, diet, exercise, recreation, and housing to increase health human capital. Further, the model shows that education influences the efficiency of producing health. The health stock produced determines the amount of time an individual has for market and non market activities.

While number of years of schooling is considered a good measure of educational stock (Schultz, 1961), such a comparable measure does not exist for health capital (Mushkin, 1962). This is partly because of the multidimensional nature of health as echoed in WHO (1948) definition of health. Consequently, economists study the relationship between health and labor market outcomes such as labor force participation, wages and income using a variety of health indicators (Strauss and Thomas, 1998). The next subsection provides a discussion of some of these indicators.

Measurement of health

A number of indicators have been used to measure health in the literature (Strauss and Thomas, 1998; Mwabu, 2007a). One such indicator is the general health status. This indicator is derived from household surveys by asking individuals to rate their health as ñvery goodò, ñgoodò, ñsatisfactoryò or ñpoorò. It differs from other health indicators in that individuals do not specify their physical, mental or social health status, but assess their health instead. Another indicator is morbidity which refers to state of individual being in ill health. Information on morbidity is obtained either through surveys or health facility records. When surveys are used, respondents are asked questions about illness or specific symptoms during the survey reference period, usually four weeks prior to the interview.

Limitation on normal activity and limitations in physical activities are also indicators of health. The two are related. Limitations on normal activity have to do with days of ñnormalôô activity lost due to ill health. Limitations in physical activities relates to difficulty in performing physical functions that are considered normal activities for people in good health. Such activities include walking a particular distance, climbing stairs and lifting a particular weight. There are also nutrition ï based indicators which include nutrients indicators which measure the quantity of nutritional inputs used to produce health and anthropometric measures, such as height, weight, arm circumference, and body mass index.

One other measure of health that has been used in the literature is type of illness. Illness can be categorized as acute illness or chronic illness. Chronic illnesses involve long term disability while acute illness is short lived. Using information on the specific health condition an individual

is suffering from, it is possible to separate acute illness such as malaria from chronic illness such as HIV/AIDs. Sometimes individuals are asked directly whether or not they suffer from any chronic illness. Such information can be obtained through surveys or health facility records. Mwabu (2007a) asserts that this is a good indicator and that separating acute from chronic illness is important because long term disabilities have different effect on health than acute disabilities. However since diseases are diagnosed after individuals have contacted the health care system, they may reflect health care treatment choices of individuals and households. Strauss and Thomas (1998) and Mwabu (2007a) provide a detailed discussion of measures of health.

Health situation in Kenya

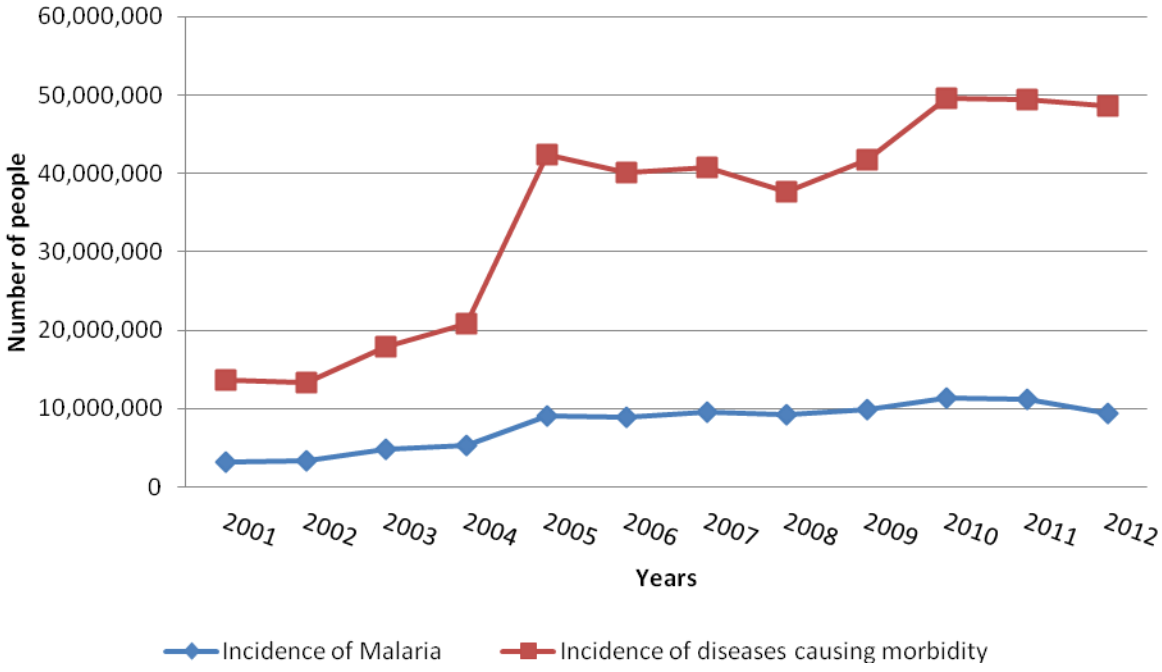
This study measures health using type of illness focusing on chronic and acute illnesses. Acute illnesses are those of short duration while chronic illnesses take long to become established and are of long duration (Jones, 2010; WHO, 2005a). Some authors have argued that chronic illness can be used in the place of non communicable diseases (NCD) because some NCD have a communicable component to them since the risk behavior that underlie them can be transmitted such as cervical cancer (WHO, 2005a; Ackland et al., 2003). Others however argue that use of the term chronic to refer to NCD is erroneous because chronic illnesses also include some communicable diseases such as HIV/AIDS (Unwin et al, 2004).

Kenya faces a major challenge in improving the health status of her population. As shown in figure 1-1, the incidence[1] of diseases rose sharply over the period 2001-2012. Throughout this period, except in 2012, the main cause of morbidity[2] was malaria. This explains why the trend in malaria cases largely mimics the trend of all diseases combined. Between 2001 and 2011, malaria contributed approximately 30% of the incidence of diseases causing morbidity in Kenya (Republic of Kenya, 2012; 2009; 2006). We observe a decline in malaria cases between 2010 and 2012. In fact, in 2012 diseases of the respiratory system overtook malaria becoming the leading cause of morbidity (Republic of Kenya, 2013). The decrease in malaria cases might be due to governmentôs effort through Insecticide Treated Nets (ITN); Intermittent Prophylaxis

[1] Number of new cases of a condition, symptom or injury that develop during a specific time period
[2] Diseased state, disability or poor health due to any cause

Treatment; (IPTp) and Inside Residual Spraying (IRS). The number of people reporting malaria illness is however still high.

Figure 1-1: Incidence of Diseases Causing Morbidity in Kenya (2001-2012)



Source: Republic of Kenya, *Economic Surveys, various issues*

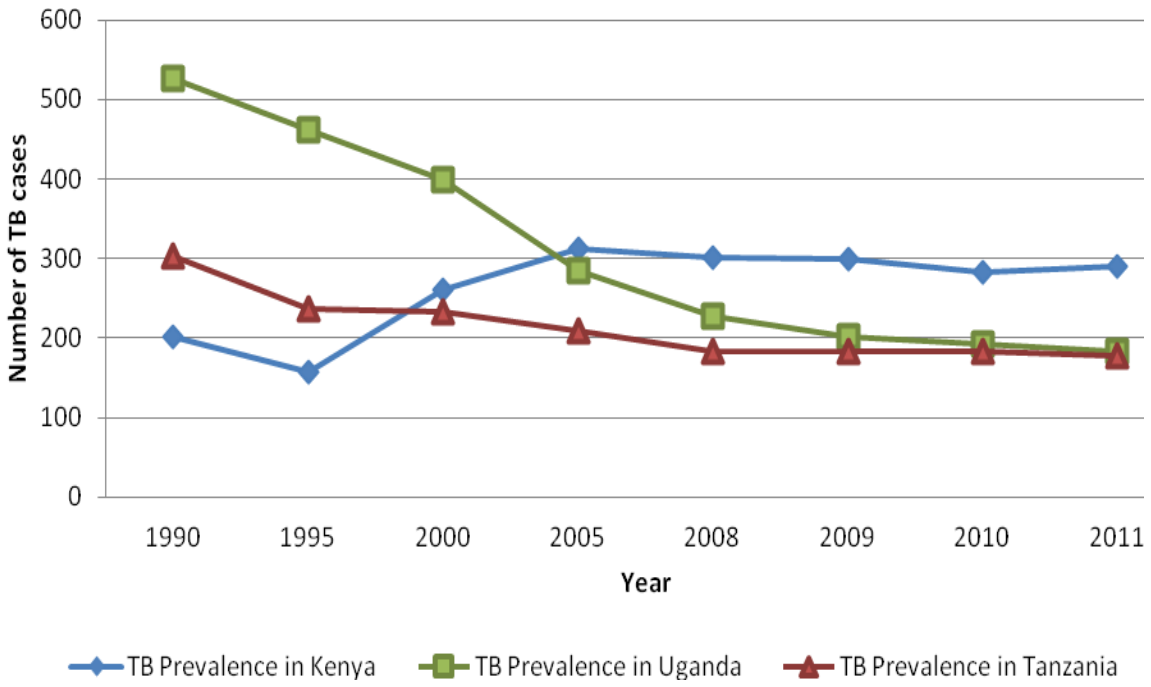
The number of Kenyans living with HIV/AIDS is high. In 2007, the estimated number of adults in Kenya aged 15-64 infected with HIV/AIDS was 1.4 million and Kenya had the third highest number of people living with HIV/AIDS in Sub-Saharan Africa (SSA) (NASCOP et al., 2009; UNAID, 2008). The number increased to 1.6 million in 2011 and is expected to increase (NACC and NASCOP, 2012). This is of concern because those infected by HIV/AIDS are in the economically active bracket.

The burden of tuberculosis (TB), a disease highly related to HIV/AIDs, is relatively high for the Kenyan population. Uganda and Tanzania had higher TB prevalence[3] and incidence than Kenya in 1990. But the situation reversed in 2000 for Tanzania and in 2005 for Uganda (Figure 1-2 and

[3] Total number of cases of a condition, symptom or injury

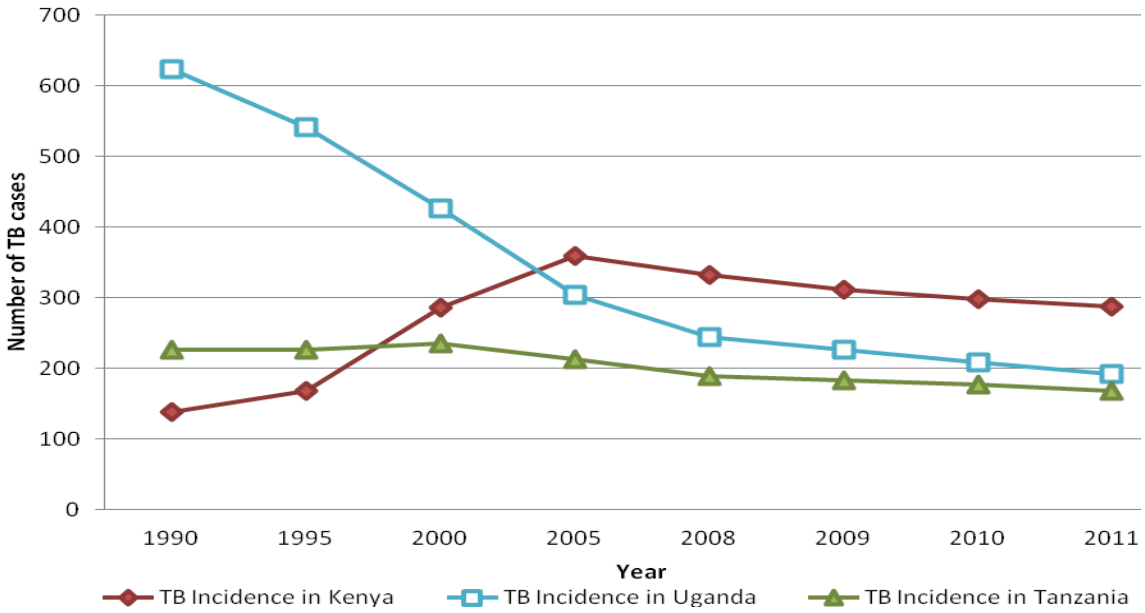
1-3). In 2011, Kenyaôs TB prevalence rate was 291 per 100,000 population, the incidence rate was 288 per 100,000 and the mortality rate was 22 per 100, 000 (World Health Organization, 2012). Kenya is among the 22 countries with high TB burden - countries that account for approximately 80% of all new TB cases each year- in the world (World Health Organization, 2012). In 2012, tuberculosis was the leading cause of death in Kenya (Republic of Kenya, 2013).

Figure 1-2: TB Prevalence for Kenya, Uganda and Tanzania (1990-2011)



Source: World Health Organization, 2012

Figure 1-3: TB Incidence for Kenya, Uganda and Tanzania (2001-2011)



Source: World Health Organization, 2012

The burden of NCD, once thought to be diseases of the rich nations, is also high in developing countries. In 2008, NCD accounted for 63% of the global deaths and about 80% of these deaths occurred in low- and middle - income countries (World Health Organization, 2011). Many developing countries face a double burden of communicable diseases and NCD. Further, in low- and middle ï income countries, 29% of NCD deaths occur among people under age 60 unlike 13% for the high income countries. In Kenya, NCD have become a major contributor to the burden of ill health, representing 50 ï 70% of all inpatient admissions between 2002 and 2008 and up to half of inpatient mortality (MOMS and MOPHS, 2012).

These statistics indicate that Kenya still has a challenge in improving the health status of its population. As indicated in the foregoing discussion, these illnesses affect persons in the working age population (15-64 years). Kenya like many SSA countries is banking on its labor force to achieve projected economic growth (Republic of Kenya, 2007). However, poor health has the potential to reduce productive time, efficiency and therefore economic growth. In Kenya in 2012, HIV/AIDS contributed the most (14.0%) to loss of productive time followed by malaria (3.4%) and tuberculosis (2.1%) (WHO, 2014). Therefore the three diseases together

accounted for 19.5% of the time lost from productive activities due to illness (WHO, 2014). This implies a lot of labor time is lost in Kenya due to poor health status. The United Nations recognized that these illnesses could constrain socio economic development. Therefore combating of HIV, Malaria and other diseases was included as a Millennium Development Goal (UN Millennium Project, 2005).

1.2. Labor force status and earnings

Table 1-1 presents key labor market statistics for Kenya drawn from available secondary sources. In 2005, the working age population (15 ï 64 years) in Kenya was 19.9 million, 4 million higher than in 1998. Of the 19.9 million, 14.6 million were in the labor force implying a participation rate of 72.6% compared to 73.6% in 1998. The slight decline in participation rate was due to a decline in womenôs participation rate from 72.6% in 1998 to 69.7% in 2005. Male participation rate increased from 74.7% to 75.7%.

Employment in non-agricultural self-employment has grown over time surpassing the agricultural self-employment which was once the largest source of employment in Kenya. In 1998, majority (42%) of the employed persons were in the agricultural self-employment. In the same year, the non-agricultural self-employment and wage employment absorbed 32% and 24% of the employed population respectively. The pattern was different in 2005. Most (46%) of the employed were in the non-agricultural self-employment. The shares of employed in wage employment and agricultural self-employment were 14% and 41%, respectively.

Gender disparities in employment are prevalent in Kenya. The proportion of women of working age employed in wage employment was 7% in 1998 and 4% in 2005 compared to 17% and 9% of men. In the non-agricultural self-employment, 17% of those employed in 1998 were men and 14% were women. By 2005, 25% of those in non-agricultural self-employment were men and 22% were women. In contrast, more women than men were in agricultural self-employment in both 1998 and 2005. That is 17% men and 25% women in 1998 and 18% men and 22% women in 2005.

Although average nominal wage rose between 1998 and 2005, the real wage (nominal wage

deflated by consumer price index (CPI)) fell. The average nominal monthly earnings for paid employees in 1998 were Ksh. 7,766 increasing to Ksh. 9, 353 in 2005. However, real wage fell from Ksh. 4,738 in 1998 to Ksh. 4,653 in 2005.

Table 1-1: Labor Market Statistics for Kenya by Gender

Variables	**1998**		**2005**	
	Men	**Women**	**Men**	**Women**
Working age population	15.9 million		19.9 million	
Economically active population	12.3 million		14.6 million	
Labor force participation rate (%)	74.7	72.6	75.7	69.7
Share of wage employment in total employment (%)	17	7	9	4
Share of non-agricultural self-employment in total employment (%)	17	14	25	22
Share of agricultural self-employment in total employment (%)	17	25	18	22
Nominal wage (Ksh)	8,440	5,752	9,794	8,412
Real wage (Ksh)	5,149	3,509	4873	4185

Source: Republic of Kenya, 2003; 2008 CPI in 1998 was 163.9, CPI in 2005 was 201.8, 1982-83=100

1.3. Statement of the problem

Kenya faces a heavy and rising disease burden. Malaria, tuberculosis and HIV/AIDs continue to weigh negatively on the health status of the Kenyan population (Republic of Kenya, 2012; 2009; 2006; NASCOP et al., 2009; WHO, 2012). The rising proportion of Kenyans suffering from NCD makes the health situation worse (World Health Organization, 2011). Of major concern is that NCD in low and middle income countries affect individuals of working age, at the most productive part of their lives (WHO, 2011). Similarly HIV/AIDS, mostly affects working age population.

A heavy disease burden is of concern because it erodes health human capital. Since the seminal article by Grossman (1972), health is viewed as a capital stock that affects an individualôs healthy time. This implies that illness may reduce total healthy time available to an individual, thus affecting their labor force participation. Ill health may also cause individuals to prefer leisure to work, again affecting their labor force participation. Further, by affecting general well-being of individuals, illness may hinder individuals from participating in some types of employment given that the nature of work and flexibility of work schedules varies by type of employment. Health human capital may also influence an individualôs capacity to fulfill job requirements and therefore productivity (Becker, 1962; Mushkin, 1962; Schultz, 1961). Since most Kenyans derive income from labor, the potential negative effect of illness on labor market outcomes has implications for poverty levels.

Despite the potentially adverse consequences of a rising disease burden on individual labor market outcomes, research on the relationship between adult health and labor market outcomes in Kenya is scarce. Previous studies of Kenya on labor market typically consider the education dimension of human capital (Appleton et al., 1999; Bwonda, 2013; Kabubo-Mariara, 2003; Kimenyi et al., 2006; Knight and Sabot, 1990; Atieno & Teal, 2006; Nyaga, 2010; Wamuthenya, 2010; Wambugu, 2003; 2011; Soderbom et al., 2004). In contrast, very few studies have examined the returns (penalty) to health human capital. Kioko et al. (2013) and Mwabu (2007b) examined the effect of malaria on wage earnings in Kenya while Fox et al. (2004) studied the impact of HIV/AIDS on labor productivity of tea plantation workers in Kericho, Kenya.

The main research question this thesis sought to answer is whether or not acute and chronic illness affects labor market outcomes in Kenya? The specific research questions are: how is labor force participation affected by chronic and acute illness?; how is employment status affected by chronic and acute illness?; and how are labor earnings affected by chronic and acute illness?

1.4. Objectives of the study

The main objective of this thesis is to analyze the effect of illness on labor supply, employment status and earnings among the economically active population in Kenya. The specific objectives are:

a) To examine the effect of chronic and acute illness on individual labor force participation

decision.

b) To investigate whether or not chronic and acute illnesses affect employment patterns.
c) To analyze the effect of chronic and acute illness on individual labor earnings in wage .employment, in non-agricultural self-employment and in agricultural self-employment.
d) To suggest policy recommendations for improving labor market outcomes in Kenya.

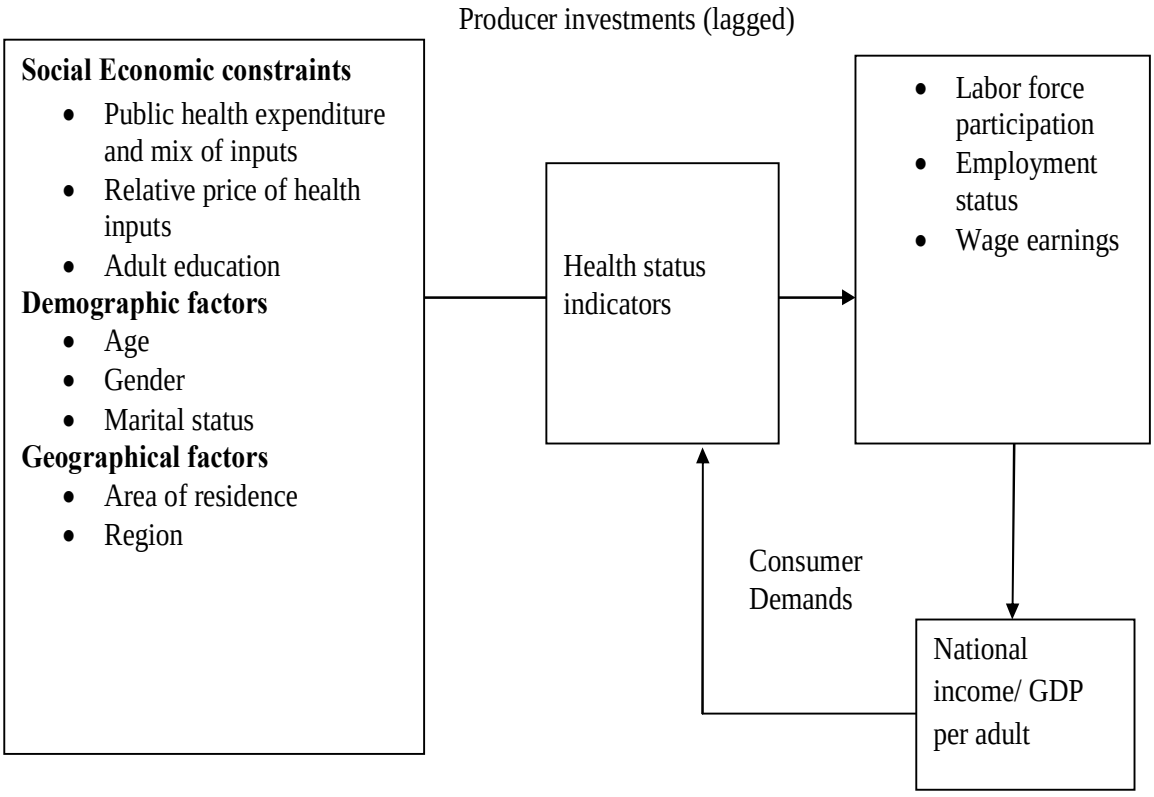
1.5. Conceptual framework

The framework for assessing the impact of health on labor market outcomes was developed by Schultz (1999). A modified version for this study is in figure 1-4. Socioeconomic, demographic and geographical factors may directly influence labor market outcomes. But these factors can also determine an individualôs health status. In turn, health status influences labor market outcomes. There is usually a time lag between process of formation of health capital and its effect on the labor market represented by producer lags.

Health status can influence labor force participation through three channels. First healthy individuals have more time available for market and non market activities (Grossman, 1972) Second, individuals in good health may prefer leisure to work (Cai and Kalb, 2006). Health status may also influence employment status because when faced with less total time available for market and non market activities, ill individuals may prefer employment types with flexible hours of work (Cai and Kalb, 2006). Ill health may also interfere with training and affect employment prospects. Even if ill individuals gain access to some form of employment, illness may diminish their capacity to fulfill job requirements (Leibenstein, 1957; Becker, 1962; Mushkin, 1962; Schultz, 1961). If this lowers their productivity, illness can reduce earnings.

The framework indicates that there can be a feedback effect from labor market outcomes to health status. This is because labor force participation, employment status and wages can affect income per person and therefore individualôs ability (consumer demand) to acquire health inputs to maintain and improve health capital.

Figure 1-4: Determinants and Consequences of Accumulating Health Human Capital



Source: Adapted from Schultz (1999)

1.6. Estimation issues and data sources

Empirically three problems make the estimation of the effect of health status on labor market outcomes difficult. These problems are potential endogeneity of health status, potential sample selection bias and unobserved individual heterogeneity. These problems need to be addressed in order to obtain unbiased estimates.

Endogeneity of health status

Endogeneity occurs if there is correlation between one or more explanatory variables and the error term (Wooldridge, 2002). In labor market outcomes models, health status may be endogenous because of three reasons. First simultaneity between the health variable and labor market outcome variable may cause endogeneity. Grossmanôs model suggests that ill health may reduce the amount of time an individual has for market and non market activities thereby affecting labor force participation (Grossman, 1972). However, inactivity associated with being

out of the labor force can in turn negatively affect health (Sickles and Taubman, 1986). In addition, jobs that are hazardous or involve risks affect individualsô health (WHO, 2003). Further, individuals in the labor force may use part of the income they earn to improve their health.

Second, errors in measuring and reporting health may also cause endogeneity. It has been argued that individuals may use economic or psychological reasons to alter their self reported health to rationalize their labor market decisions (Stern, 1989; Bound, 1991). This is usually referred to as rationalization endogeneity. Individuals who are out of the labor force may report worse health status to justify their being out of the labor force. However, the effect of this bias may be smaller in developing countries because unlike in developed countries, there are no unemployment benefits. Similarly, what individuals consider good health may vary from one individual to another and from one group to another (Bound, 1991). This is likely to bring about reporting bias. Finally, endogeneity may also occur due to omitted variable bias (Stern, 1989). If for example, there are unobserved factors such as motivation that may affect both health and labor force participation, such may result in omitted variable bias.

Unobserved individual heterogeneity

Heterogeneity occurs if there is interaction between the unobservable factors and the endogenous variables causing the effect of the endogenous variables on the dependent variable to vary by individuals (Wooldridge, 2002). Unobserved heterogeneity bias will exist in this study if there is non linear interaction between the health variables and unobservable factors (such as motivation) causing the effect of health on labor market participation and earnings to vary by individual workers. This biases the estimates of effect of illness on labor market outcomes (Wooldridge, 2002).

The approach taken in this thesis to address potential endogeneity of the health variable and unobserved individual heterogeneity was to implement the control function approach estimation procedure (Card, 2001; Florens et al., 2008; Petrin and Train, 2009; Diagne and Diene, 2011)

Sample selection bias

It is important to control for sample selection bias when estimating the effect of illness on earnings in various types of employment to achieve the third objective of the thesis. Earnings are observed for individuals in wage employment, non-agricultural self-employment and agricultural self-employment. We do not observe earnings for non working individuals. If there are unobserved factors that affect an individualôs chances of being in various employment states and these unobserved factors are correlated with unobserved factors affecting earnings, then there will be sample selection bias. Therefore restricting the sample only to the employed persons may bring inconsistent estimates (Greene, 2008). This thesis used a two step approach suggested by Bourguignon, Fournier and Gurgand (here after BFG) to control for selection bias (Bourguignon et al., 2007). This approach not only provides robust estimates, but also identifies the employment status that is the source of selection bias.

Data sources

This study used data from the Kenya Integrated Household Budget Survey (KIHBS) 2005/6. This is the most recent nationally representative survey conducted by the Kenya National Bureau of Statistics (KNBS). The survey was conducted in 1,343 randomly selected clusters in Kenya and comprised 861 rural and 482 urban clusters. These were the primary sampling units. A sample size of 13,430 households was selected that comprised 10 households randomly selected with equal probability in each cluster. The sample sizes in rural and urban areas were 8,610 and 4,820 households respectively (Republic of Kenya, 2007).

The total number of individuals in the sample of households was approximately 66,667. This study focused on individuals aged 15-64 years who were not full time students. This is the economically active population (Republic of Kenya, 2008). A total of 17,634, individuals in the survey belonged to this group. Of these, 8, 411 were men and 9,223 were females.

Four questionnaires were used to collect data: a 21-day recall module household questionnaire; 14-day recall household expenditure diaries to record consumption and purchases; a market price questionnaire and a community questionnaire (Republic of Kenya, 2007). A wide

spectrum of socio-economic indicators required to measure, monitor and analyze the progress made in improving living standards in Kenya was collected. In particular, the survey collected information on demographics, housing, education, health, agriculture, labor, livestock, household enterprises, expenditure and consumption.

The information collected on the health of household member included morbidity, health care seeking behavior, use of bed nets and disabilities. The set of questions asked to collect morbidity data were: ñWas (name) sick or injured in the last 4 weeks?ò; ñWhat sort of sickness/injury did (name) suffer from?ò; ñDoes (name) suffer from a chronic illness?ô; ñWhat chronic illness does (name) suffer from?ò

The labor market module gathered a range of information on individualôs main activities in the past seven days. Specifically, the respondents were asked to state whether they worked for pay, were on leave, were on sick leave, worked on own business, worked on own agricultural holding, were seeking work, doing nothing, retired, homemakers or incapacitated. Information on monthly earnings in the individualôs employment was also collected.

A community questionnaire was also administered to a group of knowledgeable residents in each cluster. The group members were randomly selected from diverse fields such as village headman, headmaster of a local school, agricultural field assistant, religious leaders, local merchants, health workers or other knowledgeable residents. A minimum of five respondents constituted a focus group that discussed several community issues and reached consensus that represented the community. Information was collected on basic physical infrastructure (schools, health facilities, etc) access to (distance) and quality of public services, economic activities, agriculture, community welfare, security and safety.

1.7. Contribution of the thesis

This thesis contributes to the empirical literature on health and labor market outcomes in a number of ways. First, the thesis provides empirical evidence from Kenya on the effect of ill health on three labor market outcomes: labor force participation, employment status and earnings. This is important because the high and rising disease burden in Kenya has potentially

negative effects on labor market outcomes, yet most Kenyans derive income from labor.

Secondly, different indicators of health may have differing effects on labor market outcomes of men and women (Gambin, 2005). Although several studies (e.g. Kabubo-Mariara, 2003; Nyaga, 2010; Wambugu, 2011) have examined gender differences in the effect of education on wages and access to employment in Kenya, there is no study on gender differences in the effect of health on labor market outcomes. In the light of this, this study contributes to literature by analyzing the effect of illness on labor market outcomes for men and women separately. This is important because poor health may adversely affect labor market outcomes of one gender more than the other. Evidence on this issue can aid health policy makers in targeting.

Thirdly, this study estimates the effects of two types of illnesses: acute and chronic illness on labor market outcomes. This is important because long term disabilities associated with chronic illness may have different effects on health than short term disabilities associated with acute illness (Mwabu, 2007a). Therefore, the two types of illnesses may have differing effects on labor market outcomes. Use of the two types of illnesses can also indicate which one better predicts labor market outcomes.

Fourthly, empirical evidence from other countries (e.g. Glick and Sahn, 1998) suggests that the impact of health on earnings may differ according to the individualôs type of employment. There is a dearth of Kenyan literature on this. Previous studies in Kenya only focused on a single sector of employment in studying relationship between health and labor market outcomes (Kioko et al, 2013; Fox et al., 2004). This study separates wage employment earnings, non-agricultural self-employment earnings and agricultural self-employment earnings to conduct a detailed analysis. This allows for isolating ill health earnings penalty for each type of employment.

Finally, this study incorporates econometric strategies that take into account potential sample selectivity bias, endogeneity of illness and unobserved heterogeneity of individuals. Specifically, the thesis used newly developed technique by Bourguignon, Fournier and Gurgand (BFG) which avoids unnecessarily restrictive assumptions imposed by earlier techniques (e.g. linearity assumption) to address potential sample selectivity bias in earnings determination arising from

non random entry into various employment types (Bourguignon et al., 2007). The study also tests and controls for potential endogeneity of the health variables and potential unobserved heterogeneity among workers using control function approach (Card, 2001; Florens et al., 2008; Petrin and Train, 2009; Diagne and Diene, 2011). Failure to control for endogeneity, heterogeneity and selection bias leads to biased and inconsistent estimates (Greene, 2008).

1.8. Organization of the thesis

In the rest of this thesis, each chapter addresses a specific objective of the study. Each chapter begins with an introduction, followed by review of literature. This is followed by research methodology and empirical results. A summary and conclusion completes each chapter. Chapter two focuses on the relationship between illness and individual labor force participation. Chapter three analyses the effect of illness on employment pattern. Chapter four examines the relationship between illness and earnings in wage employment, in agricultural self-employment and in non-agricultural self-employment. The final chapter (chapter five) presents the summary, conclusions and policy recommendations.

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CHAPTER TWO: EFFECT OF ILLNESS ON LABOR FORCE PARTICIPATION

2.1. Introduction

Kenya faces a heavy and rising burden among working age population (WHO, 2011; NASCOP et al., 2009). This is of concern because health as a dimension of human capital (Grossman, 1972) affects individualsô healthy time hence labor supply decisions. Illness may also make individuals to prefer leisure to work (Cai and Kalb, 2006) and therefore less likely to be in the labor force. Further, health determines the level of productivity and hence earnings (Leibenstein, 1957; Becker, 1962; Mushkin, 1962; Schultz, 1961) and therefore labor supply decisions. In particular if market wage is below the reservation wage, the ill individual does not participate in the labor force. On the other hand, reduced wages may make individuals want to work to make up for lower wages and pay health care costs hence increase labor force participation. Further, in a dynamic labor supply model, ill health may affect an individualôs expected life horizon hence affecting labor supply decisions (Suhrcke et al., 2005). Failure to participate in the labor market implies loss of income and because Kenyans mainly derive income from labor, non participation has welfare implications.

While a number of studies examine labor force participation in Africa (Sackey, 2005; Lokshin et al., 2004; Tandrayen ï Ragoobur et al., 2011; Mugume and Canagarajah, 2005; Siphambe and Motswapong, 2010; Ntuli and Wittenberg, 2013) comparatively few studies consider how health status affects labor force participation (Bridges and Lawson, 2008; Nanfosso and Zamo-Akono, 2010). In Kenya, there is a dearth of labor market research on this issue. The three previous studies on effect of health on labor market outcomes focus on wages (Fox et al, 2004; Mwabu, 2007b; Kioko et al., 2013).

Understanding the relationship between health and labor force participation is important for a number of reasons. First, if ill health reduces the probability of labor force participation, it may lead to productivity loss both to individuals and the economy. In Kenya, previous empirical evidence suggests that persons out of the labor force are more likely to be poor (Odhiambo and Manda, 2003). Secondly, information from this study can be used to estimate lost production due to illness. This can be used to design appropriate interventions to avoid such productivity

losses. Finally, a survey of the literature on health and labor market outcomes by Currie and Madrian (1999) conclude that there is a dearth of empirical studies on the relationship between health and labor market outcomes for populations other than the old.

The purpose of this essay was to examine the relationship between illness and labor force participation among men and women of working age in Kenya. Specifically, the objectives addressed in this essay are:

a) To estimate the effect of chronic and acute illnesses on individual labor force participation.
b) To test for gender differences in the effect of illness on individual labor force participation.
c) To draw policy implications for increasing labor force participation.

The essay makes three contributions to the literature on the effect of health on labor supply decisions. First it provides empirical evidence from Kenya on the relationship between health and labor market participation. The study provides evidence on this issue separately for men and women. This is important because labor supply effect of health may differ between men and women (Gambin, 2005). This information can be used to target health interventions by gender.

Second, instead of relying on a single health variable, the essay considered both chronic and acute illness as indicators of health. The two types of illness have differing effects on health (Mwabu, 2007a) and hence may have differing effects on labor supply decisions. Third, this essay used the control function approach estimation procedure (Card, 2001; Florens et al., 2008; Petrin and Train, 2009; Diagne and Diene, 2011) to address potential endogeneity of the health variable and unobserved individual heterogeneity. The control function approach is the appropriate method of dealing with endogeneity and unobserved heterogeneity in nonlinear models.

The rest of the essay is organized as follows. Section 2.2 reviews theoretical and empirical literature on health and labor force participation. Section 2.3 presents the methodology, data and descriptive statistics. Section 2.4 presents the results while section 2.5 presents summary, conclusion and policy implications.

2.2. Literature review

Individuals are said to be participating in the labor market if they are employed or are seeking employment (Cahuc and Zylberberg, 2004). Health status affects labor force participation by affecting wages (Leibenstein, 1957; Becker, 1962; Mushkin, 1962; Schultz, 1961), an individualôs preference between leisure and work (Cai and Kalb, 2006), total healthy time (Grossman, 1972) and expected life horizon in a dynamic labor supply model (Suhrcke et al., 2005).

2.2.1. Theoretical literature

Health as a form of human capital (Grossman, 1972) affects healthy time. So, good health is expected to increase an individualôs healthy time while ill health may reduce an individualôs healthy time. The neoclassical theory of labor supply assumes that each individual has a limited amount of time to allocate between work and leisure (Cahuc and Zylberberg, 2004). By reducing healthy time available to an individual, illness can influence labor supply decisions.

Illness can also affect labor force participation because it may affect preference between leisure and work (Cai and Kalb, 2006). Illness decreases an individualôs stock of health capital creating the need for rest time and time to take care of own health leading individuals to prefer more leisure to work. However individuals in poor health may also have a higher demand for health services and so may want to generate enough income to pay for their medical bills. Illness in this case shifts preference away from leisure thereby increasing labor supply.

Human capital theory views health as a form of human capital that affects an individualôs capacity to fulfill job requirements and hence productivity and wages (Leibenstein, 1957; Becker, 1962; Mushkin, 1962; Schultz, 1961). Those in ill health may have lower productivity and hence lower wages than healthy individuals. Reduced wages have two effects. First, reduced wages imply a lower opportunity cost of leisure thereby reducing the likelihood of labor force participation. This is the substitution effect. Second reduced wages may reduce an individualôs total income causing them to want to work to make up for lost income. Also, since individuals in poor health may have low productivity, employers may use their illness as a signal of low productivity. This would reduce their chance of being employed.

In a dynamic model of labor supply, health may also affect labor supply decision by affecting expected life horizon (Suhrcke et al., 2005). Ill health may reduce an individualôs expected life horizon hence lower lifetime earnings. The individual may prefer to stay longer in the labor market to compensate for lost income. However, a shorter life horizon may also mean reduction in what individuals need for their lifetime consumption and thus reduction in labor force participation. Therefore, in a dynamic model, the effect of illness on labor force participation is ambiguous, it can increase or decrease the probability of labor force participation.

2.2.2. Empirical literature

There are two strands of literature on the relationship between health status and labor force participation. One strand analyzed the relationship between health status and labor force participation among the elderly (Zucchelli et al., 2010; Cai and Kalb, 2006; Mete and Schultz, 2002; Rice et al., 2006; Hagan et al., 2009; Au et al., 2005). This literature focuses mainly on developed countries motivated by a sizable proportion of the elderly population and the need to retain them in the labor force. These studies examine how ill health influences labor supply of older individuals and the probability of early exit from the labor market. The other strand of literature analyzed the relationship between health status and labor force participation among all persons in the working age bracket (Brown et al., 2010; Stern, 1989; Nanfosso and Zamo-Akono, 2010; Bridges and Lawson, 2008; Zhang et al., 2009).

The studies on the labor force participation of the elderly mainly used panel survey data. So, they are able to control for individuals- specific effects to obtain unbiased estimates. Zucchelli et al. (2010) and Cai and Kalb (2006) study the effect of health status on labor market exits and labor force participation of older Australians respectively. Rice et al. (2006) and Disney et al. (2006) focused on UK workers and Hagan et al. (2009) extended their analysis to cover seven European countries. Au et al. (2005) estimated the effect of health on decision to work of older Canadians while Mete and Schultz (2002) study the relationship between good health and labor force participation among the elderly in Taiwan.

The major estimation problem encountered by these studies was potential endogeneity of the health variable in the labor force participation equation. They all concluded that failure to control for potential endogeneity may underestimate the effect of ill health on labor force participation (Cai and Kalb, 2006). To control for endogeneity of health, some studies construct a latent health stock variable which was then used in place of the potentially endogenous health variable (Zucchelli et al., 2010; Rice et al., 2006; Disney et al., 2006; Au et al., 2006). Others like Cai and Kalb (2006) estimated the labor force equation and the health equation simultaneously. Mete and Schultz (2002) used instrumental variable approach. They used parental longevity (if father or mother died before age 60) and whether an individual was born in Taiwan versus Mainland China and farm/city/town of residence at age 12 as instruments.

Majority of these studies used individual self reported / self assessed health measures (Zucchelli et al., 2010; Cai and Kalb, 2006; Mete and Schutz, 2002; Rice et al., 2006; Disney et al., 2006; Hagan et al., 2009 and Au et al., 2005). In addition, Mete and Schultz (2002) used activities of daily living (ADL) index and specific health conditions and illnesses, Au et al. (2005) used health utility index and Rice et al. (2006) used self reported functional limitations. The health utility index was constructed from specific health conditions and health limitations that were aggregated using preference scores.

Self assessed health measures have a number of weaknesses (Strauss and Thomas, 1998; Mwabu, 2007a). First, they are subjective because good health means different things to different people. It is also not clear which reference category individualôs should rate their health in comparison to. Finally this measure of health may be correlated with use of health services since people get to know about their health status only after they visit the health facility. Thus, it is likely to be biased downwards for individuals with limited access to health services.

To account for heterogeneity in the elderly population, the analysis of effect of health status on labor force participation was disaggregated by gender. Zucchelli et al. (2010) found that in Australia, men were more likely than women to exit early from the labor market due to negative health shocks. In contrast, Mete and Schultz (2002) found that in Taiwan improvement in health status increases labor market participation of both men and women. The effect was higher for

women than for men. Rice et al. (2006) report mixed findings for the elderly in the United Kingdom. While health limitations increased the probability of retirement by a larger magnitude for men than women, the latent health variable increased the probability of retirement by the same magnitude (30%) for both men and women. Au et al. (2005) found that the effect of better health status on the probability of working was the same for older men and women in Canada.

It can therefore be concluded that there is no consensus among these studies on whether the effect of illness on labor force participation is higher for men than for women. Results obtained differ depending on the indicators of health status used. There is need for more studies to help towards building consensus as to whether ill health is a greater barrier to women than men participation in labor market.

A number of studies consider the effect of health on labor force participation among men only. For example, Cai and Kalb (2006) found significant negative effect of ill health on menôs probability of participating in the labor force in Australia. Hagan et al. (2009) found that ill health increased the likelihood of early retirement in a sample of European countries while Disney et al. (2006) found that health status was strongly and positively associated with employment in Britain.

The other strand of literature consists of studies that focus on all persons in the working age bracket. In a survey of the literature on health and labor market, Currie and Madrian (1999) highlight lack of studies that focus on all age groups of the working age population. Outside Africa, Stern (1989); Brown et al. (2010); Zhang et al. (2009) and Harris (2008) study the relationship between health status and labor force participation among the working age population. Zhang et al. (2009) and Harris (2008) use data from Australia while Stern (1989) focused on the United States of America and Brown et al. (2010) used data from the United Kingdom.

Stern (1989) and Brown et al. (2010) measured health using self assessed health status. But Stern (1989) also considered a limits index which equaled 1 if health limits the amount and type of work individuals do and zero if otherwise. Zhang et al. (2009) measured health using presence

of four categories of chronic diseases (cardiovascular diseases, diabetes, mental disease and other chronic diseases including (asthma, cancer and arthritis). Harris (2008) also measured health using presence of chronic illnesses (cardiovascular diseases and diabetes)

These studies encounter the problem of endogenous health status in labor force participation equations. Zhang et al. (2009) point out that while self reported chronic illness is regarded to be less subjective and involves less reporting error than self assessed health measures, it too may be endogenous. This is because self reported chronic illness may be affected by unobserved factors that also affect labor market behavior. The studies mainly deal with endogeneity using instrumentaal variable techniques. Stern (1989) instrumented for health variables using specific health conditions such as mental illness, blindness, and physical limitations. Zhang et al. (2009) used frequency of exercising, smoking habits, whether or not an individual was overweight and whether or not an individual was obese as instruments for chronic illness. Harris (2008) instrumented for cardiovascular diseases using smoking status, weight, exercise and diabetes status and for diabetes using whether the individualôs mother or father had diabetes. Other studies for example Brown et al. (2010) generated a health stock variable by regressing self assessed health on specific health conditions, health limitations and socio economic characteristics assumed to affect health status reporting behavior such as age, marital status and education.

The studies generally find that illness has a negative effect on the probability of participating in the labor force. Zhang et al. (2009) found that the effect of chronic illness on labor force participation varies by gender and age group. They found that men were more likely than women not to participate in the labor force due to chronic illness especially mental illness. Further, that the effect of chronic illness was found to be higher for older individuals compared to those in their prime years. Harris (2008) found that men with cardiovascular disease were more likely than women with cardiovascular disease participate in the labor market. Women with diabetes were more likely than men with diabetes to be labor force participants. Therefore, although the effect of illness on labor force participation varies by gender, the findings on whether the effect of illness is greater for men or for women are mixed, pointing to the need for more studies.

A number of studies focus on the determinants of labor force participation in Africa (Sackey, 2005; Lokshin et al., 2004; Tandrayen ï Ragoobur et al., 2011; Mugume and Canagarajah, 2005; Siphambe and Motswapong, 2010; Ntuli and Wittenberg, 2013), however, very few studies examine the effect of ill health on labor force participation. Nanfosso and Zamo-Akono (2010) investigated the relationship between health (self assessed health status and disability index which equaled 1 if an individual was disabled and 0 if otherwise) and female labor force participation in urban Cameroon using survey data. Bridges and Lawson (2008) examined the effect of health (number of work days lost due to illnesses) on labor force participation in Uganda. Bridges and Lawson (2008) instrumented for health using quality of household facilities and quality of local health infrastructure. But Nanfosso and Zamo-Akono (2010) do not control for potential endogeneity of health status. Both studies found that illness reduced the likelihood of participating in the labor force. Bridges and Lawson (2008) also found that the negative effect of ill health on labor force participation was greater for women than men.

2.2.3. Summary of literature

The theoretical labor supply literature is not clear on how illness affects labor force participation decisions. Illness can either increase or decrease the probability of labor force participation. For empirical studies, while many studies examine the effect of health on labor force participation, many of these focus on labor markets outside Africa. And even those mainly study labor market behavior of the elderly (Zucchelli et al., 2010; Cai and Kalb, 2006; Mete and Schultz, 2002; Rice et al., 2006; Hagan et al., 2009; Au et al., 2005). On the other hand labor force participation studies in Africa do not typically examine the effect of health. This study will fill the knowledge gap by providing empirical evidence from Kenya on the relationship between health and labor force participation separately among men and women in the working age population.

The few studies that examine gender differences in the effect of illness on labor force participation reported conflicting findings (Zucchelli et al., 2010; Mete and Schultz, 2002; Rice et al., 2006; Bridges and Lawson, 2008; Zang et al., 2009 and Harris 2008). While some find that negative effect of illness on labor force participation is greater for men than for women (Zang et al., 2009), others find that the effect is greater for women than for men (Mete and Schultz, 2002;

Bridges and Lawson, 2008). Yet, others find that the effect is the same for both men and women (Au et al., 2005). Other authors report mixed findings with respect to health indicators. While for some health indicators, the effect is greater for men than for women, for others the effect is greater for women than for men (Rice et al., 2006; Harris, 2008). Additional studies to examine gender differences may help towards achieving consensus.

Only a few studies have assessed the effect of specific types of diseases on labor force participation and they focus only on chronic illness (Harris, 2008; Zang et al., 2009) with none in Africa. This study compared the effect of chronic and acute illness on labor force participation in Kenya. This is important because the incidence of chronic illness and the incidence of acute illness are high. The effect of the two types of diseases on health may differ (Mwabu, 2007a) and thus their effect on labor force participation may also vary. The review also shows that different diseases may have differing effect on labor force participation of men and women justifying the need to separate chronic and acute illnesses.

The literature review points to the importance of controlling for endogeneity of health in labor force participation equations. Treating health status as exogenous may lead to underestimation of the effect of health status on labor force participation. The most prevalent method is to use instrumental variable technique to control for endogeneity of the health variable. The literature review demonstrates that instrumental variables vary widely depending on the health indicator used and data available.

2.3. Methodology

This section discusses the methods used in analyzing the relationship between illness and labor force participation.

2.3.1. Conceptual framework

An individualôs health status is affected by socioeconomic constraints such as education and demographic characteristics such as age (Grossman, 1972) and by geographical factors such as area of residence (EUPHA, 2005). Health status then affects an individualôs labor force participation by affecting their productivity and wages (Becker, 1962; Mushkin, 1962; Schultz,

1961; Leibenstein, 1957), by affecting preferences between leisure and work (Cai and Kalb, 2006) and by affecting total available healthy time (Grossman, 1972). Some socio economic factors (e.g. education) that affect health status also affect labor force participation directly. Participation in the labor market also enables access to income that can be used to improve health. This shows possible feedback effects between health and labor force participation as shown in the conceptual framework in chapter 1.

2.3.2. Theoretical framework

Following Cahuc and Zylberberg (2004), an individualôs single period utility function depends on consumption (C) of market goods and leisure (L).

$$U = U(C, L) \tag{2.1}$$

The utility function is assumed to be well-behaved such that $U_C > 0, U_{CC} < 0, U_L > 0, U_{LL} < 0$. That is the marginal utilities of consumption and leisure are increasing but at a decreasing rate. An individual is assumed to allocate their total available time (T) to either leisure (L) or to market work (h). The total time an individual allocates to work (the time constraint) is

$$h = T - L \tag{2.2}$$

The individual also faces a budget constraint in which total consumption depends on market wage (w), time allocated to work h and non labor income (V) such that

$$C \leq wh + V \tag{2.3}$$

Since marginal utility of consumption is positive, an individual satisfies the budget constraint with equality. Combining (2.2) and (2.3) yields the full income constraint.

$$C = w(T - L) + V \tag{2.4}$$

The lagrangian expression to represent the individualôs utility maximization is

$$U(C, L) + \lambda(V + wT - wL - C) \tag{2.5}$$

The first order conditions with respect to leisure and consumption are given as

$$U_L(C^*, L^*) = \lambda w \tag{2.6}$$

$$U_C(C^*, L^*) = \lambda \tag{2.7}$$

Dividing equation (2.6) by (2.7) yield the equation for optimal labor supply decision

$$\frac{U_L(C^*, L^*)}{U_C(C^*, L^*)} = w \tag{2.8}$$

This condition states that for optimal labor supply, the marginal rate of substitution between leisure and consumption good $(U_L / U_C))$ must equal the market wage. At corner solution, the marginal rate of substitution represents the individualôs reservation wage. An individual participates only if the market wage exceeds the reservation wage. The labor force participation decision is therefore influenced by market wage and non labor income. Factors that influence the two variables influence labor force participation. Health enters equation (2.8) by influencing market wages (Leibenstein, 1957; Becker, 1962; Mushkin, 1962; Schultz, 1961), an individualôs preference between leisure and work (Cai and Kalb, 2006) and total healthy time (Grossman, 1972) thus affecting labor force participation.

2.3.3. Empirical model

From the theoretical model, individuals will participate in the labor force if the marginal rate of substitution between consumption good and leisure is lower than the market wage. Let the observed labor force participation variable be defined as follows

$$y = \begin{cases} 1 \text{ if an individual is in the labor force} \\ 0 \text{ if otherwise} \end{cases} \tag{2.9}$$

The model is derived using the latent variable approach following Wooldridge (2002); Long (1997) and Long and Freese (2006). An individualôs propensity to be in the labor market represented by an unobservable variable y^* is related to a vector of explanatory variables (x) by the following equation

$$y^* = x\beta + \varepsilon \tag{2.10}$$

Where β, ε are parameters and error tem respectively.

The observed labor force participation variable and the latent variable are related by the following equation,

$$y = \begin{cases} 1 \text{ if } y^* > 0 \\ 0 \text{ if } y^* \leq 0 \end{cases} \tag{2.11}$$

The probability of an individual participating in the labor force can be expressed as follows

$$\Pr(y = 1 \mid x) = \Pr(y^* > 0 \mid x) \tag{2.12}$$

Substituting equation (2.10) into equation (2.12) yield the following equation

$$\Pr(y = 1 \mid x) = \Pr(\varepsilon > -x\beta \mid x) = \Pr(\varepsilon < x\beta \mid x) = F(x\beta) \tag{2.13}$$

The probability of labor force participation depends on the distribution of the error term, ε. Assuming that the error term follows a normal distribution leads to a probit model while assuming the error term follows a logistic distribution leads to a logit model (Long and Freese, 2006). The probit model is widely applied in estimating the labor force participation equation. This study followed in that tradition.

Following Wooldridge (2002, p.477) and Mwabu (2009), the model estimated can be specified as follows:

$$y = [x_1\beta + \alpha H + \varepsilon_1 > 0] \tag{2.14}$$

$$H = [x\beta_2 + \varepsilon_2 > 0] \tag{2.15}$$

where, H is health status, y is the observed labor force participation status. x is a vector of exogenous variables that includes x_1 exogenous variables that belong to the labor force participation equation and a vector of instrumental variables, x_2 that affect the health variable. β_1, β_2, α are parameters to be estimated and $\varepsilon_1, \varepsilon_2$ are disturbance terms.

A number of estimation issues may arise if equation (2.14) is estimated using a standard probit model. These include endogeneity of the health variable and unobserved individual heterogeneity.

Endogeneity

Health status is potentially endogenous in labor force participation models because of three reasons: simultaneity between the health status variable and labor force participation, measurement and reporting error and omitted variable bias (Bound, 1991; Stern, 1989). Previous studies of labor market effects of ill health, address potential endogeneity of health in various ways. Some (Zucchelli et al., 2010; Brown et al., 2010; Rice et al., 2006; Hagan et al., 2009) construct a latent health stock variable by regressing subjective measures of health on what are considered objective measures or specific health conditions. Other (Bridges and Lawson, 2008; Mete and Schultz, 2002) use the instrumental variable approach. Some of the instruments used include parental longevity, birth place, health infrastructure, distance to markets, distance to water sources, distance to health facilities and food prices.

Unobserved heterogeneity

Unobserved heterogeneity will exist in this study if there is non linear interaction between the health variables and unobservable factors causing the effect of health on labor force participation to vary by individual workers. For example, highly motivated individuals are likely to work hard, to be better schooled and to participate in the labor market. Similarly individuals who are highly motivated are more likely to maintain better psychological health and thus to be in better health. Failure to take into account unobserved heterogeneity and simultaneity leads to underestimation of the direct effects of health status on labor force participation (Cai and Kalb, 2006).

This essay deals with potential endogeneity of the health variable and potential unobserved individual heterogeneity using the control function approach estimation procedure (Card, 2001; Florens et al., 2008; Petrin and Train, 2009; Diagne and Diene, 2011). The first step of the control function approach is the two-stage residual inclusion (2SRI) estimation method (Terza et

al., 2008). This estimation procedure requires valid instrumental variables. These are variables that are strongly correlated with health status but not correlated with labor force participation. An instrumental variable is considered valid if it is relevant, strong and exogenous (Wooldridge, 2002; Mwabu, 2009). Such instruments are often very difficult to find (Bound, et al., 1995).

Several variables have been proposed as potential instruments for health in labor market models (Strauss and Thomas, 1998). These include prices of health inputs, food prices, time costs for travelling to the health provider and waiting time once at the health provider, distances to providers or availability of health services in the community, quality of health services, health infrastructure such as water quality and sanitation services and local disease environment.

However, Strauss and Thomas (1998) suggest that instrumental variables measured at community level may not be the best for two reasons. First, community level instrumental variables may be weakly related with health utilization patterns of individuals and therefore resulting in biased conclusion especially in small samples. Secondly, that such instrumental variables may be potentially endogenous because individuals may choose to live next to public health infrastructure or the government may selectively place public health infrastructure in response to local health conditions, leading to placement bias.

In this study, the instrumental variables used for chronic and acute illness are average distance in kilometers to the nearest weekly market and number of health facilities in the district of residence. Distances are proxies of time costs of health care (Strauss and Thomas, 1998). Longer distances also mean higher transport cost. Number of health facilities in the district is a proxy for availability of health services (Strauss and Thomas, 1998). Higher costs of seeking care may lead to reduced consumption of health care. Similarly, lack of health facility may equally reduce consumption of health care yet health care is an input in the production of health. The instrumental variables must satisfy three conditions: they must not be correlated with ε_1, must not have a direct influence on y and must be highly correlated with H.

The control function approach is implemented in three steps to account for endogeneity of health status and unobserved heterogeneity. First, the reduced form health status equation (2.15) was

estimated by OLS following Wooldridge (2002). Secondly, the reduced form residuals (V) are included in the labor force participation equation (2.14) as one of the explanatory variables to test and control for endogeneity. These two steps constitute the 2SRI estimation method (Terza et al., 2008).

$$y = x_1\beta_1 + \alpha_1 H + \gamma V + \varepsilon_1 \tag{2.16}$$

Third, to test and control for unobserved individual heterogeneity, the interaction of the reduced form health status residuals and the endogenous health variable (($H \times V$) is included in the labor force participation equation (2.16) to yield the following labor force participation equation.

$$y = x_1\beta_1 + \alpha_1 H + \gamma V + \theta(V \times H) + \varepsilon_1 \tag{2.17}$$

Equation (2.17) constitutes the control function approach (Card, 2001; Florens et al., 2008; Petrin and Train, 2009; Diagne and Diene, 2011). The variables V and $V \times H$ are the control function variables (Mwabu, 2009). The variable V controls for unobserved factors correlated with the health variable thus allowing the health variable to be treated as exogenous. $H \times V$ controls for non linear interactions of unobserved variables with the health status variable that have not been controlled for.

Variable definitions

The dependent variable is observed labor force participation. It takes the value 1 if an individual reported to work for pay, to be on leave, to be in non-agricultural self-employment, to be in agricultural self-employment or seeking work. It takes a value 0 if an individual reported that they were doing nothing, retired, homemakers or incapacitated. The independent variables in the labor force participation equation are health status, education, age, marital status, number of children below 5 years in a household, transfers, region and area of residence.

Health status is included in the model because health is viewed as a component of human capital that can affect productivity and hence wages (Leibenstein, 1957; Becker, 1962; Mushkin, 1962; Schultz, 1961), an individualôs preference between leisure and work (Cai and Kalb, 2006), total healthy time (Grossman, 1972) and thereby affecting labor force participation. The study

considers the effect of both chronic and acute illness. Chronic illness variable equals 1 if an individual reported having a chronic illness and zero if an individual reported having no illness. Acute illness variable equals 1 if an individual reported having an acute illness and zero if an individual reported having no illness. Ill health can reduce oneôs wage, reduce oneôs healthy time, cause one to prefer more leisure to work or reduce time span thus reducing labor force participation. However, ill health can cause one to want to work more to make up for lower wages and be able to pay medical bills and hence increase labor force participation. Thus it is possible to have either negative or positive relationship between health status and labor force participation.

Education enters the labor force participation model because it is considered a form of human capital that influences wages and hence labor force participation (Mincer, 1958). In this study education is measured in four levels to capture the highest level of education attained: no formal education, primary education, secondary education and tertiary education. A dummy variable is created for each level of education. It takes a value 1 if an individual reported having that particular level of education and 0 if otherwise. Since wages increase with education level, educated people are more likely to participate in the labor force than less educated persons because of higher foregone earnings. Thus a positive relationship is expected between education and labor force participation. Other studies for example (Bridges and Lawson, 2008; Mugume and Canagarajah, 2005) find a positive relationship between education and labor force participation especially at higher levels of education.

Individualôs age measured in years is a proxy for work experience (Mincer, 1958). Individuals acquire skills and experience as time passes hence increased productivity. The higher productivity increases wage earnings. However as people age, productivity declines leading to a decrease in wage earnings particularly in jobs where physical effort is required. Therefore, life time earnings generally exhibit an inverted u shaped pattern of growth (Mincer, 1958; Becker, 1962).

Marital status is measured as a dummy variable which equals 1 if an individual reported being married and 0 if otherwise. Marital status is included in the model to capture familial

environment (Cahuc and Zylberberg, 2004). It is expected that married women are less likely to participate in the labor force while married men are more likely to participate for a number of reasons. First, women may have a higher reservation wage once married because they have an alternative source of income from their husbands (Glick and Sahn, 1997). Secondly, societal expectations usually place on women the role of home makers. Men on the other hand are expected to work and provide for their families.

Three dummies were created for presence of children below 5 years in the household. The first is the no child dummy which equals 1 if there is no child in the household and 0 if otherwise. The second is the one child dummy which equals 1 if there is 1 child in the household and 0 if otherwise. The third is more than 1 child dummy which equals 1 if a household had two or more children and 0 if otherwise. Presence of children is included in the model to capture familial environment (Cahuc and Zylberberg, 2004). It is expected that individuals coming from families with children below 5 years especially women are less likely to participate in the labor force. Women may opt to take care of their young children and so exit the labor force (Lokshin et al., 2004; Bridges and Lawson, 2008).

Trasnfers is included in the model as a proxy of non labor income. Labor supply theory identifies non labor income as a determinant of labor force participation (Cahuc and Zylberberg, 2004). Transfers is measured as a dummy which equals 1 if an individualôs household reported receiving transfers (inkind or cash) and 0 if otherwise. Non labor income increases a personôs reservation wage. So persons that have non labor income may have lower probability of participating in the labor force. A negative relationship between receipt of transfers and labor force partcipation is expected. Cai and Kalb (2006) and Mete and Schultz (2002) found a negative relationsip between non labor income and labor force participation.

Dummy variables for area of residence and regions are included in the labor force participation model because labor market conditions for example job opportunities may vary by location (Bridges and Lawson, 2008; Mugume and Canagarajah, 2005). A dummy variable for area of residence equals 1 if an individual lived in the rural area and 0 if otherwise. In addition eight dummies were created for each of the eight regions (Western, Nyanza, Coast, Central, Eastern,

North Eastern, Rift Valley and Nairobi) in Kenya.

2.3.4. Data and descriptive statistics

The essay used data drawn from the 2005/06 Kenya Integrated Household Budget Survey (Republic of Kenya, 2007). Table 2-1 presents the mean and standard deviation of variables used in the analysis. A higher proportion of women than men reported both chronic and acute illness. While 10% of men reported having chronic illness and 16% reported having acute illness, 17% and 25% of women reported having chronic and acute illness respectively.

Majority of men and women in the sample reported having no formal education (31% and 37% for men and women respectively). Those with primary level of education were also many at 31% and 32% for both men and women respectively. About 18% of the men reported having tertiary education compared to only 14% of the women. Generally a higher fraction of women reported lower levels of education (no formal education and primary education) than men, while a higher fraction of men reported higher levels of education (secondary and tertiary education) than women

The mean age of men was 34 years while that of women was 35 years. A smaller fraction of women in the sample reported to be married (61%) compared to 64% for men. Similarly, a larger proportion of men in the sample reported to be living in rural areas (70%) compared to 65% of the women. Almost the same fraction of both men and women reported to have no child below 5 years. Labor force participation also varied by region. The average distance to the nearest weekly market was 34 kilometers. There was an average of 64 and 56 private and public health facilities in each district respectively.

Table 2-1: Descriptive Statistics of Variables Included in the labor force participation Model

Variables	Mean (Standard deviation)		
	Male sample	Female sample	Full sample
Health Status			
Chronic illness (=1 if an individual reported having chronic illness, 0 otherwise)	0.10 (0.29)	0.16(0.36)	0.13(0.34)
Acute illness (=1 if an individual reported having acute illness, 0 otherwise	0.17 (0.38)	0.25 (0.43)	0.21(0.41)
Education			
No formal education (=1 if an individual reported to have no formal education, 0 otherwise)	0.31 (0.46)	0.37 (0.48)	0.35 (0.48)
Primary education (=1 if an individual reported having primary education, 0 otherwise)	0.31(0.46)	0.32 (0.47)	0.32 (0.47)
Secondary education (=1 if an individual reported having secondary education, 0 otherwise)	0.20 (0.40)	0.17 (0.38)	0.18 (0.39)
Tertiary education (=1 if an individual reported having tertiary education, 0 otherwise)	0.18 (0.39)	0.14 (0.35)	0.14 (0.35)
Age	34 (12)	35 (12)	34 (12)
Marital status			
Marital status (=1 if an individual reported to be married, 0 otherwise)	0.64 (0.48)	0.61 (0.49)	0.62 (0.49)
Children below 5 years			
No children (=1 if a household reported having no child below 5 years, 0 otherwise)	0.59 (0.49)	0.57 (0.50)	0.56 (0.50)
One child (=1 if a household reported having 1 child below 5 years, 0 otherwise)	0.23 (0.42)	0.25 (0.43)	0.24 (0.43)
Two or more children (=1 if a household reported having 2 or more children below 5 years, 0 otherwise	0.18 (0.38)	0.18 (0.39)	0.20 (0.40)
Region			
Nairobi region (=1 if an individual reported to be living in Nairobi Province, 0 otherwise)	0.06 (0.23)	0.05 (0.22)	0.05 (0.22)
Central region (=1 if an individual reported to be living in Central Province, 0 otherwise)	0.12 (0.32)	0.14 (0.35)	0.11 (0.31)
Coast region (=1 if an individual reported to be living in Coast Province, 0 otherwise)	0.11 (0.31)	0.08 (0.27)	0.12 (0.32)
Eastern region (=1 if an individual reported to be living in Eastern Province, 0 otherwise)	0.18 (0.39)	0.18 (0.39)	0.18 (0.38)
North Eastern region (=1 if an individual reported to be living in North Eastern Province, 0 otherwise)	0.02 (0.14)	0.02 (0.09)	0.04 (0.19)
Nyanza region (=1 if an individual reported to be living in Nyanza Province, 0 otherwise)	0.15 (0.36)	0.18 (0.39)	0.15 (0.36)
Rift Valley region (=1 if an individual reported to be living in Rift Valley Province, 0 otherwise)	0.27 (0.44)	0.25 (0.43)	0.26 (0.44)
Western region (=1 if an individual reported to be living in Western Province, 0 otherwise)	0.10 (0.29)	0.11 (0.31)	0.10 (0.30)
Other variables			
Rural area (1 if an individual reported to be living in the rural area, 0 otherwise	0.65 (0.48)	0.70 (0.46)	0.70 (0.47)
Transfers (=1 if a household reported receiving transfers, 0 otherwise)	0.68 (0.47)	0.69 (0.46)	0.67 (0.46)
Distance to weekly market in kilometers			34(102)
Number of private health facilities in the district			64 (128)
Number of public health facilities in the district			56 (31)
Sample size	8411	9223	17634

Source: Authorôs computation based on KIHBS data, Standard errors in parenthesis

2.4. Results and discussions

This section presents the empirical results of the effect of chronic and acute illness on labor force participation. Estimates of the determinants of chronic and acute illnesses are also presented.

2.4.1. Effect of acute and chronic illness on labor force participation

The analysis begins with testing for poolability of data, that is, whether there is need for estimating the male and female sample models separately or whether the full sample model is sufficient. To conduct the test, all the variables in the model were interacted with the gender dummy and a test of their joint significance done. Results of the test are presented in Appendix 1 Table A1. When health status is measured by chronic illness, the χ^2 statistic with 19 degrees of freedom is equal to 865.14 (p-value = 0.000). When health status is measured by acute illness, the χ^2 statistic with 19 degrees of freedom is equal to 948.06 (p-value = 0.000). In both cases the null hypothesis that there is no significant difference between the estimated male and female coefficients was rejected. The test results imply that it is appropriate to estimate the male and female sample models separately.

Consequently, this section presents three sets of results separately for men and women: probit estimates (marginal effects), control function approach estimates controlling for endogeneity of health and control function approach estimates controlling for both endogeneity of health and unobserved heterogeneity. The probit coefficients are presented in the Appendix 1 Table A2 and A3 while the marginal effects are presented in tables 2.3 and 2.4. Control function approach estimation procedure allows testing for potential endogeneity of chronic and acute illnesses. If the reduced form health equation residuals are insignificant in the labor force participation equation, it implies that the particular health variable is exogenous.

To generate the reduced form health equation residuals, distance in kilometers to nearest market and number of health facilities in the district were used as instrumental variables. Table 2-2 presents the F statistics for the joint significance of identifying instrumental variables. The P values are sufficiently small. Thus the null hypothesis that the coefficients of distance to weekly market and number of health facilities are jointly zero is rejected. The F statistics are generally greater than the proposed 10 (Staiger and Stock, 1997). Thus, the instrumental variables are

generally strong. A test of validity of the instruments was also carried out. The Sargan test shows that we do not reject the null hypothesis that the instruments are valid. Details of first stage results are in table 2.5.

Table 2-2: F statistics for Significance of Identifying Instrumental Variables

Instrument	Chronic illness			Acute illness		
	Full sample	Male	Female	Full sample	Male	Female
Joint F test for Ho: coefficients on instruments =0	23.22 (0.000)	4.87 (0.000)	21.93 (0.000)	16.01 (0.000)	7.22 (0.000)	9.36 (0.000)
R squared	0.062	0.044	0.074	0.052	0.051	0.043
Partial R squared	0.001	0.001	0.002	0.001	0.001	0.002
Sargan χ^2	0.682 (0.409)	0.001 (0.984)	0.977 (0.323)	1.551 (0.213)	0.811 (0.368)	1.053 (0.305)

P values in parenthesis

From table 2-3 and 2-4 it is observed that the marginal effects of both chronic and acute illness residuals are insignificant. This implies that chronic and acute illness can be treated as exogenous in labor force participation equation. Similarly, the marginal effect of the interaction between reduced form residuals and the potentially endogenous illness variable (either acute or chronic) are insignificant. This suggests that the bias due to unobserved individual heterogeneity is unlikely to be a major issue. Thus, the probit model results are sufficient.

The probit estimates (in columns 2 to 4) indicate that individuals with chronic or acute illness are less likely than those who are not ill to participate in the labor force. Specifically, chronic illness and acute illness reduce the likelihood of participating in the labor market by 8 and 2 percentage points respectively. Additionally, the effect of chronic and acute illness is higher for women than for men. While acute illness reduces a womanôs probability of participating in the labor market by 3 percentage points it reduces a manôs probability of participating by 2 percentage points. Similarly while chronic illness reduces a womanôs probability of participating in the labor market by 10 percentage points, it reduces a manôs probability of participating in the labor market by 5 percentage points. These results imply that reducing acute illness by between 2 to 5 percent will result in an increase in men and womenôs in labor force participation by between 4 to 10 percent and 6 to 15 percent respectively. Similarly reducing chronic illness by between 2 to

5 percent will result in an increase in labor force participation of men and women by between 10 to 25 and 20 to 50 percent respectively.

These findings are in line with theory. Illness may reduce an individualôs wage (Leibenstein, 1957; Becker, 1962; Mushkin, 1962; Schultz, 1961), affect an individualôs preference between leisure and work (Cai and Kalb, 2006) or reduce total healthy time (Grossman, 1972). Chronic illnesses tend to develop slowly, last a long time, and are often progressive in nature. This may explain why they have a larger effect on individualsô labor market participation decisions than acute illnesses which are usually sudden and short term in nature.

The gender difference in the effect of illness on labor force participation may reflect gender differences in symptom prevalence. A review of literature on symptom reporting in men and women by Barsky et al. (2001) concluded that women are more likely to report numerous, more frequent and more chronic symptoms than men. In addition, women have a lower pain threshold and tolerance. These differences may bring differences in how illness affects labor force participation decisions.

The findings in this study add to the findings of studies in other countries that found negative effect of ill health on labor force participation (Bridges and Lawson, 2008; Brown et al., 2010; Mete and Schultz, 2002; Cai and Kalb, 2006). Cai and Kalb (2006) found that individuals in excellent health have a 74 percentage points higher probability of participating in the labor force compared to those in poor health. Brown et al. (2010) found that for individuals in good or very good health, the probability of participating in the labor force was 11 percentage points higher than those in poor or very poor health. Bridges and Lawson (2008) found that the negative effect of ill health on labor force participation was greater for women than men. Specifically, they found that ill health reduced womenôs labor force participation from 50 to 19 percent and reduced menôs labor force participation from 80 to 40 percent.

However, findings in this essay contradict the finding by Zhang et al. (2009) who found that men were more likely than women to reduce their likelihood of participating in the labor force due to illness. They found that men (women) suffering from chronic illness are 53 (49) percentage points less likely to participate in the labor force compared to those with no chronic

illnesses. Harris, (2008) reported mixed findings. Though the efffect of cardiovascular diseases on labor force participation was higher for men than women, the effect of diabetes on labor force participation was higher for women than men. For this study, cardiovascular diseases reduced the probability of participating in the labor force by 10.6 and 8.8 percentage points for men and women respectively, diabetes reduced the probability of participating in the labor force by 5.8 and 12.4 percentage points for men and women respectively.

As expected, the results show that an individualôs probability of participating in the labor market increases with age. A turning point however occurs at a maximum from which we observe a negative relationship between age and labor force participation. Intuitively, age could be picking the effect of investment in human capital and experience which increases an individualôs productivity and hence wages (Mincer, 1958). With a higher wage, individuals have a higher opportunity cost of not participating in the labor force. As time passes, however the productivity and wage begins to decrease thereby reducing the opportunity cost of not participating in the labor force. This finding supports findings of Mugume and Canagarajah (2005) and Nanfosso and Zamo-Akono (2010). They found a concave relationship between age and labor force participation and attributed this to the effect of human capital investment on wages and hence on labor force participation.

Men are more likely than women to participate in the labor market. This could be explained by the fact that a considerable proportion of women reported being home makers and hence not included in the labor force. Similarly in the presence of wage discrimination against women, women will generally earn lower wages hence have low opportunity cost of leisure. This would affect their probability of participating in the labor market. Mugume and Canagarajah (2005) and Bridges and Lawson (2008) also found that men are more likely than women to participate in the labor force. Societal responsibilities placed on men may force them to want to find a job and hence to participate in the labor force. For example women are expected to live with their parents for as long as they want. Men on the other hand are expected to move out of their parent's home once they have matured.

Relative to no formal education, tertiary education has significant positive effect on labor

force participation. The study uncovers no significant effects of primary and secondary education on labor force participation. Individuals who had attained tertiary education are 8 percentage points more likely to participate in the labor market compared to those who have no formal education. This may reflect the effect of investment in education human capital on wages. More educated individuals in Kenya earn more than less educated (Knight and Sabot, 1990; Soderbom et al., 2004; Appleton, 1999; Wambugu, 2003) and therefore have a higher opportunity cost of not participating in the labor force compared to those that have lower levels of education. This finding supports Mugume and Canagarajah (2005) and Bridges and Lawson (2008) who found primary and/or secondary levels of education to have insignificant effects on labor force participation. This may reflect lower returns to primary and secondary educations compared to tertiary education. Wambugu (2011) for example found that return to university education was high in all sectors of the Kenyan economy.

The estimates indicate that the effect of education on the probability of participating in the labor market differ by gender. The effect of tertiary education relative to having no formal education is higher for women than for men. While women with tertiary education are 13 percentage points more likely to participate in the labor market, men with a similar level of education are only 2 percentage points more likely to participate in the labor market relative to their counterparts with no formal education. This may be attributed to increased call for gender equity making educated women stand a higher chance of being employed as organizations attempt to maintain equity. This means that the returns to female education in terms of enabling entry into the labor force is higher than that for males. Bridges and Lawson (2008) also found that in Uganda the effect of tertiary education on labor force participation were larger for women than men.

Being married reduces the likelihood of an individual being in the labor force by 6 percentage points compared to their unmarried counterparts. This effect of marital status on participation varies across gender. While being married reduces the probability of participation for women, it increases the probability of participating in the labor market for men. Married women are 17 percentage points less likely to be in the labor force compared to their unmarried counterparts while married men are actually 5 percentage points more likely to be in the labor force

compared to their unmarried counterparts. This can be explained by the fact that women on the one hand once married have a higher reservation wage since they have an alternative source of income from their husbands (Glick and Sahn, 1997). For men, on the other hand, marriage comes with responsibility especially in the African society where men are viewed as the bread winners and thus an impetus to seek employment.

Women who belong to households with children below 5 years are less likely to participate in the labor market compared to those who belong to households with no young children. In households with 1 child below 5 years, women are 5 percentage points less likely to participate in the labor market while in households with 2 or more children below 5 years, women are 6 percentage points less likely to participate in the labor market compared to women who belong to households with no children below 5 years. This may be because when children are young, women tend to play a bigger role in child care which may reduce the chance of participating in the labor market. At times, women opt to stay out of the labor market completely until their children have grown to becoming independent. Similar findings were reported by Sahn and Alderman (1988) for Sri Lanka and Bridges and Lawson (2008) for Uganda. They found that the higher the number of young children (0-5 year) in a household, the lower the likelihood of participating in the labor force especially for women. Lokshin et al. (2004) also found that married women with children were less likely to participate in the labor market in Kenya.

Individuals living in households which received transfers have a lower probability of participating in the labor market. This may be because transfers are usually viewed as non labor income since they are not generated though labor market activities. Just like any other non labor income, labor supply theory suggests that it should increase an individualôs reservation wage and therefore reduce the likelihood of participation in the labor market (Cahuc and Zylberberg, 2004). The effect of transfers on participation is higher for women than men. For instance, while receipt of transfers reduces the probability of a woman participating in the labor market by 6 percentage points, it only reduces the probability of a man participating in the labor market by 1 percentage point.

Labor force participation also varies with area of residence. Individuals living in the rural areas are more likely to participate in the labor market compared to their counterparts in urban areas. This at first sight appears counterintuitive but data shows that agriculture, which is predominantly rural, employs a sizeable proportion of the labor force (41%). Mugume and Canagarajah (2005) also found that being in the rural areas increased the likelihood of participating in the labor force in Uganda.

Individuals living in Coast and North Eastern regions are less likely to participate in the labor market compared to their counterparts living in Nairobi. This is an intuitive result given that the two regions have few income generating activities compared to other regions. Most parts of the two regions are characterized by extreme weather conditions which may render agriculture impossible yet this is a major source of employment at national level. The regional dummies may also capture the effect of differences in culture, religion and other region specific factors. For example, residents of Coast and North Eastern regions are predominantly Muslim. Religion may have negative effect on labor force participation because some religions require women to stay home. In Uganda, Bridges and Lawson (2008) also found that participation in the labor force varies with region with those living in the North being less likely to participate in the labor force. They attribute this to lack of income earning opportunities in the North compared to other regions.

Table 2-3: Estimates of the Impact of Acute Illness on Labor Force Participation

Variables	Probit (Marginal effects)			Two stage-residual inclusion (2SRI)			Control function approach		
	Full sample	Male sample	Female sample	Full sample	Male sample	Female sample	Full sample	Male sample	Female sample
Acute illness	-0.0239**	-0.0176*	-0.0316**	-0.3268	-0.2583	-0.2943	-0.2672	-0.1793	-0.2469
	[0.010]	[0.011]	[0.015]	[0.246]	[0.348]	[0.334]	[0.251]	[0.337]	[0.347]
Acute				0.2559	0.1745	0.2494	0.283	0.1942	0.2809
illness residual				[0.187]	[0.190]	[0.318]	[0.189]	[0.191]	[0.324]
Interaction of acute illness and acute							-0.0964	-0.0817	-0.1047
illness residual							[0.107]	[0.126]	[0.189]
Age	0.0434***	0.0214***	0.0554***	0.0459***	0.0236***	0.0572***	0.0460***	0.0237***	0.0572***
	[0.002]	[0.002]	[0.004]	[0.003]	[0.003]	[0.005]	[0.003]	[0.003]	[0.005]
Age squared	-0.0005***	-0.0003***	-0.0006***	-0.0005***	-0.0003***	-0.0006***	-0.0005***	-0.0003***	-0.0006***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Gender (male=1)	0.2155***			0.1918***			0.1911***		
	[0.007]			[0.016]			[0.016]		
Education (no formal education is the reference category)									
Primary education	0.0081	-0.0038	0.0176	0.0053	-0.0039	0.0161	0.0052	-0.004	0.0159
	[0.009]	[0.009]	[0.015]	[0.010]	[0.011]	[0.018]	[0.010]	[0.011]	[0.018]
Secondary education	0.0059	-0.0042	0.0155	-0.0086	-0.0041	-0.0127	-0.009	-0.0046	-0.0129
	[0.011]	[0.011]	[0.019]	[0.015]	[0.015]	[0.026]	[0.015]	[0.015]	[0.026]
Tertiary education	0.0742***	0.0215*	0.1357***	0.0678***	0.0143	0.1385***	0.0678***	0.0141	0.1382***
	[0.011]	[0.012]	[0.020]	[0.015]	[0.017]	[0.026]	[0.015]	[0.017]	[0.026]
Marital status	-0.0614***	0.0794***	-0.1707***	-0.0649***	0.0746***	-0.1748***	-0.0646***	0.0746***	-0.1745***
(married =1)	[0.009]	[0.012]	[0.014]	[0.011]	[0.015]	[0.017]	[0.011]	[0.015]	[0.017]
Presence of children 0-5 years (none is the reference category)									
1 child 0-5 years	0.0017	0.0119	-0.0208	0.0147	0.0214**	-0.0047	0.0149	0.0214**	-0.0045
	[0.009]	[0.009]	[0.015]	[0.010]	[0.010]	[0.017]	[0.010]	[0.010]	[0.017]
2 or more children	-0.0219**	-0.0096	-0.0504***	-0.0261*	-0.0127	-0.0525**	-0.0263*	-0.013	-0.0528**

0-5 years	[0.011]	[0.012]	[0.018]	[0.014]	[0.015]	[0.024]	[0.014]	[0.015]	[0.024]
Transfers (1 if a	-0.0311***	-0.0114	-0.0555***	-0.0260***	-0.0087	-0.0494***	-0.0259***	-0.0085	-0.0494***
household received transfers	[0.008]	[0.008]	[0.014]	[0.010]	[0.010]	[0.016]	[0.010]	[0.010]	[0.016]
Rural area	0.0625***	0.009	0.1323***	0.0558***	0.0028	0.1305***	0.0553***	0.0026	0.1300***
(1 if rural)	[0.009]	[0.009]	[0.015]	[0.012]	[0.012]	[0.020]	[0.012]	[0.012]	[0.020]
Regional dummies (Nairobi is the reference province)									
Central region	0.0861***	0.0349**	0.1462***	0.0866***	0.0396**	0.1391***	0.0866***	0.0394**	0.1394***
	[0.015]	[0.017]	[0.026]	[0.017]	[0.020]	[0.031]	[0.017]	[0.020]	[0.031]
Coast region	-0.0988***	-0.0608**	-0.1414***	-0.1028***	-0.0610*	-0.1669***	-0.1022***	-0.0606*	-0.1659***
	[0.022]	[0.025]	[0.035]	[0.028]	[0.033]	[0.044]	[0.028]	[0.033]	[0.045]
Eastern region	0.0193	-0.0069	0.0523*	0.0365	0.0019	0.069	0.0376	0.0029	0.0703
	[0.017]	[0.020]	[0.029]	[0.026]	[0.030]	[0.044]	[0.026]	[0.029]	[0.044]
North Eastern region	-0.3110***	-0.3254***	-0.2538***	-0.3039***	-0.3283***	-0.2330**	-0.3079***	-0.3329***	-0.2327**
	[0.050]	[0.060]	[0.091]	[0.061]	[0.076]	[0.112]	[0.061]	[0.076]	[0.113]
Nyanza region	0.0322**	-0.0196	0.0940***	0.0826***	0.0067	0.1603***	0.0832***	0.0074	0.1610***
	[0.016]	[0.021]	[0.027]	[0.030]	[0.038]	[0.051]	[0.030]	[0.038]	[0.051]
Rift Valley region	0.0111	-0.0058	0.0312	0.0172	-0.0064	0.0395	0.0177	-0.0059	0.0401
	[0.017]	[0.019]	[0.028]	[0.021]	[0.024]	[0.035]	[0.021]	[0.024]	[0.035]
Western region	-0.0168	-0.0420*	0.014	0.0208	-0.0168	0.0483	0.0215	-0.0161	0.0488
	[0.019]	[0.025]	[0.031]	[0.042]	[0.050]	[0.071]	[0.042]	[0.050]	[0.071]
Number of observations	12,652	6,500	6,062	9,815	5,058	4,757	9,815	5,058	4,757
Wald χ^2	1694***	465***	764***	1346***	352***	677***	1346***	360***	677***
Pseudo R^2	0.1519	0.1050	0.1101	0.1562	0.1055	0.1242	0.1563	0.1056	0.1242

Robust standard errors in brackets ***, ** , *: significant at 1%, 5% and 10% respectively

Table 2-4: Estimates of the Effect of Chronic Illness on Labor Force Participation

Variables	Probit (marginal effects)			Two-stage residual inclusion (2SRI)			Control function approach		
	Full sample	Male sample	Female sample	Full sample	Male sample	Female sample	Full sample	Male sample	Female sample
Chronic illness	-0.0753***	-0.0536***	-0.0986***	-0.2893	-0.3744	-0.1479	-0.2478	-0.5176	-0.1785
	[0.014]	[0.016]	[0.021]	[0.301]	[0.480]	[0.394]	[0.321]	[0.506]	[0.436]
Chronic				0.1572	0.1744	0.0338	0.1644	0.1608	0.0268
Illness residual				[0.222]	[0.234]	[0.367]	[0.223]	[0.236]	[0.369]
Interaction of chronic illness and							-0.0454	0.0975	0.0434
chronic illness residual							[0.139]	[0.149]	[0.260]
Age	0.0398***	0.0179***	0.0538***	0.0414***	0.0197***	0.0540***	0.0414***	0.0195***	0.0539***
	[0.002]	[0.002]	[0.004]	[0.003]	[0.003]	[0.005]	[0.003]	[0.003]	[0.005]
Age squared	-0.0005***	-0.0002***	-0.0006***	-0.0005***	-0.0002***	-0.0006***	-0.0005***	-0.0002***	-0.0006***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Gender (male=1)	0.2164***			0.1977***			0.1977***		
	[0.008]			[0.016]			[0.016]		
Education (mo formal education is the reference category)									
Primary education	0.0098	-0.0112	0.0315*	0.0099	-0.0083	0.034	0.01	-0.0083	0.034
	[0.009]	[0.010]	[0.016]	[0.013]	[0.014]	[0.022]	[0.013]	[0.014]	[0.022]
Secondary education	0.0107	-0.0021	0.0248	0.003	0.0033	0.0059	0.0029	0.0036	0.0059
	[0.011]	[0.012]	[0.020]	[0.018]	[0.019]	[0.031]	[0.018]	[0.019]	[0.031]
Tertiary education	0.0840***	0.0384***	0.1336***	0.0838***	0.0376**	0.1424***	0.0839***	0.0376**	0.1423***
	[0.011]	[0.012]	[0.021]	[0.016]	[0.017]	[0.028]	[0.016]	[0.017]	[0.028]
Marital status	-0.0440***	0.0987***	-0.1583***	-0.0596***	0.0801***	-0.1678***	-0.0593***	0.0798***	-0.1680***
(married =1)	[0.009]	[0.013]	[0.015]	[0.012]	[0.016]	[0.019]	[0.012]	[0.016]	[0.019]
Presence of children 0-5 years (none is the reference category)									
1 child 0-5 years	-0.0163*	0.0035	-0.0522***	0.0012	0.0186	-0.0333*	0.0012	0.0188*	-0.0333*
	[0.010]	[0.010]	[0.017]	[0.011]	[0.011]	[0.019]	[0.011]	[0.011]	[0.019]
2 or more children	-0.0244**	-0.0081	-0.0614***	-0.0266**	-0.007	-0.0650***	-0.0266**	-0.0071	-0.0650***

0-5 years	[0.011]	[0.012]	[0.019]	[0.013]	[0.014]	[0.022]	[0.013]	[0.014]	[0.022]
Transfers (1 if a household received transfers	-0.0275***	-0.0102	-0.0508***	-0.0196*	-0.0046	-0.0430**	-0.0196*	-0.0047	-0.0430**
	[0.008]	[0.009]	[0.014]	[0.011]	[0.011]	[0.018]	[0.011]	[0.011]	[0.018]
Rural area	0.0628***	0.0123	0.1325***	0.0686***	0.0175	0.1391***	0.0686***	0.0177	0.1391***
(1 if rural)	[0.009]	[0.010]	[0.016]	[0.011]	[0.011]	[0.018]	[0.011]	[0.011]	[0.018]
Regional dummies (Nairobi is the reference province)									
Central region	0.0845***	0.0348**	0.1401***	0.0727***	0.0248	0.1271***	0.0727***	0.025	0.1271***
	[0.015]	[0.018]	[0.027]	[0.020]	[0.024]	[0.034]	[0.020]	[0.024]	[0.034]
Coast region	-0.0989***	-0.0664**	-0.1407***	-0.1247***	-0.0880**	-0.1826***	-0.1249***	-0.0876**	-0.1826***
	[0.022]	[0.027]	[0.036]	[0.028]	[0.035]	[0.043]	[0.028]	[0.035]	[0.043]
Eastern region	0.0214	-0.0063	0.0505*	0.0117	-0.0211	0.0459	0.0117	-0.0212	0.046
	[0.018]	[0.021]	[0.030]	[0.021]	[0.027]	[0.035]	[0.021]	[0.027]	[0.035]
North Eastern region	-0.3194***	-0.3160***	-0.3529***	-0.3032***	-0.3244***	-0.3209***	-0.3044***	-0.3214***	-0.3204***
	[0.049]	[0.061]	[0.090]	[0.059]	[0.076]	[0.113]	[0.060]	[0.076]	[0.113]
Nyanza region	0.0407**	-0.0215	0.1100***	0.0664***	-0.0096	0.1433***	0.0661***	-0.009	0.1436***
	[0.017]	[0.022]	[0.028]	[0.024]	[0.033]	[0.040]	[0.024]	[0.033]	[0.040]
Rift Valley region	0.0195	-0.0059	0.0422	0.0136	-0.0185	0.0433	0.0135	-0.0185	0.0435
	[0.017]	[0.020]	[0.029]	[0.020]	[0.026]	[0.035]	[0.020]	[0.025]	[0.035]
Western region	-0.0113	-0.0445*	0.0235	-0.0185	-0.0482	0.0055	-0.0186	-0.048	0.0057
	[0.020]	[0.027]	[0.032]	[0.028]	[0.038]	[0.045]	[0.028]	[0.038]	[0.045]
Number of observations	11,322	5,930	5,392	8,804	4,604	4,200	8,804	4,604	4,200
Wald χ^2	1507***	424***	662***	1174***	317***	592***	1175***	318***	592***
Pseudo R^2	0.1463	0.1046	0.1052	0.1481	0.099	0.1201	0.1481	0.0994	0.1201

Robust standard errors in brackets ***, ** , *: significant at 1%, 5% and 10% respectively

2.4.2. Reduced-form model of determinants of illnesses

The focus of this essay is the effects of illness on labor force participation. It is therefore necessary to understand factors that may influence probability of reporting illness. It is also important to discuss the determinants of illness because these are the first stage results for the labor force participation model. Table 2-5 reports probit estimates (marginal effects) of factors that influence the probability of reporting chronic and acute illnesses. The coefficients are reported in Appendix 1 Table A4.

The results show that education reduces the likelihood of reporting both chronic and acute illness. Tertiary education for instance reduces the likelihood of individuals reporting acute and chronic illness by 4 percentage points. The effect of education on the probability of reporting both types of illnesses is higher for women than men. While tertiary education reduces the probability of a woman reporting chronic and acute illness by 5 and 6 percentage points respectively, for men, tertiary education only reduces probability of reporting both illnesses by 3 percentage points. These results are in line with theory of health production. Grossman (1972) argues that education increases efficiency of producing health and so individuals with higher levels of education are more likely to be healthier. Education increases symptom awareness and knowledge of health prevention measures (McKinnon, 1995). Fonseca and Zheng (2011) and Cutler et al. (2008) also argued that education is a powerful determinant of health because of its impact on behavior especially through the ability to process new information and take advantage of technology.

Men are less likely to report illness than women. The likelihood of reporting acute illness is 8 percentage points lower for men than women. The likelihood of a man reporting chronic illness is 6 percentage points lower than that of a woman. This could be attributed to the fact that women experience many reproductive health related illnesses and complications unlike men. For example pregnancy related complications only affect women and also pregnancy itself makes women more prone to other illnesses such as malaria (WHO, 2003). The findings in this study support Barsky et al., (2001) who found that women are more likely to report numerous, more frequent and more chronic symptoms than men.

The probability of reporting acute illness increases with age up to a certain age beyond which the probability of reporting illness falls. This is however not so for chronic illness. The probability of reporting chronic illness increases continuously with age for women. Younger men are less likely to report chronic illness but the probability of reporting the chronic illness increases as one grows older. The finding of a non linear effect of age on health is in line with health production theory by Grossman (1972). He asserted that individuals inherit some initial stock of health and that this depreciates with age and that the depreciation process is at an increasing rate once a certain stage of the life-cycle is reached.

Married women are less likely to report chronic illness while married men are more likely to report acute illness. The findings for women are in line with findings by Carr and Springer (2010) and Verbrugge (1979) who found that married individuals are more likely to be healthier than their unmarried counterparts. This can be explained by marital roles and lifestyles that influence health and also by selectivity into marriage because of health.

Living in rural areas reduces the likelihood of reporting both chronic and acute illnesses. For acute illness, this may reflect quality of health infrastructural services such as water quality and sanitation services which are a major problem in urban areas and especially for slum dwellers thus contributing to illnesses. For chronic illness this may reflect access to fresh food, less junk foods and a less polluted environment in the rural areas that are sometimes associated with chronic illnesses. According to EUPHA (2005) food habits, physical activities and smoking in urban areas increase the risk of chronic diseases. This may also be because of limited access to health care in rural areas relative to urban areas hence lower likelihood of diagnosis.

Individuals living in Coast, Western, Rift Valley, Nyanza, Eastern, Central and North Eastern regions are less likely to report illness compared to those living in Nairobi province. Nairobi is more urbanized than the rest of the provinces in Kenya and so this may reflect the negative effect of urbanization on health as suggested by EUPHA (2005).

The longer the distance to the nearest weekly market, the lower the probability of reporting both chronic and acute illnesses. Most health facilities are usually located in nearby markets and so this may be capturing accessibility to health care. Distances are proxies of time costs of

accessing health care (Strauss and Thomas, 1998). Longer distances also mean higher transport cost. Individuals can only learn of their health status after visiting health facilities. Longer distances deter such visits and so may negatively affect the probability of reporting illness not necessarily because individuals are well but because they lack information on their health status.

The higher the number of health facilities in a district of residence, the lower the likelihood of individuals in that district reporting both acute and chronic illnesses. According to Strauss and Thomas (1998) this is a proxy of availability of health services in the district. A higher number of health facilities allows people to access treatment.

Table 2-5: Estimates of the Determinants of Chronic and Acute Illness, Marginal effects

	Chronic illness			Acute illness		
	Full sample	Male sample	Female sample	Full sample	Male sample	Female sample
Age	0.0049***	-0.0007	0.0095***	0.0081***	0.0084***	0.0061*
	[0.002]	[0.002]	[0.003]	[0.002]	[0.003]	[0.004]
Age squared	-0.000004	0.0001*	0.0001	-0.0001**	-0.0001**	-0.00003
	[0.00002]	[0.00003]	[0.00004]	[0.00003]	[0.00004]	[0.0001]
Gender (male=1)	-0.0560***			-0.0760***		
	[0.007]			[0.008]		
Education (no education is the reference category)						
Primary education	-0.0243***	-0.0171*	-0.0321***	-0.0112	-0.0153	-0.0067
	[0.008]	[0.010]	[0.012]	[0.010]	[0.013]	[0.015]
Secondary education	-0.0456***	-0.0292***	-0.0640***	-0.0410***	-0.0499***	-0.0284
	[0.008]	[0.011]	[0.013]	[0.011]	[0.014]	[0.019]
Tertiary education	-0.0383***	-0.0261**	-0.0502***	-0.0425***	-0.0319**	-0.0607***
	[0.009]	[0.011]	[0.015]	[0.013]	[0.015]	[0.021]
Marital status (married =1)	-0.0159*	0.0041	-0.0253**	0.0212**	0.0277*	0.0196
	[0.009]	[0.014]	[0.012]	[0.010]	[0.016]	[0.014]
Presence of children 0-5 years (None is the reference category)						
One child	0.0094	0.0123	0.0063	-0.0012	-0.012	0.0092
	[0.008]	[0.011]	[0.013]	[0.010]	[0.013]	[0.015]
Two or more children	-0.0094	0.0125	-0.0321**	-0.0384***	-0.0441***	-0.0317*
	[0.009]	[0.013]	[0.014]	[0.011]	[0.014]	[0.017]
Rural area (1 if rural)	-0.0027	0.0118	-0.0169	-0.0363***	-0.0471***	-0.0225
	[0.008]	[0.010]	[0.013]	[0.010]	[0.013]	[0.015]
Regional dummies (Nairobi is the reference region)						
Central region	-0.0558***	-0.0522***	-0.0633***	-0.1863***	-0.1484***	-0.2335***
	[0.014]	[0.017]	[0.024]	[0.034]	[0.043]	[0.051]
Coastal region	-0.0443***	-0.0561***	-0.0304	-0.1557***	-0.1142**	-0.2024***

	[0.016]	[0.016]	[0.030]	[0.038]	[0.053]	[0.053]
Eastern region	-0.0297*	-0.0376*	-0.0266	-0.1350***	-0.0859	-0.1917**
	[0.017]	[0.020]	[0.029]	[0.052]	[0.072]	[0.075]
North Eastern region	-0.0870***		-0.0448	-0.1939***	-0.1657***	-0.2135***
	[0.017]		[0.067]	[0.012]	[0.009]	[0.038]
Nyanza region	0.0434*	0.017	0.0666*	-0.0783	-0.0258	-0.1384
	[0.024]	[0.028]	[0.039]	[0.060]	[0.086]	[0.084]
Rift valley region	-0.0378**	-0.0391*	-0.0448	-0.1869***	-0.1271*	-0.2545***
	[0.017]	[0.021]	[0.028]	[0.051]	[0.070]	[0.073]
Western region	0.0153	-0.0076	0.0355	-0.0704	-0.0065	-0.1409*
	[0.023]	[0.026]	[0.039]	[0.063]	[0.096]	[0.084]
Transfers (1 if household received	0.0183***	0.0253***	0.0095	0.0192**	0.0157	0.0231*
Transfers)	[0.007]	[0.009]	[0.012]	[0.009]	[0.011]	[0.014]
Instruments						
Distance to weekly market	-0.0002***	-0.0001**	-0.0003***	-0.0002***	-0.0002**	-0.0002**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Number of health facilities	-0.0004***	-0.0003	-0.0007***	-0.0005***	-0.0003**	-0.0006***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Number of observations	8,809	4,536	4,203	9,821	5,060	4,761
Wald χ^2	452***	166***	263***	496***	244***	195***
Pseudo R^2	0.0781	0.0600	0.0826	0.0510	0.0549	0.0377

Robust standard errors in brackets ***, ** , *: significant at 1%, 5% and 10% respectively

2.5. Summary, conclusion and policy implication

Summary and conclusion

Empirical evidence suggests that in Kenya labor force participation reduces the probability of being poor (Odhiambo and Manda, 2003). Economic theory suggests that poor health may negatively affect labor force participation (Leibenstein, 1957; Becker, 1962; Mushkin, 1962; Schultz, 1961; Cai and Kalb, 2006; Grossman, 1972). Understanding the effect of poor heath on labor force participation is important for designing appropriate policy to deal with poverty through increased labor force participation. While several studies (Kabubo-Mariara, 2003; Lokshin et al., 2004; Tandrayen-Ragoobur et al., 2011; Mugume and Canagarajah, 2005; Siphambe and Motswapong, 2010; Ntuli and Wittenberg, 2013) examined labor force participation, there is scarce evidence on labor supply effects of health in Africa. This essay addresses this gap with the main objective of estimating the effect of chronic and acute illness on labor force participation in Kenya. The empirical analysis used data drawn from a nationally representative household survey conducted by the Government of Kenya to assess living standards.

The estimates of the effect of health status on labor force participation may be biased because health status is potentially endogenous in labor force participation models. This could arise from measurement and reporting errors, simultaneity and omitted variable bias (Stern, 1989; Bound, 1991). Unobserved individual heterogeneity may also bias the estimates if there is non linear interaction between the health variables and unobservable factors causing the effect of health on labor force participation to vary by individual workers. The empirical strategy used in this essay to address potential endogeneity and unobserved heterogeneity is the control function approach estimation procedure. The, results suggest that chronic illness and acute illnesses can be treated as exogenous to the labor force participation decisions. In addition, the results do not uncover unobserved individual heterogeneity bias. Consequently, probit estimates were relied on to answer the research questions.

The results indicate that both acute and chronic illnesses reduce the likelihood of individuals participating in the labor market. The effect of chronic illness is larger: acute and chronic illnesses reduce participation by 2 and 8 percentage points respectively. Women are more likely

than men to reduce participation due to illness. While the likelihood of women reducing participation due to acute and chronic illnesses is 3 and 10 percentage points respectively, the likelihood of men reducing participation due to chronic and acute illness is 2 and 5 percentage points respectively. Simulation results show that reducing both chronic and acute illnesses by between 2 to 5 percent can increase labor force participation by between 4 to 50 percent.

Tertiary education significantly affects participation in the labor market and increases the likelihood of participating in the labor market by 8 percentage points. Primary and secondary education has no significant effect on participation. The effect of tertiary education on participation is higher for women than men; it increases womenôs and menôs participation by 13 and 2 percentage points respectively. Other variables that significantly influence participation are individualôs age, marital status, receipt of transfers, regional dummies and presence of children below 5 years in the household.

The main research question addressed in this essay was whether chronic and acute illness affects labor force participation. By reducing the chance of participating in the labor force, illness restricts individualôs access to possible employment opportunity with negative implications for poverty and economic growth. Odhiambo and Manda (2003) found that labor force participation reduces poverty. Individuals who otherwise have skills and education relevant for the labor market are forced to stay away from the labor force due to illness. This amount to wasting of human capital both to the individual and to the economy As long as illness incidence and prevalence remain high, participation in the labor force will be lower than optimal and the productive potential of the working population thereby limited.

Kenyan labor market statistics show that women had a lower labor force participation rate than men and are more likely than men to report both chronic and acute illnesses. The estimation results indicate that the effect of both chronic and acute illnesses is higher for women than for men pointing to the need to protect women from the negative effect of illness. This essay therefore helps highlight the differential effect of illness on labor force participation for men and women. The two types of illness considered have differing effects on labor force participation. This essay therefore also contributes to literature by bringing out the differential effect of acute and chronic illness on labor force participation. Further, results suggest that illness may be

treated as endogenous in labor force participation models and unobserved individual heterogeneity may not be a major issue in estimating relationship between health and labor force participation.

Policy implications

Labor force participation is determined by tertiary education, health status and other personal characteristics. Policies aimed at increasing access to tertiary education will increase labor force participation. However given that illness negatively affects labor force participation, education policies should be complimented by policies to reduce the incidence and prevalence of illness in the population. In particular results indicated that chronic illnesses have more disabling effects on labor force participation than acute illness. And since chronic illnesses can be managed through lifestyle, proper diet and medication, making this information available may reduce the disease incidence and prevalence. Provision of management drugs should also be expanded to keep people in the labor force. The negative effect of illness is higher for women than men, therefore there is need to focus on gender in health policy.

These results have implications for costs and benefits of health interventions. Health policy makers should know that other than promoting good health because in itself it generates utility, promoting good health is also important because ill health leads to lower productivity due to reduced probability of participating in the labor force.

Areas of further research

Future research on this area can examine the effect of specific types of illnesses (such as HIV/AIDS, diabetes) on labor force participation. Such studies can also disaggregate the effect of illness on labor force participation by age groups to investigate whether the effect of illness on labor force participations varies by age groups. This study only measured health by type of disease future studies can consider other dimensions of health such as nutritional status. Disaggregation of the effects of illness on labor force participation by spatial dimension i.e. rural-urban differences may also give interesting analysis.

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CHAPTER THREE: EFFECT OF ILLNESS ON EMPLOYMENT STATUS

3.1. Introduction

Economic growth of a country is characterized by an increased share of labor force in wage employment, paving way for further growth and increased standards of living (World Bank, 1995; 2012). Workers move from low productivity jobs to higher productivity jobs leading to increased output as the economy moves closer to the efficient frontier (World Bank, 2012). In Kenya, labor market statistics show that the share of wage employment in total employment has shrank over time from 28.7 percent in 2000 to 18.54 percent in 2011 while the share on non agriculture self employment has risen from 65.3 percent in 2000 to 75.4 percent in 2011 (Republic of Kenya, 2006; 2012).

Allocation and reallocation of labor among employment types is important for economic development of SSA and any constraints to this process slow down the transformation process (Agenor, 1996). Grossman (1972) argues that illness may reduce the amount of time an individual has for market activities. This may make individuals prefer employments with flexible working hours thus affecting allocation and reallocation among various forms of employment. Given the high and rising disease burden in Kenya, how does this affect employment patterns?

Previous studies have examined factors that determine participation in various employment segments (Kabubo- Mariara, 2003; Atieno, 2006; Atieno and Teal, 2006; Nyaga, 2010; Wamuthenya, 2010; Wambugu, 2011) in Kenya. However, these studies do not consider the effect of health status on access to various forms of employment. Studying the relationship between illness and access to employment is important for understanding the potential constraint of illness on allocation of labor. This can help shape economic policies to promote the transformation process through allocation and reallocation of labor with implications for economic development.

This essay examines whether illness is a constraint to participation in three types of employment in the Kenyan economy: wage employment, non-agricultural self-employment and agricultural self-employment. Specifically the objectives of the essay are to:

a) Examine the relationship between chronic illness and participation in wage employment, non-agricultural self-employment and agricultural self-employment.
b) Examine the relationship between acute illness and participation in wage employment, non-agricultural self-employment and agricultural self-employment.
c) Investigate whether there are gender differences in the effect of illness on employment type.
d) Draw policy implications for changing the structure of employment.

This essay contributes to literature by providing empirical evidence from Kenya on the effect of illness on individual employment status. Such information is important in formulating growth policies given the potential effect of illness on participation in various employment types and hence on the economic transformation process with implications for economic growth. The analysis is done separately for men and women. This is useful because the effect of health on labor market outcomes vary between men and women (Gambin, 2005)

Three types of employment are considered: wage employment, non-agricultural self-employment and agricultural self-employment. This categorization helps isolate the effect of illness on each employment type given that the effect may vary considerably. Wage employment tends to be characterized by written contracts and may be rigid in terms of working hours. Self employment is usually characterized by flexible working hours, job autonomy and non standard work week (Lombard, 2001). Work in agricultural employment is mainly manual and requires physical effort.

This essay also considers the effect of both chronic and acute illness on type of employment. This is important because the effect of long term disability associated with chronic illness on health may differ from short term disability associated with acute illness (Mwabu, 2007). This distinction is especially important given that choice of employment type is a long term decision and is therefore likely to be affected only by long term illness.

The rest of the essay is organized as follows. Section 3.2 reviews literature on health and employment status. Section 3.3 presents the methodology, data and descriptive statistics.

Section 3.4 presents the results and discussion of results and section 3.5 provides a summary and conclusion to the essay and policy implications.

3.2. Literature review

This section reviews literature on the relationship between health status and type of employment. The theoretical literature focuses on potential channels in the relationship between illness and type of employment. The empirical literature examines the role of health in determining the type of employment and transition between employment states. The section ends with a conclusion and identifies the gap filled by this study.

3.2.1. Theoretical literature

An individualôs health status can influence access to various forms of employment. According to Grossman (1972), illness reduces an individualôs stock of health causing them to prefer to spend less time working to take care of their health. The ill individuals may therefore prefer the type of employment with flexible working hours such as in self employment. Hundley (2001) and Lombard (2001) found that flexibility of hours of employment, job autonomy and nonstandard work week make individuals especially women to prefer self employment. Illness is therefore important in individualôs employment choice.

Health as a dimension of human capital also determines wages (Leibenstein, 1957; Becker, 1962; Mushkin, 1962; Schultz, 1961). If poor health status reduces individualsô productivity and hence wage, it makes them less competitive and reduces their chances of wage employment. For instance, wage employers could use ill health as a screening device thereby reducing the likelihood of individuals in ill health being employed. Individuals may then enter self employment. But in the agricultural self-employment, most work relies on physical strength. Illness may reduce an individualôs capacity to perform tasks in this type of employment thus reducing their productivity.

3.2.2. Empirical literature

Studies on relationship between health status and type of employment have mainly taken two approaches. The first set of studies examines effect of health status on transition across various labor market states (Parker and Rougier, 2007; Zissimopoulos and Karoly, 2007; Giandrea, et al.,

2008; Fuchs, 1982; Zucchelli et al., 2012). Most of these studies are on developed countries which have rich panel data sets to allow such analysis. The other set of studies examine how health status is related with an individualôs type of employment. Such studies have been conducted using data from developing countries (Bridges and Lawson, 2008; Thomas and Strauss, 1997).

The studies concerned with transition across labor market states mainly use American data set (Fuchs, 1982; Zissimopoulos and Karoly, 2007; Giandrea, et al., 2008) except for Zucchelli et al. (2012) who uses Australian data. Fuchs (1982); Zissimopoulos and Karoly (2007) and Giandrea et al. (2008) were concerned with the effect of health status on transition from wage employment to self employment. Zucchelli et al. (2012) analyzed the effect of ill health and health shocks on mobility between full-time employment, part-time employment, self-employment and inactivity among older workers.

Fuchs (1982) and Zissimopoulos and Karoly (2007) used health related work limitations while Zucchelli et al. (2012) used a measure of health stock and health shock. The health stock was obtained by regressing self assessed health on specific health indicators. The health shock was defined as a binary variable which equaled 1 if an individual reported having a serious injury or illness in the past twelve months prior to the interview. Giandrea et al. (2008) measured health using self assessed health status.

Fuchs (1982) found that while health status significantly determined working, it was not a significant predictor of a wage worker switching to self employment. On the contrary, Zissimopoulos and Karoly (2007) found that a work limiting health condition pushes individuals into self employment. Zucchelli et al. (2012) also reported similar findings that health shocks enhanced the probability of switching to part-time and self-employment in the subsequent year. Contrary to previous authors, Giandrea, et al. (2008) found that ill health reduced the likelihood of transitioning to self employment from wage employment.

These studies found gender differences in the effect of illness on type of work. Zucchelli (2012) found that women were more likely than men to transition to part time employment or self employment due to health shock. On the contrary, Zissimopoulos and Karoly (2007) found that men were more likely than women to switch to self employment. The likelihood of moving to

self employment increased by 47% and 30% for men and women respectively who had a health condition that limited their work relative to those who did not experience a health limiting condition.

There is little evidence of this nature for developing countries as these studies have focused mainly on developed countries. The effect of illness on type of employment may vary considerably between the developed and developing countries. This is especially so because in the developed countries, self employment only comprises a small percentage of the work force (15%) compared to more than half for low and middle income countries (Gindling and Newhouse, 2012). Further, while agricultural employment accounts only for 4.6% of employment in developed countries, it accounts for 41.7% of employment in developing countries (Gindling and Newhouse, 2012). Therefore empirical evidence from developing countries would provide valuable information.

It is not clear how illness affects transition across various labor market states. While some studies (Zissimopoulos and Karoly, 2007; Zucchelli et al., 2012) found that illness causes individuals to move from wage employment to self employment, others (e.g. Giandrea, et al., 2008) found the opposite - that ill health reduced the likelihood of transitioning to self employment from wage employment. Others yet still found no effect of health status on transitioning across labor market states (Fuchs, 1982). Further, while some studies (Zissimopoulos and Karoly, 2007) found that men were more likely to transit from one sector to another due to illness others (Zucchelli, 2012) found that women were actually more likely. There is need for more studies especially those on developing countries.

There are a number of studies for Kenya analyzing employment structure with each focusing on different categories (Kabubo- Mariara, 2003; Atieno, 2006; Atieno and Teal, 2006; Nyaga, 2010; Wamuthenya, 2010; Wambugu, 2011). The factors found to significantly influence employment structure are, education, gender, marital status, presence of children below six years, age, land ownership, household headship, area of residence and non labor income. These studies however do not consider health status effects. Understanding the effects of illness on labor allocation and reallocation is important in designing policies to promote economic transformation and growth.

Only a limited number of studies for developing countries (Thomas and Strauss, 1997; Bridges and Lawson, 2008) analyze the relationship between health status and individualôs employment status. Thomas and Strauss (1997) estimated for women in urban Brazil the effect of height on choice between market employment, self employment and non participation using a multinomial logit. For men, however, since majority (95%) were employed, they estimated the effect of height on choice between market employment and self employment using a logit model. They found that conditional on working, taller men were more likely to be self employed than in market employment. For women they found a positive and similar effect on probability of working in the market sector and self employment relative to not working.

Using cross sectional data from Uganda, Bridges and Lawson (2008) estimated the effects of number of days lost due to illness or injury on choice between self employment, wage employment and non participation using a multinomial probit model. They measured health status using number of days lost due to illness or injury. They found that ill health reduced the probability of being in wage employment relative to self-employment especially for women.

3.2.3. Summary of the literature

Theoretically, health status is potentially an important factor in the process that shapes the observed distribution of individuals across employment types. Empirically, there is limited empirical evidence on the effect of illness on individualôs employment status especially in SSA. In addition, even studies on the subject for developed countries found conflicting results. Some studies found no effect of health status on transition from wage employment to self employment (Fuchs, 1982). Later studies however found significant effect of health status on transition across employment states. Zucchelli et al. (2012) and Zissimopoulos and Karoly (2007) found that poor health causes individuals to transition from wage employment to part time employment and self employment. On the contrary, Giandrea. et al., 2008 found that poor health reduced the likelihood of individuals transitioning to self employment. This study will help toward building consensus on the relationship between illness and employment status and add to the literature on the effect of illness of employment outcomes in SSA.

3.3. Methodology

3.3.1. Conceptual framework

Access to employment is an important labor market outcome. Health status can be an important determinant of access to employment. Health status influences an individualôs probability of participating in various types of employments by influencing total healthy time which individuals have for market and non market activities (Grossman, 1972). Health status, is in turn influenced by socioeconomic, demographic and geographical factors. The conceptual framework in chapter1 also shows that socioeconomic, demographic and geographical factors directly influence access to employment.

3.3.2. Empirical model

This section presents the methods used in analyzing the relationship between health status and participation in various employment types in Kenya. The model has four employment states (S): wage employment ($S=1$), non-agricultural self-employment ($S=2$), agricultural self-employment ($S=3$) and not working ($S=4$). That is, in addition to the three employment types, a category for individual not working is included to make the categories exhaustive.

Following Robertson and Symons (1990) and Mwabu and Evenson (1997), an individual i attaches a subjective utility U_{iS} on each employment state S. An individual chooses employment state S if

$$U_{iS} > U_{iM} \tag{3.1}$$

Where M is all other employment states except S. The utility index U_{iS} comprises of a systematic part (U_{iS}^{*}) and an unobservable individual part (ε_{iS}). Thus,

$$U_{iS} = U_{iS}^{*} + \varepsilon_{iS} \tag{3.2}$$

Where ε_{is}, captures both random aspects of individual i and the possibility that the model may not predict choice of employment state by individual i with certainty.

The utility index is related to a set of explanatory variables including health status as follows

$$U_{is} = \beta_s Z_i + \delta H_i \tag{3.3}$$

Where, Z_i is a vector of personal and socio economic characteristics of individual i, H_i, is health status of individual i.

Assuming ε_{iS} as an extreme value probability distribution (Wooldridge, 2002), the probability of individual i choosing employment state S can be written as

$$P_{is} = \frac{\exp(U_{is})}{\sum_{M} \exp(U_{iM})} \tag{3.4}$$

We can divide the numerator and denominator of equation (3.3) by $\exp U_{is}$ so that the equation is expressed in terms of utility difference

$$P_{is} = \{\exp(U_{im} - U_{is})\}^{-1} \tag{3.5}$$

Equation (3.5) is estimated using maximum likelihood and the associated log likelihood function is given as

$$\ln L = \sum_i \sum_M d_{is} \ln\{\exp(U_{iM} - U_{is})^{-1} \tag{3.6}$$

Variable definitions

The dependent variable is categorical and has four categories: wage employment, non-agricultural self-employment, agricultural self-employment and not working. The independent variables include health status, age, education, marital status, presence of children 0-5 years, transfers and area of residence.

Health status is included in the model because it is considered a form of human capital that can affect an individualôs total healthy time (Grossman, 1972). This may make individuals in health to prefer employments with flexible time. Illness can also affect an individualôs potential wage (Leibenstein, 1957; Becker, 1962; Mushkin, 1962; Schultz, 1961) thereby affecting their employability in certain types of employment. Health is measured by chronic and acute illness. Acute illness equals 1 if individuals reported having acute illness and 0 if otherwise. Chronic illness equals 1 if an individual reported having chronic illness and 0 if otherwise. It is expected that chronic and acute illnesses will reduce the likelihood of individuals working in the wage

employment and agricultural self-employment but increase the likelihood of individuals working in the non-agricultural self-employment (Zucchelli et al., 2012; Zissimopoulos and Karoly, 2007; Bridges and Lawson, 2008).

Education is a form of human capital that affects an individualôs wage (Mincer, 1958). Human capital requirement of jobs may vary by type of employment and therefore education may affect access to different types of employment. Education is measured in four levels: no education, primary education, secondary education and tertiary education. Four dummy variables were created one for each level of education which equals 1 if an individual reported to have a given level of education and 0 if otherwise. Education is expected to increase the likelihood of individuals working in the wage employment but to reduce the likelihood of individuals working in the self-employment agricultural and non-agricultural self-employment. This is because employers may use educational qualifications as a criterion for selection into wage employment. Wage employment may require more skilled workers. According to human capital theory, education increases productivity (Mincer, 1958; Schultz, 1961; Mushkin, 1962)

Individualôs age is measured in years. It is a proxy for work experience. A positive relationship is expected between age and probability of participating in wage employment. This is because individuals acquire experience and skills as time passes. However, later in life deterioration may reduce productivity and hence employability (Mincer, 1958). Hence, we expect a non linear relationship between age and probability of participating in various employments in line with Dimova et al. (2010); Wambugu (2011); Nyaga (2010); Kabubo-Mariara (2003) and Atieno (2006) who found a concave relationship between age and probability of participating in the various employment types.

Marital status is included in the model to capture familial environment (Cahuc and Zylberberg, 2004). Marital status is measured as a dummy variable which equals 1 if an individual reported being married and 0 if otherwise. Married men are expected to be more likely to participate in the wage employment. Married women are however expected to be more likely to participate in self employment given that this type of employment offers the flexibility that married women especially with children need. Previous studies found that married women were less likely to be

in wage employment than their unmarried counterparts (Bridges and Lawson, 2008; Lokshin et al., 2004).

Presence of children 0-5 years is captured by three dummies. The first is the no child dummy which equals 1 if there is no child in the household and 0 otherwise. The second is the one child dummy which equals 1 if a household had one child and 0 otherwise. The third is more than 1 child dummy which equals 1 if a household had two or more children and 0 otherwise. Presence of children is included in the model to capture familial environment (Cahuc and Zylberberg, 2004). Women especially with young children are expected to be less likely to be in wage employment but more likely to be in self employment given the flexibility such sectors offer. (Bridges and Lawson, 2008; Lokshin et al., 2004)

Transfers are measured as a dummy which equal 1 if a household reported receiving transfers (inkind or cash) and 0 otherwise. Transfers are a form of non labor income. Non labor income is expected to be a significant determinant of allocation of labor to various sectors (Wambugu, 2011; Nyaga, 2010).

The model also include area of residence as a potential predictor of labor allocation. It is included in the study because employability in certain types of employments is likely to vary by area of residence. For instance people in the rural areas are more likely be engaged in agricultural employment. One dummy variable was created which equalled 1 if an individual reported to be living in the rural area and 0 otherwise. Urban residence is expected to increase chances of formal employment but reduce chance of agricultural employment (Atieno, 2006).

3.3.3. Data and descriptive statistics

This essay used data from a nationally representative survey-Kenya Integrated Household Budget Survey. Table 3-1, 3-2 and 3.3 present the descriptive statistics of full sample, male sample and female sample respectively by type of employment. The statistics show that a smaller proportion of both men and women in wage employment reported having chronic illness compared to those in self employment. While 9% of men in wage employment reported to have chronic illness, 11% and 10% of men in non-agricultural self-employment and in agricultural self-employment respectively reported having chronic illness. For women, while 12% of those in

wage employment reported to have chronic illness, 20% of women in non-agricultural self-employment reported to have chronic illness compared to 16% of women in agricultural self-employment. We do not observe much variation in the proportion reporting acute illness across employment types.

The proportion of individuals in wage employment increases with the level of education. However, the proportion of individuals in self employment and those not working declines as the level of education increases. The mean age of men (women) in wage employment was 34 (33) years. The mean age for men and women in non-agricultural self-employment was 36 and 35 years respectively. The mean age of individuals in agricultural self-employment was 35 and 37 years for men and women respectively. For individuals who reported not working, their mean age was 31 years.

A smaller proportion of married women reported to be in wage employment compared to those in agricultural and non-agricultural self-employment and those not working. Women with children were also less likely to be in the wage employment but more likely to be in self employment or not to be working. For men, however, a higher proportion of married men reported to be in the wage employment and in non-agricultural self-employment compared to those in agricultural self-employment and those not working.

Men and women living in the rural areas were more likely to be in agricultural self-employment. Further, women living in households that received transfers were more likely to be in non-agricultural self-employment. For men, however, there is no systematic variation in the proportion of men who lived in households that received transfers and employment type.

Table 3-1: Descriptive Statistics of Variables Included in the Employment Model, Full Sample

Variables	Wage employment	Non-agricultural self-employment	Agricultural self-employment	Not working
Health Status	0.10 (0.30)	0.15 (0.36)	0.13 (0.34)	0.15 (0.36)
Chronic illness (=1 if an individual reported having chronic illness, 0 if otherwise)	0.20 (0.40)	0.23 (0.42)	0.21 (0.41)	0.21 (0.41)
Acute illness (=1 if an individual reported having acute illness, 0 otherwise				
Education	0.24 (0.43)	0.29 (0.46)	0.45 (0.50)	0.39 (0.49)
No formal education (=1 if an individual reported to have no formal education, 0 otherwise)	0.26 (0.44)	0.34 (0.47)	0.35 (0.48)	0.33 (0.47)
Primary education (=1 if an individual reported having primary education, 0 otherwise)	0.20 (0.40)	0.22 (0.42)	0.15 (0.36)	0.19 (0.39)
Secondary education (=1 if an individual reported having secondary education, 0 otherwise)	0.30 (0.47)	0.15 (0.35)	0.06 (0.23)	0.09 (0.29)
Tertiary education (=1 if an individual reported having tertiary education, 0 otherwise)				
Age	34 (11)	35 (11)	36 (14)	31 (13)
Marital status				
Marital status (=1 if an individual reported to be married, 0 otherwise)	0.62 (0.48)	0.71 (0.45)	0.63 (0.48)	0.56 (0.50)
Children below 5 years	0.62 (0.49)	0.56 (0.50)	0.57 (0.50)	0.52 (0.50)
No children (=1 if a household reported having no child below 5 years, 0 otherwise)				
One child (=1 if a household reported having 1 child below 5 years, 0 otherwise)	0.24 (0.43)	0.26 (0.44)	0.22 (0.41)	0.25 (0.43)
Two or more children (=1 if a household reported having 2 or more children below 5 years, 0 otherwise	0.14 (0.35)	0.18 (0.38)	0.22 (0.41)	0.23 (0.42)
Area of residence				
Rural area (1 if an individual reported to be living in the rural area, 0 otherwise	0.47 (0.50)	0.48 (0.50)	0.94 (0.24)	0.65 (0.48)
Transfers (=1 if a household reported receiving transfers, 0 otherwise)	0.69 (0.46)	0.71 (0.46)	0.67 (0.47)	0.69 (0.46)
Sample size	4225 (24%)	2456 (14%)	5291 (30%)	5651 (32%)

Source: Author, based on KIHBS data (Republic of Kenya, 2007) Standard errors in parenthesis

Table 3-2: Descriptive Statistics of Variables Included in the Employment Model, Male Sample

Variables	Wage employment	Non-agricultural self-employment	Agricultural self-employment	Not working
Health Status				
Chronic illness (=1 if an individual reported having chronic illness, 0 if otherwise)	0.09 (0.28)	0.11 (0.31)	0.10 (0.31)	0.11 (0.31)
Acute illness (=1 if an individual reported having acute illness, 0 otherwise	0.18 (0.39)	0.20 (0.40)	0.16 (0.37)	0.16 (0.36)
Education				
No formal education (=1 if an individual reported to have no formal education, 0 otherwise)	0.25 (0.43)	0.26 (0.44)	0.41(0.49)	0.35 (0.48)
Primary education (=1 if an individual reported having primary education, 0 otherwise)	0.26 (0.44)	0.33 (0.47)	0.34 (0.48)	0.33 (0.47)
Secondary education (=1 if an individual reported having secondary education, 0 otherwise)	0.28 (0.45)	0.17 (0.38)	0.07 (0.26)	0.10 (0.30)
Tertiary education (=1 if an individual reported having tertiary education, 0 otherwise)	0.20 (0.40)	0.23 (0.42)	0.17 (0.38)	0.22 (0.41)
Age	34 (11)	36 (11)	35 (14)	31 (13)
Marital status				
Marital status (=1 if an individual reported to be married, 0 otherwise)	0.69 (0.46)	0.75 (0.43)	0.59 (0.49)	0.40 (0.49)
Children below 5 years				
No children (=1 if a household reported having no child below 5 years, 0 otherwise)	0.62 (0.48)	0.55 (0.50)	0.59 (0.49)	0.62 (0.49)
One child (=1 if a household reported having 1 child below 5 years, 0 otherwise)	0.24 (0.42)	0.27 (0.44)	0.20 (0.40)	0.20 (0.40)
Two or more children (=1 if a household reported having 2 or more children below 5 years, 0 otherwise	0.15 (0.35)	0.18 (0.38)	0.21 (0.41)	0.18 (0.39)
Area of residence				
Rural area (1 if an individual reported to be living in the rural area, 0 otherwise	0.49 (0.50)	0.47 (0.50)	0.94 (0.23)	0.68 (0.47)
Transfers (=1 if a household reported receiving transfers, 0 otherwise)	0.69 (0.46)	0.68 (0.47)	0.67 (0.47)	0.69 (0.46)
Sample size	2883 (34%)	1238 (15%)	2514 (30%)	1770 (21%)

Source: Author, based on KIHBS data (Republic of Kenya, 2007) Standard errors in parenthesis

Table 3-3: Descriptive Statistics of Variables Included in the Employment Model, Female Sample

Variables	Wage employment	Non-agricultural self-employment	Agricultural self-employment	Not working
Health Status				
Chronic illness (=1 if an individual reported having chronic illness, 0 if otherwise)	0.12 (0.33)	0.20(0.40)	0.16 (0.37)	0.17 (0.37)
Acute illness (=1 if an individual reported having acute illness, 0 otherwise	0.23 (0.42)	0.26 (0.44)	0.26 (0.44)	0.24 (0.43)
Education	0.23 (0.42)	0.33 (0.47)	0.48 (0.50)	0.42 (0.49)
No formal education (=1 if an individual reported to have no formal education, 0 otherwise)				
Primary education (=1 if an individual reported having primary education, 0 otherwise)	0.26 (0.44)	0.35 (0.48)	0.35 (0.48)	0.33 (0.47)
Secondary education (=1 if an individual reported having secondary education, 0 otherwise)	0.19 (0.39)	0.21 (0.41)	0.13 (0.33)	0.17 (0.38)
Tertiary education (=1 if an individual reported having tertiary education, 0 otherwise)	0.33 (0.47)	0.12 (0.32)	0.04 (0.19)	0.08 (0.28)
Age	33 (10)	35 (11)	37 (13)	31 (12)
Marital status				
Marital status (=1 if an individual reported to be married, 0 otherwise)	0.48 (0.50)	0.68 (0.47)	0.67 (0.47)	0.63 (048)
Children below 5 years				
No children (=1 if a household reported having no child below 5 years, 0 otherwise)	0.62 (0.49)	0.56 (0.50)	0.55 (0.50)	0.48 (0.50)
One child (=1 if a household reported having 1 child below 5 years, 0 otherwise)	0.25 (0.43)	0.26 (0.44)	0.23 (0.42)	0.27 (0.45)
Two or more children (=1 if a household reported having 2 or more children below 5 years, 0 otherwise	0.13 (0.34)	0.18 (0.38)	0.22 (0.41)	0.25 (0.43)
Area of residence				
Rural area (1 if an individual reported to be living in the rural area, 0 otherwise	0.43 (0.50)	0.49 (0.50)	0.94 (0.24)	0.63 (0.48)
Transfers (=1 if a household reported receiving transfers, 0 otherwise)	0.70 (0.46)	0.73 (0.44)	0.67 (0.47)	0.69 (0.46)
Sample size	1342 (15%)	1218 (13%)	2777 (30%)	3881 (42%)

Source: Author, based on KIHBS data (Republic of Kenya, 2007) Standard errors in parenthesis

3.4. Results and discussions

This section presents maximum likelihood estimates from the multinomial probit model with an emphasis on the effect of illness on probability of participating in wage employment, in non-agricultural self-employment and in agricultural self-employment relative to not working. Multinomial probit model was used because the multinomial logit has restrictive assumption of independence of irrelevant alternatives (IIA). The assumption states that the odds of being in employment state, S over employment state, M are independent of all other employment states and number of employment states. A Hausman test rejected the null hypothesis that IIA property holds. The details of the test are presented in Appendix 2 Tables A5 and A6. In addition, tests of whether any of the four employment states can be combined were conducted (Appendix 2 Tables A7 and A8). The results show that the null hypothesis that the categories can be combined can be rejected. This, therefore, favors retaining four employment outcomes.

We also test for poolability of the data, that is, whether it is appropriate to estimate the male and female employment status equations, separately (Appendix 2 Table A9). To carry out the test, the independent variables were interacted with the gender dummy and the joint significance of these interaction terms tested. When health is measured by chronic illness, the χ^2 statistic, with 36 degrees of freedom is 931.4 (p-value = 0.000). Therefore, the null hypothesis that there is no significant difference in the estimated male and female coefficients is rejected. When health is measured by acute illness, the χ^2 statistic, with 36 degrees of freedom is 1021.46 (p-value = 0.000), and thus the null hypothesis is rejected too. Thus, it is appropriate to estimate separate equations for the male and female samples.

Table 3-4 and 3-5 present the marginal effects of multinomial probit model of employment status. The coefficients are reported in Appendix 2 Tables A10 and A11. The results show that individuals with chronic illness have a lower chance than non ill persons of being in wage employment and in agricultural self-employment relative to not working. The likelihood of wage employment and agricultural self-employment is lower by 4.7 and 3.7 percentage points respectively for individuals with chronic illness. Women are most affected by chronic illness. For them, chronic illness reduces their chance of wage employment and agricultural self-

employment by 5 and 4.7 percentage points respectively. For men, however, the effect of chronic illness on all the three types of employment is insignificant. Further, the results indicate that acute illness does not significantly influence allocation of individuals into various employment types. These results imply that a 2 to 5 percent reduction in chronic illness will cause wage employment and agricultural self-employment to increase by between 10 to 25 percent.

The estimated effects of both chronic and acute illnesses are as expected. The two types of illnesses differ in the sense that chronic illnesses are of long duration and slow progression while acute illnesses start very quickly and only last for a short while. The results indicate that only chronic illness significantly influences individualôs probability of participating in various employment types. This is intuitive given that allocation of labor is a long term decision and so is influenced only by long term illness conditions rather than short term ones (Mwabu, 2007). While long term conditions like HIV/AIDS, diabetes, asthma, can cause someone to prefer some types of employments to others, short term conditions like malaria are unlikely.

The negative effect of chronic illness on chance of wage employment and agricultural self-employment can be attributed to the fact that wage employment is usually characterized by non flexible working hours and a standard work week, yet chronically ill individuals may require a flexible work schedule depending on type and severity of the chronic illness. Also since illness may affect an individualôs capacity to fulfill job requirements, hence productivity, chronically ill individuals may be less competitive for wage employment. Further, work in the agricultural sector relies heavily on physical ability yet chronic illness may make individuals weak and thus it is difficult for them to perform agricultural tasks.

These findings are in line with those of Bridges and Lawson (2008) who found that illness reduces the likelihood of being in the wage employment especially for women in Uganda. Zissimopoulos and Karoly (2007) also reported similar findings that illness increases the likelihood of individuals switching from full time wage employment to self employment. This, they argue may be because self employment is less formal than wage employment allowing workers here to take time off when ill. Similarly this could be because jobs in self employment are open to those in ill health unlike those in wage employment.

The results however contradict those of Giandrea. et al., (2008) who found that men in poor health or men whose spouse were in poor health were less likely than other similar respondents to switch from full time wage employment to self employment. This may be associated with the benefits of wage employment such as health insurance. This study also finds that chronic illness does not significantly influence menôs choice of type of employment contrary to Zissimopoulos and Karoly (2007) who find that men are the most affected by illness. This may reflect ability to make accommodations in work employment when self employed as opposed to when wage employment.

Education increases the probability of wage employment. Individuals with tertiary education are 28 percentage points more likely to be in wage employment compared to those with no formal education. The of effect tertiary education on wage employment is even higher for women. While tertiary education increases menôs probability of wage employment by 21 percentage points it increases womenôs probability of wage employment by 34 percentage points relative to those with no formal education.

Unlike for wage employment, however, tertiary education reduces the probability of self employment. It reduces the likelihood of individuals being in the non-agricultural and agricultural self-employment by 4 percentage points and 15 percentage points respectively. The tertiary educational effects on probability of agricultural self-employment are higher for women at 16 percentage points compared to men at 14 percentage points. Further, for women, secondary education also significantly reduces the likelihood of being employed in the agricultural self-employment.

Previous studies on Kenya also found that education is a key determinant of sector participation. Kabubo- Mariara (2003) found that higher levels of education increased the likelihood of men and women working in the public and private sectors relative to being self employed. Focusing on womenôs labor market behavior, Atieno (2006) found that education is a key determinant to womenôs access to formal sector employment. Nyaga (2010) found that primary, secondary, undergraduate and post graduate education increased the likelihood of participating in all the key sectors of employment relative to having no education. Wambugu (2011) found that education increased the likelihood of both men and women entering wage employment and that access to

informal and agricultural employment required low levels of education.

Studies outside Kenya also support the finding that education is a significant determinant of type of employment. For instance Bridges and Lawson (2008) found that in Uganda having a university education raised the probability of being in wage employment relative to self-employment for men. However the effect of education on female sector participation was insignificant unlike in Kenya where our study shows that education is a significant determinant of the probability of a woman working in wage employment. Similarly Vijverberg (1993); Dimova et al. (2010) and Glick and Sahn (1997) also found that education played an important role in sector participation in Cote dôIvoire, urban West Africa and Guinea respectively.

The positive effect of education on wage employment can be attributed to the fact that the wage employment has an organized system of employment with clear written rules of recruitment, with specific educational qualifications required for specific positions. Those who do not attain minimum educational requirements are not considered for employment. In contrast, non-agricultural and agricultural self-employments are not necessarily based on educational achievement.

Age and age squared are used to capture experience and lifecycle effects. The marginal effects show that age increases the likelihood of wage and non-agricultural self-employment but a turning point occurs where increases in age reduce the likelihood of wage employment and agricultural self-employment. The findings are in line with Dimova et al. (2010); Wambugu (2011); Nyaga (2010); Kabubo-Mariara (2003) and Atieno (2006) who found a concave relation between age variables and sector participation. This concave relationship is expected since individuals with more experience are more likely to be in wage employment. Other than educational requirements, employers also ask for experience in a given profession. However, as age increases, a point is reached when workerôs productivity starts to diminish thereby reducing their employability in wage employment.

Similarly, for non-agricultural self-employment, individuals with more experience are more likely to start own business. For agricultural self-employment, age reduces likelihood of

agricultural self-employment up to a certain point beyond which age increases the likelihood of agricultural self-employment. This convex relationship is intuitive given that young individuals may prefer non-agricultural work but it is only later in life after retirement that some may chose agricultural work (Institute of Development Studies, 2012).

Men are more likely than women to be in wage employment and in non-agricultural self-employment. Their probability of wage employment and non-agricultural self-employment is higher than that of women by 21 and 3 percentage points respectively. Men are however less likely to be in agricultural self-employment. In line with this study, Nyaga (2010) found that men are more likely to be in the formal sector, while Glick and Sahn (1997) found that women are more likely than men to be in wage employment. The higher probability of men participating in wage employment may be attributed to higher education attainment among men than among women. Because education increases the likelihood of being in wage employment, the effect may be stronger for men than among women. Additionally womenôs limited skills, limited access to productive resources, heavy domestic workload and cultural attitudes may explain their lower likelihood of participating in the formal sector (Suda, 2002).

Self-employment requires capital. Most women in Kenya still face constraints accessing capital to start own businesses due to lack of collateral since only a small percentage of women own property (Mwobobia, 2012). This may explain why women are less likely to be in non-agricultural self-employment. The higher chances of women being in agricultural self-employment may reflect sharing of responsibilities where the husband works off farm while the wife stays home and cultivates the land.

Married men are more likely than unmarried men to be in wage employment and non-agricultural self-employment. The chance of a married man being in wage employment and in non-agricultural self-employment is 10 percentage points higher than for a comparable but unmarried one. A married woman, on the other hand, is less likely than an unmarried women to be in wage employment but more likely to be in agricultural self-employment. Compared to their unmarried counterparts, a married woman is 16 percentage points less likely to be in wage employment and 3 percentage points more likely to be in the agricultural self-employment. Similar findings are shared by Wambugu (2011). Kabubo-Mariara (2003) and Wamuthenya

(2010) found that married men had higher likelihood of working in the formal sector relative to the informal sector. The negative effect of marriage on chance of women being employed in wage employment may reflect employerôs prejudice against female employees because of fear that they will interupt their careers due to family responsibilities.

Individuals living in rural areas are less likely than urban workers to be in wage employment and in non-agricultural self-employment but are more likely to be in agricultural self-employment. This is expected given that agriculture in Kenya is a predominantly rural activity while most wage employment and non-agricultural self-employment (usually inform of ñJua Kaliò activities) tend to be based in urban areas.

Men and women living in households that received transfers were more likely to be in wage employment. Similarly women from households that received transfers were more likely to be in non-agricultural self-employment. However, men and women living in households that received transfers were less likely to be in agricultural self-employment. This finding supports the finding by Wambugu (2011) that women from households that received transfers were less likely to be in the informal sector but contradicts finding by Nyaga (2010) that men and women living in households that received transfers were less likely to be in the formal sector but more likely to be in the informal sector.

Presence of children below 5 years in a household reduces the likelihood of wage employment. Individuals living in a household with children below 5 years are 5 percentage points less likely to be in wage employment relative to individuals living in households with no such children. Surprisingly however, the effect of children below 5 years on the probability of wage employment is higher for men than women. While children reduce a manôs chance of wage employment by 8 percentage points, they only reduce a womanôs chance by 3 percentage points. This finding are in line with Dimova et al. (2010) that presence of children (0-5 years) increased the likelihood of men being in self employment and that the effect is higher for men than women. Kabubo-Mariara (2003) also found that presence of children 0-6 years reduced the likelihood of men working in wage employment relative to self employment. This could be because children bring about two responsibilities: of provision and of need to be taken care of.

Reduced chance of participation in wage employment due to presence of children may indicate need for children to be taken care of.

Table 3-4: Estimates of Effect of Chronic Illness on Employment status, Marginal Effects

Variable	Full sample			Male sample			Female sample		
	Wage employment	Non-agricultural self - employment	Agricultural self-employment	Wage employment	Non-agricultural self-employment	Agricultural Self-employment	Wage employment	Non-agricultural self - employment	Agricultural self - employment
Chronic illness	-0.0465***	0.0102	-0.0317**	-0.0244	-0.0057	-0.0169	-0.0548***	0.0157	-0.0471***
	[0.014]	[0.011]	[0.013]	[0.023]	[0.017]	[0.020]	[0.014]	[0.015]	[0.017]
Age	0.0378***	0.0157***	-0.0081***	0.0386***	0.0059*	-0.0196***	0.0263***	0.0223***	0.0065*
	[0.003]	[0.002]	[0.002]	[0.004]	[0.003]	[0.003]	[0.003]	[0.003]	[0.004]
Age squared	-0.0005***	-0.0002***	0.0002***	-0.0005***	-0.0001*	0.0003***	-0.0003***	-0.0003***	0.0001
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Gender: male=1	0.2045***	0.0204***	-0.0353***						
	[0.009]	[0.007]	[0.009]						
Education (no formal education is the reference category)									
Primary education	0.014	0.0043	0.0015	-0.0122	0.0056	-0.0087	0.0245	0.0038	0.0198
	[0.012]	[0.009]	[0.011]	[0.018]	[0.013]	[0.015]	[0.015]	[0.013]	[0.015]
Secondary education	0.0345**	0.0006	-0.0295**	-0.0102	0.0167	-0.0252	0.0691***	-0.0146	-0.0254
	[0.014]	[0.011]	[0.013]	[0.020]	[0.016]	[0.017]	[0.019]	[0.015]	[0.020]
Tertiary education	0.2807***	-0.0411***	-0.1507***	0.2117***	-0.0218	-0.1394***	0.3428***	-0.0630***	-0.1595***
	[0.017]	[0.010]	[0.012]	[0.022]	[0.015]	[0.016]	[0.025]	[0.013]	[0.018]
Marital status	-0.0574***	0.0621***	0.0049	0.0965***	0.1021***	-0.0122	-0.1620***	0.0291**	0.0199
(married=1	[0.012]	[0.009]	[0.012]	[0.019]	[0.014]	[0.018]	[0.014]	[0.011]	[0.015]
Presence of children 0-5 years (no child is the reference category)									
1 child	-0.0019	0.0135	-0.0421***	-0.0217	0.0289**	-0.0254*	0	-0.0072	-0.0534***
	[0.011]	[0.009]	[0.011]	[0.017]	[0.013]	[0.015]	[0.013]	[0.012]	[0.015]
2 or more children	-0.0415***	-0.0062	0.0016	-0.0758***	-0.0039	0.0322*	-0.0319**	-0.0135	-0.0185
	[0.013]	[0.010]	[0.012]	[0.019]	[0.015]	[0.018]	[0.015]	[0.014]	[0.017]
Rural area	-0.1777***	-0.1342***	0.4053***	-0.2195***	-0.1158***	0.3775***	-0.1055***	-0.1453***	0.4193***
	[0.010]	[0.008]	[0.007]	[0.014]	[0.011]	[0.010]	[0.012]	[0.012]	[0.011]
Transfers	0.0329***	0.0166**	-0.0744***	0.0409***	0.008	-0.0632***	0.0252**	0.0249**	-0.0876***
	[0.010]	[0.008]	[0.010]	[0.015]	[0.011]	[0.014]	[0.012]	[0.011]	[0.015]
Number of observations	11,230	11,230	11,230	5,880	5,880	5,880	5,350	5,350	5,350
LR χ^2	3691	3691	3691	1685	1685	1685	1754	1754	1754
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Robust standard errors in brackets ***, ** , *: significant at 1%, 5% and 10% respectively

Table 3-5: Estimates of Effect of Acute Illness on Employment Status, Marginal Effects

Variable	Full sample			Male sample			Female sample		
	Wage employment	Non-agricultural self-employment	Agricultural self-employment	Wage employment	Non-agricultural self-employment	Agricultural self-employment	Wage employment	Non-agricultural self-employment	Agricultural self-employment
Acute illness	-0.0023	0.0089	-0.0138	0.006	0.016	-0.0139	-0.0093	0.0024	-0.0167
	[0.011]	[0.009]	[0.011]	[0.017]	[0.013]	[0.015]	[0.013]	[0.011]	[0.014]
Age	0.0401***	0.0175***	-0.0083***	0.0376***	0.0097***	-0.0178***	0.0307***	0.0215***	0.0038
	[0.003]	[0.002]	[0.002]	[0.004]	[0.003]	[0.003]	[0.003]	[0.003]	[0.004]
Age squared	-0.0005***	-0.0002***	0.0002***	-0.0005***	-0.0001***	0.0003***	-0.0004***	-0.0002***	0
	[0.000]	[0.000]	[0.000]						
Gender: Male=1	0.2058***	0.0266***	-0.0386***						
	[0.009]	[0.007]	[0.009]						
Education (No formal education if the reference category)									
Primary education	0.0011	0.0125	0.0057	-0.0301*	0.0144	0.0087	0.0159	0.0098	0.0133
	[0.011]	[0.009]	[0.010]	[0.017]	[0.013]	[0.014]	[0.014]	[0.012]	[0.015]
Secondary education	0.0158	0.0082	-0.0257**	-0.0209	0.0045	-0.0046	0.0392**	0.0127	-0.0384**
	[0.013]	[0.011]	[0.012]	[0.019]	[0.015]	[0.017]	[0.017]	[0.015]	[0.018]
Tertiary education	0.2631***	-0.0371***	-0.1457***	0.1976***	-0.0359**	-0.1284***	0.3157***	-0.0419***	-0.1542***
	[0.016]	[0.010]	[0.012]	[0.021]	[0.014]	[0.016]	[0.024]	[0.014]	[0.018]
Marital status	-0.0689***	0.0496***	0.009	0.0952***	0.0874***	-0.0208	-0.1737***	0.0175	0.0343**
(Married=1)	[0.011]	[0.009]	[0.011]	[0.019]	[0.014]	[0.017]	[0.013]	[0.011]	[0.014]
Presence of children 0-5 years (No child is the reference category)									
1 child (0-5 years)	-0.005	0.0285***	-0.0365***	-0.0199	0.0446***	-0.0290**	-0.0081	0.0083	-0.0363**
	[0.011]	[0.009]	[0.010]	[0.017]	[0.013]	[0.014]	[0.013]	[0.012]	[0.015]
2 or more children	-0.0593***	0.0027	0.0118	-0.0918***	0.0122	0.0373**	-0.0484***	-0.0112	-0.0013
	[0.012]	[0.010]	[0.012]	[0.018]	[0.015]	[0.017]	[0.014]	[0.013]	[0.016]
Rural area	-0.1804***	-0.1359***	0.4052***	-0.2170***	-0.1243***	0.3750***	-0.1125***	-0.1404***	0.4194***
	[0.009]	[0.008]	[0.007]	[0.014]	[0.011]	[0.010]	[0.011]	[0.011]	[0.010]
Transfers	0.0186*	0.0142*	-0.0679***	0.0262*	0.0118	-0.0601***	0.0143	0.0164	-0.0779***
	[0.010]	[0.008]	[0.010]	[0.014]	[0.010]	[0.013]	[0.011]	[0.010]	[0.014]
Number of observations	12,451	12,451	12,451	6,440	6,440	6,440	6,011	6,011	6,011
LR χ^2	4188	4188	4188	1859	1859	1859	1984	1984	1984
P-value	0.000	0.000	0.000	0.000	0.000	0.0000	0.000	0.000	0.000

Robust standard errors in brackets ***, ** , *: significant at 1%, 5% and 10% respectively

3.5. Summary, conclusion and policy implication

Summary and conclusion

Allocations and reallocation of labor across sectors is important for economic development and constraints to this process slow down the economic transformation process (Agenor, 1996). Health as a form of human capital can affect time available for work (Grossman, 1972). Ill health may lead individuals to choose work with flexible working hours hence affecting allocation and reallocation of labor across various employment types. Given that the burden of illness in Kenya is high and increasing (Economic surveys, various issues), it is important to understand how illness affects employment patterns. The main objective of this essay was to examine the effect of illness on the probability of participating in various employment types in Kenya.

Previous studies of employment patterns in Kenya have examined factors affecting sector participation (Kabubo- Mariara, 2003; Atieno, 2006; Atieno and Teal, 2006; Nyaga, 2010; Wamuthenya, 2010; Wambugu, 2011). However, these studies do not estimate the effect of health status on sector participation. The focus has been on the education dimension of human capital. If health human capital constrains labor allocation and reallocation across various employment types, this could have implications for economic transformation and economic development. This is because economic growth occurs as the workers move into wage employment and higher productivity jobs.

The effect of chronic and acute illness on the probability of participating in various employment types was estimated in this essay using multinomial probit models. The estimated model had four employment states: wage employment, non-agricultural self-employment, agricultural self-employment and not working. The use of multinomial probit was justified because the data did not support the multinomial logitôs assumption of IIA.

From the empirical analysis, chronic illness constrains participation in various employment types especially for women. Chronically ill women are less likely to be in wage employment and in agricultural self-employment. Their likelihood of participating in wage employment and in agricultural self-employment is lower by 5 percentage points compared to those who are not ill. Acute illness is not a barrier to participating in various employment types for both men and

women. Chronic illness is not a significant determinant of menôs probability of participating in various employment types. Simulations show that a 2 to 5 percent reduction in chronic illness increases wage employment and agricultural self-employment by between 10 to 25 percent.

Results indicate that it is only chronic illness that significantly affects employment status and not acute illness. This points to the usefulness of separating acute illness from chronic illness when estimating the effect of illness on employment status. Also, the effect of chronic illness on employment status is only significant for women and not men highlighting the importance of carrying separate analysis for men and women. Further, results indicate that chronic illness only significantly affects the likelihood of participating in wage employment and in agricultural self-employment but not in non-agricultural self-employment underscoring the need to separate agricultural from non-agricultural self-employment when doing such analysis.

Education has significant effects on patterns of employment. Individuals with tertiary education are more likely to be in wage employment but are less likely to be in self employment. The effect of education on probability of participating in the various employment types is higher for women than for men. Men are more likely to be in wage employment and in non-agricultural wage employment but are less likely to be in agricultural self-employment. Other factors that significantly affect sector participation include: age, marital status, area of residence, non labor income and presence of children 0-5 years.

The results indicate that chronic illness reduces chance of wage employment and agricultural self-employment especially for women. In Africa, half of poor individuals (living on one dollar a day) operate a non agricultural business (Banerjee and Duflo, 2007). According to ILO (2013), many employed individuals earn so little that they cannot even afford a standard of living of a dollar each day. By acting as a constraint to women participating in wage employment, illness therefore, exposes women to poverty

Further, the economy as a whole suffers due to this negative effect of illness on labor allocation and reallocation. The process of economic growth is affected if there are constraints to the process of labor allocation and reallocation (Agenor, 1996). One aspect of increased growth of a country is increased share of workforce in the wage employment (World Bank, 1995; 2012). Growth

occurs as low productivity jobs are replaced by high productivity jobs. As long as illness pushes individuals into low productivity jobs, it negatively affects the transformation process and hence the growth process.

Policy implications

The findings in this essay imply that illness especially chronic illness constrains women access to wage employment and agricultural self employment. Wage employment is usually characterized by job security and benefits such as pension plan and health insurance (Agenor, 1996). By also being unlikely to be in agricultural self employment, chronically ill women are left with the only choice of non-agricultural self-employment. Yet, according to Banerjee and Duflo (2007), many of the poor in Africa report to be involved in non-agricultural self-employment. There is therefore need for government to expand health interventions to manage and reduce incidence and prevalence of chronic illnesses so as to promote wage employment and agricultural self employment. Such health intervention should especially target women.

Education, especially tertiary education, increases chance of wage employment more so for women. This implies that measures to increase access to tertiary education would increases access to wage employment and agricultural self employment. Given that the effect of female education is larger than that for male education, specific interventions to increase access to tertiary education for women should be explored.

Areas for future research

Studies that have analyzed the relationship between illness and employment status in developed countries have mainly used panel data sets. Panel data is suitable for such analysis because it facilitates tracking of individuals through time and how their health status changes over time and how this affects their movement across sectors. Future studies in developing countries should consider estimating the effect of illness on employment status using panel data. This was beyond the scope of this essay due to data limitations. Future studies can also examine the relationship between health status and individual occupational choices. Studies can also explore the effect of different types of diseases (such as HIV/AID, high blood pressure) on employment status and the effects of other dimensions of health on employment status. Similarly a question that emerged

from this thesis is whether ill individuals are discriminated against in their choice of employment type. Future studies can explore this further.

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CHAPTER FOUR: EFFECT OF ILLNESS ON EARNINGS

4.1. Introduction

Neoclassical economic theory postulates that economic growth depends mainly on stock of labor, stock of capital and on factor productivity (Solow, 1956). In the Solow model, productivity depends on exogenous technological progress. Researchers have attempted to replace the assumption of exogenous technical progress by providing an explanation as to what may be driving productivity and this has led to the discussion about the importance of human capital in increasing productivity and hence economic growth (Mankiw et al, 1992; Mincer, 1958; Mushkin, 1962; Ben-Porath, 1967; Schultz 1961; Becker, 1962).

Health as a component of human capital (Grossman, 1972) can influence an individualôs capacity to fulfill job requirements and hence their productivity (Becker, 1962; Mushkin, 1962; Schultz, 1961; Grossman, 1972). Healthy workers are physically and mentally more energetic and may have higher cognitive skills and reasoning ability and hence may be more productive than their unhealthy counterparts. They are also expected to be more flexible and adaptable to changes and to make efficient use of technology and machinery. They may also be more able to concentrate than those in ill health and to exert effort. Employers may prefer healthy workers to unhealthy workers on account of higher potential productivity of healthy workers. Workers in ill health may be discriminated against by being offered lower wages (Johnson and Lambrinos, 1985). Ill individuals may accept non wage benefits such as medical insurance in exchange for lower wages (Cai, 2009).

Ill health may therefore be negatively correlated with labor earnings. In Kenya, most individuals derive their income from labor earnings. Labor earnings therefore directly influence individualôs standards of living with implications for poverty reduction and economic growth (World Bank, 2012). By affecting earnings, illness may also bring about differences in earnings and further exacerbate inequalities in income. It is important to worry about the relationship between illness and earnings because of a high and rising disease burden in Kenya.

Prior labor market research on wages in Kenya has mainly focused on the wage premium to education (Appleton et al., 1999; Soderbom et al., 2004; Kimenyi et al, 2006; Knight and Sabot,

1990; Bwonda, 2013). However, little attention has been given to other dimensions of human capital despite the high disease burden faced by Kenya and the importance of labor earnings for the welfare of the Kenyan households. Fox et al. (2004) analyzed the impact of HIV/AIDS on labor productivity of agricultural tea estate workers in Kericho, Kenya. Kioko et al. (2013) and Mwabu (2007b) estimated the economic impact of malaria on wage earnings in Kenya. This essay extends the literature by examining the impact of health status on earnings in various forms of employment using recent modeling techniques.

This essay makes four contributions to the literature. First it provides empirical evidence from Kenya on the effect of illness on labor earnings. This is important given the high and rising disease burden in Kenya and the potential negative effect of illness on productivity and hence on earnings. Second, this study considers the effect of both chronic and acute illness on earnings. This is important because chronic illness and acute illness have differing effects on health and possibly on earnings (Mwabu, 2007a). Third, this study provides a more comprehensive view of the effect of illness on earnings by considering three employment types. There is evidence (Glick and Sahn, 1998) that the impact of health status on earnings may vary according to the type of employment. Fourth, this essay controls for potential endogeneity of the health variable, potential unobserved individual heterogeneity and potential sample selection bias.

The primary objective of this essay was to examine the relationship between ill heath and earnings in Kenya. Specifically, the objectives of this essay are to:

a) Examine the relationship between chronic and acute illnesses and earnings of wage employees, self-employed non-agricultural workers and self-employed agricultural workers.
b) Investigate whether there are gender differences in the effect of illness on earnings in the three employment types.
c) Draw policy implications for increasing labor earnings.

The rest of the essay is organized as follows. Section 4.2 reviews theoretical and empirical literature on health and earnings. Section 4.3 presents the methodology, data and summary

statistics. Section 4.4 presents the results while section 4.5 presents the summary, conclusion and policy implications.

4.2. Literature review

Although there has been growing interest in the potential effect of health on incomes, micro studies are still few. This section reviews both theoretical and empirical literature on the relationship between health and earnings. Sub section 4.2.1 reviews theories on the relationship between health and productivity. These are the human capital theory, the discrimination theory and the total compensation theory. This is followed by a review of empirical studies in sub section 4.2.2.

4.2.1. Theoretical literature

The relationship between health and wages can be explained by three theories: Human capital theory, discrimination theory and total compensation theory (Cai, 2009). The human capital theory views health as a form of human capital that influences a personôs productivity (Becker, 1962; Mushkin, 1962; Schultz, 1961; Grossman, 1972). Becker (1962) argues that physical health and emotional health may be important determinants of earnings. He argues that a better diet adds to physical strength and stamina thereby improving an individualôs productive capacity. According to Schultz (1961), health improves the quality of human resources. He relates large differences among individuals in earnings mainly to differences in health and education. Mushkin (1962) argues that health increases the quality of what laborers produce and increases effectiveness of individuals at work. Health is therefore thought to influence an individualôs capacity to fulfil job requirements hence their productivity. According to Grossman (1972), healthy workers are able to work more efficiently than their unhealthy counterparts and have the capacity to adequately perform job reqirements. Healthy workers may be willing to invest in skill development since they have longer lifespans to reap the returns from investments which improve their productivity.

According to the discriminantion theory, employers may discriminate against individuals in ill health by offering them lower wages regardless of their productivity (Johnson and Lambrinos, 1985). Employers may prefer to employ healthier individuals since they are more productive

and so the unhealthy ones can only be considered if they agree to take up lower wages.

The theory of compensating wage differentials or total compensation theory can also explain earnings differences between healthy and unhealthy individuals (Mullahy and Sindelar, 1995). According to the theory, individuals in poor health may accept lower wages in exchange for other benefits that favor their ill state such as flexible work schedules, smaller work load and medical insurance (Cai, 2009).

4.2.2. Empirical literature

Several studies have analyzed the relationship between health status and earnings. One early study is by Luft (1975) who examined the effect of illness and disability on wages of U.S workers using simple mean analysis and regression analysis. He found that the impact of illness on wage rates was greater for men than for women. However, the estimates may be biased because endogeneity of the health variable was not controlled for, in the wage equation estimated.

Since the study by Luft (1975), a number of studies have examined the relationship between health status and wages using recent estimation techniques. Mwabu (2007b) estimated the economic burden of malaria in Kenya using ordinary least squares (OLS) and least absolute deviations method. However the study did not control for endogeneity of the health variable. He found that that malaria reduced wage incomes by between 15-16 percentage points relative to other diseases.

Schultz (2002) examined the effect of height on wages in Ghana, Brazil and United States. In another study, Schultz (2003) examined the effect of height and body mass index (BMI) on wages in Ghana and Ivory Coast. Kioko et al (2013) estimated the economic impact of malaria on wages in Kenya. These studies control for endogeneity of the health variable using the instrumental variable approach. Instrumental variables used range from regional health input prices and parental education (Schultz, 2002) to local health infrastructure and food prices (Schultz, 2003), to time taken to get to the river during wet and dry seasons and time taken to reach the firewood collection point (Kioko et al., 2013)

Schultz (2003) found that height had no significant effect on men and womenôs wages in Ivory Coast but in Ghana a 1 centimeter increase in height led to 5.6% and 7.6% increase in wages for men and women respectively. Further, a unit increase in BMI increased men and womenôs wages in Ghana and Ivory Coast by at least 7%. Schultz (2002) also found significant effect of height on wages. He found that a one centimeter increase in height was associated with 8-9 % increase in wages for men and 11% increase for women in Brazil and Ghana while for United States, this is associated with a 3% increase in wages for men and 4.6% increase in wages for women. Kioko et al. (2013) found that increased prevalence of malaria was associated with a 3.81 decline in log wage earnings. Individuals suffering from malaria earned 44% less in wage income compared to their healthy counterparts.

In estimating the effect of illness on earnings, there may be unobservable factors that affect both the probability of working and earnings resulting to sample selection bias. Failure to control for sample selection bias results in inconsistent estimates (Greene, 2008). The studies reviewed above do not control for sample selection bias. Consequently, the estimated labor market effect of health status may be biased.

Studies that controlled for sample selection have taken two approaches: those that use binary selection model and those that use a dichotomous selection model. Sahn and Alderman (1988) examined the relationship between nutrition and wages in Sri Lanka. Calorie intake was treated as potentially endogenous and instrumented using household demographic variables and prices. They controlled for selection into wage earning category by estimating a probit model and then included the inverse mills ratio in the wage equation. They found that a 1% increase in calorie intake among men led to a 0.21% increase in wages.

Thomas and Strauss (1997) also controlled for sample selection bias. They examined the effect of health status on wages of workers in urban Brazil using four anthropometric indicators of health; height, body mass index (BMI), per capita calorie intake and per capita protein intake. To control for endogeneity of BMI, per capita calorie intake and per capita protein intake, the instrumental variable method was used with relative food prices as instruments. Height was considered

exogenous because it was thought to be already determined by adulthood. They controlled for selection into employment sectors using a binary model for men and a multinomial model for women. The authors found that menôs height and BMI are associated with higher wages in the market and self employment sector and that the effects of height and BMI are higher for the self employed. For women, however, height increased wages only in the market sector but not in the self employment sector and BMI does not significantly affect their wages. Further, per capita calorie and protein intake were also found to increase wages of men and women in the market sector but to have no effect on wages in the self employed sector.

Some studies tested and found sample selection bias to be absent in the data (Glick and Sahn, 1998; Schultz and Tansel, 1997). Glick and Sahn (1998) also examined the effect of height, BMI, per capita calorie and protein availability on hourly wages in Guinea. Focusing on Ghana and Ivory Coast, Schultz and Tansel (1997) used number of days disabled due to illness as a health status measure in a study of the effect of health on wages. Both studies control for endogeneity of the health variable using the instrumental variable approach. Glick and Sahn (1998) instrumented for health using relative food prices, two measures of household assets, household size and the number of adults in the household by sex and educational level. They found that height and BMI raised earnings of men in both self employment and private wage employment but only BMI affect womenôs earnings and only for the self employed. Per capita calorie and protein availability were found not to significantly affect earnings of both men and women. Schultz and Tansel (1997) used relative food prices and local health infrastructure as instrumental variables for health and found that a disabled day was associated with a 33% and 26% reduction in wages in Ivory Coast and Ghana respectively.

4.2.3. Summary of literature

The theories of earnings determination suggest a negative relationship between illness and earnings. However, wages are usually set over a long period of time through contracts. Therefore, the effect of illness on wages may depend on how flexible wages are. While substantial empirical literature exists on developing countries of the effect of ill health on earnings, evidence on SSA remains scarce. There is need to use robust approaches in estimating the effect of

illness on earnings to obtain robust estimates. Endogeneity of health status and sample selection need to be taken into account to obtain consistent estimates. It is also important to take into account heterogeneity of individuals by sex and type of employment to obtain comprehensive estimates. This essay considers the effect of illness on earnings in wage employment, in non- agricultural self-employment and in agricultural self-employment. This is important because according to Glick and Sahn (1998), the impact of health on earnings may vary according to type of employment.

It is also possible that there maybe non linear interaction between the health status variable and unobervable factors causing the effect of health on wages to vary by individual. If not controlled for, estimates may contain unobserved heterogeneity bias. This issue has not been addressed by previous studies, but this essay attempts to fill this gap.

4.3. Methodology

4.3.1. Conceptual framework

In the conceptual framework outlined in chapter 1, earning is a labor market outcome. Personal and socioeconomic characteristics can influence earnings directly e.g. gender, education (Becker, 1962; Mincer, 1958). Health is a component of human capital (Grossman, 1972) that can be influenced by factors such as education which increases the efficiency of producing health and thus can increase an individualôs health capital. Health also depends on other variables such as age (health depreciates with age), health care among others. An individualôs stock of health influences their earnings (Becker, 1962; Mushkin, 1962; Schultz, 1961). The stock of health influences an individualôs capacity to fulfill job requirements hence influencing their productivity. This can also generate feedback effects as shown in the conceptual framework. Wages can for instance be used to improve oneôs health status.

4.3.2. Theoretical framework

Human capital theory postulates that individuals are productive agents who can be improved through investment in education, training, health and that their investments yield a stream of future, returns (Mushkin, 1962). Since these investments make individuals effective producers, they can be likened to investment in physical capital. According to Mankiw et al. (1992), human

capital is important in explaining income variations at macro level. They augment the Solow model by including accumulation of human capital in addition to physical capital.

The human capital earnings model is the framework used to study earnings determination at micro level. It was pioneered by Mincer (1958) who developed a model to explain differences in personal incomes with a focus on education. Assuming that the direct cost of educational services was zero, he compared the present value of life time earnings of individuals with differing years of education. The model predicts that individuals with more education have higher annual pay than those with less education.

Mincer and Polachek (1974) later modified the model to relate stream of investment in individualôs human capital to their earnings growth as follows,

$$E_t = E_{t-1} + rC_{t-1} \tag{4.1}$$

Where E_t is earnings in period t, E_{t-1} is earnings in period $t-1$, r is average return to investment in individualôs human capital. The return is assumed to be fixed across periods. C_{t-1} is the net investment in human capital in period $t-1$.

Let the ratio of investments in human capital in a period to the earnings in that period be given as, $k_t = \frac{C_t}{E_t}$, then equation (1) can be written as,

$$E_t = E_{t-1}(1 + rk_{t-1}) \tag{4.2}$$

By recursion, equation (2) can be written as

$$E_t = E_0(1 + rk_0)(1 + rk_1).....(1 + rk_{t-1}) \tag{4.3}$$

Since the term rk is a small fraction, logarithmic approximation of $\ln(1 + rk)$ is approximately equal to rk

Equation (4.3) can now be written as,

$$\ln E_t = \ln E_0 + r\sum_{t=0}^{t-1} k_t \tag{4.4}$$

Mincer and Polachek (1974) considered education and training components of human capital

following Mincer (1958) and Becker (1962) and so equation (4.4) can be extended as

$$\ln E_t = \ln E_0 + r\sum_{i=0}^{s-1} k_i + r\sum_{j=s}^{t-1} k_j \quad (4.5)$$

Where k_i is the investment earnings ratio during schooling period and k_j is the investment earnings ratio during the post schooling experience period.

Health human capital improves quality of labor and hence labor productivity (Mushkin, 1962). Therefore healthier individuals are expected to earn more than unhealthy individuals. The framework by Mincer and Polachek (1974) could be extended to include health capital in the earnings equation (4.5) as follows

$$\ln E_t = \ln E_0 + r\sum_{i=0}^{s-1} k_i + r\sum_{j=s}^{t-1} k_j + r\sum_{l=0}^{t-1} k_l \quad (4.6)$$

Where k_l is the ratio of investment to earnings during the period an individual invests in own health. In the next section, this theoretical framework informs the inclusion of education, training and health in the human capital earnings function.

4.3.3. Empirical model

From the theoretical framework outlines in the previous section and following Mwabu (2009); Wooldridge (2002) and Mincer (1974), we specify the earnings equation, the health equation and the sample selection equation as follows,

$$\ln E_s = \sum \beta_1 x_1 + \theta H + \varepsilon_1 \quad (4.7)$$

$$H = [x\beta_2 + \varepsilon_2 > 0] \quad (4.8)$$

$$S = x\beta_3 + \varepsilon_3 \quad (4.9)$$

Where, $\ln E_s$, is the natural log of monthly earnings of a worker in employment type S; x is a vector of exogenous variables that includes x_1 exogenous variables that determine earnings equation and a vector of instrumental variables, x_2 that affect the health variable. S, is an indicator function for selection of a worker into employment. There are four employment states (S): wage employment ($S=1$), non-agricultural self-employment ($S=2$), agricultural self-

employment ($S = 3$) and not working ($S = 4$). $\beta_1, \beta_2, \beta_3, \theta$ are parameters to be estimated while $\varepsilon_1, \varepsilon_2, \varepsilon_3$ are disturbance terms.

There are three problems that may be encountered in estimating the effect of illness on earnings. The first estimation issue is sample selection bias. It occurs when we observe the dependent variable only for a limited non random sample (Wooldridge, 2002). The Heckman (1979) selection model for binary selection variable is commonly used. However, the selection variable in this study is polychotomous, that is, individuals are either working in wage employment, in non-agricultural self-employment, in agricultural self-employment or not working. The Heckman model was extended to handle such cases (see Lee, 1983; Dubin and McFadden, 1984; and Dahl 2002) in the context of multinomial logit model. In the first stage of Lee (1983) procedure, the multinomial logit model is estimated and then the equivalent of inverse mills ratio are obtained for each employment typeôs earning equation. This ratio is based on the correlation between the disturbance term of each earnings equation and the cumulative distribution of the errors in the selection equation. This approach assumes that unobservable factors affecting an individualôs choice of wage employment against agricultural self-employment for example should be correlated in the same direction as unobservable factors affecting earnings. Lee also assumed that the selection bias can be explained by one selection term.

The approaches of Dubin and McFadden (1984) and Dahl (2002) are variants of Lee (1983)ôs approach. Dubin and McFadden (1984) relaxed the assumption by Lee (1983) that all correlations have same the sign and that one selection term is enough to control for selection bias. They instead, proposed multiple correlation terms that sum up to zero for selection in employment type S as opposed to other employment types.

Monte-Carlo experiments were carried out by Bourguignon et al. (2007) to show which model performed better. They found that while Lee (1983) is adaptable to small samples, it is not recommended because of its strong assumption on residual covariance which is most likely violated in practical work. It was found to perform worse than the Dubin and McFadden (1984) approach. Although Dubin and McFadden (1984) performed better than the Lee (1983), it relies

on the assumption that the correlation terms sum to zero. The model performed better when this assumption is true but sensitive when violated. Bourguignon et al. (2007) proposed an alternative version of Dubin and McFadden (1984) which we call the BFG approach after the deveopers (Bourguignon, Fournier and Gurgand) that relax the assumption of correlation coefficients summing up to zero. The BFG approach takes into account correlation between the error term from each earnings equation and error term from each multinomial logit choice ($\varepsilon_1, \varepsilon_3$). This approach allows us to obtain bias correction terms equal to the number of multinomial logit choices to be included in the earnings equation. Monte-Carlo experiments indicated that the BFG approach performed the best. One advantage with this approach is that even when the IIA assumption is violated, selection bias correction based on multinomial logit still provides good correction for selection bias (Bourguignon et al., 2007).

The first step in the BFG approach is to estimate the multinomial logit for sample selection in equation (4.9). Then the selectivity terms associated with each employment type are added as explanatory variables in the earnings equation (4.7) which now becomes

$$\ln E_S = \sum \beta_1 X + \theta H + \sum \phi_S \lambda_S + \varepsilon_1 \tag{4.10}$$

Where λ_S are the selection correction terms (Inverse mills ratio) equal to the number of multinomial logit choices. The BFG method allows us to correct for selection bias even when IIA condition does not hold (Bourguignon et al. 2007) The method also allows us to know whether individuals are allocated in their ôrightô employment types based on their unobserved characteristics. Due to the two step nature of the method, even if estimates from equation (4.6) are consistent, they are associated with inefficient standard errors. To obtain efficient standard errors, a bootstrapping procedure (Dimova et al., 2010) was used. The selection equation was identified using non labor income (transfers). That is, whether an individual received transfers or not.

The second estimation issue is that health status can be endogenous in the earnings equation because of simultaneity bias, omitted variables and measurement and reporting errors. Health

status may affect an individualôs productivity and hence earnings (Becker, 1962; Mushkin, 1962; Schultz, 1961). But labor earnings can be used to invest in an individualôs health status improvement. Thirdly, unobserved individual heterogeneity may occur if there is non linear interaction between the unobservable factors and the endogeneous variables causing the effect of the endogeneous variables on the dependent variable to vary by individual. Potential endogeneity of the health status variable and unobserved individual heterogeneity were dealt with using the control function approach (Card, 2001; Florens et al., 2008; Petrin and Train, 2009; Diagne and Diene, 2011). The first step of the control function approach is the two stage residual inclusion (2SRI) estimation (Terza et al., 2008)

Acute illness is instrumented for by percentage of people in the district who slept under a bed net. Choice of this instrument is informed by two reasons. First, malaria is among the leading causes of morbidity in Kenya. Mosquito nets are usually used to prevent malaria. Use of mosquito nets is therefore likely to be related with the probability of reporting illness. Second, use of mosquito nets picks the disease environment which is one of the determinants of health status (Strauss and Thomas, 1998). Chronic illness is instrumented for by percentage of children fully immunized in the district. The choice of this instrument is motivated by the fact that the percentage of children fully immunized in a district may reflect accessibility to health care in that district. Strauss and Thomas (1998) identifies health facilities as one of the determinants of health status.

The estimation procedure involves first obtaining predicted residuals (V) from the reduced-form health equation (4.8). The predicted residuals are then included in equation (4.10) as one of the explanatory variables to test and control for endogeneity of illness. This constitutes the 2SRI estimation (Terza et al., 2008).

$$\ln E_S = \sum \beta x_1 + \theta H + \sum \phi_S \lambda_S + \gamma V + \mu \qquad (4.11)$$

In addition to the reduced form residuals, the interaction of health status residuals and the health variable $(H * V)$ is included in equation (4.11) to test and control for unobserved heterogeneity. This constitutes the control function approach (Card, 2001; Florens et al., 2008; Petrin and Train, 2009; Diagne and Diene, 2011). Equation (4.11) can now be extended as follows

$$\ln E_S = \sum \beta x_1 + \theta H + \sum \phi_S \lambda_S + \gamma V + \varphi H * V + \mu \quad (4.12)$$

Where V and $H * V$ are control function approach variables. V serves to control for unobserved factors correlated with the health status variable such as time and risk preference variable, thus allowing the health status variable to be treated as exogenous. $H * V$ controls for non linear interactions of unobserved variables such as ability and motivation with the determinants of earnings that have not been controlled for.

Variable definitions

The dependent variable is the log of monthly earnings. The independent variables include health status, education, age, marital status and area of residence. Health status is included in the model because it is a form of human capital that can affect an individualôs capacity to fulfill job requirements hence productivity and earnings (Becker, 1962; Mushkin, 1962; Schultz, 1961; Grossman, 1972). Also, according to Johnson and Lambrinos (1985), unhealthy individuals may be discriminated against by their employers by being offered lower wages than their healthy counterparts. Individuals in ill health may also accept lower wages in exchange for other benefits such as medical cover, lower work load, flexible work schedules, etc (Cai, 2009). Health status is measured by type of disease, either chronic or acute illness. Chronic illness equals 1 if an individual reported having a chronic illness and zero if an individual reported no illness. Acute illness equals 1 if an individual reported an acute illness and zero if an individual reported no illness. Both chronic and acute illnesses are expected to reduce earnings of workers.

Education is included in the earnings equation because like health, education is considered a component of human capital that can affect an individualôs wage (Becker, 1962; Mushkin, 1962; Schultz, 1961). Education is measured in four levels: no education, primary education, secondary education and tertiary education. A dummy variable is created for each level of education which equals 1 if an individual reported having that level of education and 0 if otherwise. Education is expected to have a positive effect on earnings. Previous studies found this result (Wambugu, 2011; Nyaga, 2010; Kabubo-Mariara, 2003).

Individualôs age is measured in years. It is used to capture experience. According to Mincer

(1958) passage of time brings about accumulation of human capital and skills. Thus, a positive relationship is expected between age and earnings. However, as people grow older productivity declines especially in jobs that require physical strength leading to reduced earnings. Thus, a negative relationship is expected between age squared and earnings. Therefore, an inverted U relationship is expected between age and earnings as found in previous studies (see Wambugu, 2011; Kabubo-Mariara, 2003; Nyaga, 2010)

Marital status is included in the model because earnings may vary by marital status. According to Haberfeld and Cohen (1991), married men earn more than the unmarried ones for a number of reasons. First, wives may increase the husbandôs wages by for instance improving household decision making, providing emotional support, providing advice on job related matters etc. Second, men who earn may also be more likely to get married. Third, married men may be perceived as stable, responsible and therefore more productive by employers. Married women are expected to earn less. For women, marriage comes with the responsibility of children which may lead to job experience loss, productivity loss, preference for jobs with flexible work hours and possibility of discrimination by employers (Budig and England, 2001).

Individuals living in urban areas may earn more in form of wages than those in rural areas. This may be because jobs that attract lower wages such as teaching, nursing are mainly concentrated in rural areas. Area of residence is measured as a dummy variable which equals 1 if an individual reported to be living in the rural area and 0 otherwise. A negative relationship is expected between the rural dummy and wages earned. This has been found in previous studies for Kenya (Nyaga, 2010).

4.3.4. Data and descriptive statistics

The data used for this essay is drawn from the 2005/06 Kenya Integrates Household Budget Survey (KIHBS). Table 4-1, 4-2 and 4-3 present the descriptive statistics of variables used in the earnings equations. Table 4-1 presents statistics for the full sample, table 4-2 presents statistics for the male sample while table 4-3 presents statistics for the female sample.

A higher proportion of women than men reported both chronic and acute illness. While 10% of men reported having chronic illness and 16% reported having acute illness, 17% and 25% of women reported having chronic and acute illness respectively.

Majority of men and women in the sample reported having no formal education (31% and 37% for men and women respectively). Those with primary level of education were also many at 31% and 32% for both men and women respectively. About 18% of the men reported having tertiary education compared to only 14% of the women. Generally a higher fraction of women reported lower levels of education (no formal education and primary education) than men, while higher fraction of men reported higher levels of education (secondary and tertiary education) than women

The mean age of men was 34 years while that of women was 35 years. A smaller fraction of women in the sample reported to be married (61%) compared to 64% for men. Similarly, a larger proportion of men in the sample reported to be living in rural areas (70%) compared to 65% of the women.

Table 4-1: Descriptive Statistics of Variables Included in the Earnings Equation- Full sample

Variables	Wage employment	Non-agricultural self-employment	Agricultural self-employment	Not working
Health Status	0.10 (0.30)	0.15 (0.36)	0.13 (0.34)	0.15 (0.36)
Chronic illness (=1 if an individual reported having chronic illness, 0 if otherwise)	0.20 (0.40)	0.23 (0.42)	0.21 (0.41)	0.21 (0.41)
Acute illness (=1 if an individual reported having acute illness, 0 otherwise				
Education	0.24 (0.43)	0.29 (0.46)	0.45 (0.50)	0.39 (0.49)
No formal education (=1 if an individual reported to have no formal education, 0 otherwise)	0.26 (0.44)	0.34 (0.47)	0.35 (0.48)	0.33 (0.47)
Primary education (=1 if an individual reported having primary education, 0 otherwise)	0.20 (0.40)	0.22 (0.42)	0.15 (0.36)	0.19 (0.39)
Secondary education (=1 if an individual reported having secondary education, 0 otherwise)	0.30 (0.47)	0.15 (0.35)	0.06 (0.23)	0.09 (0.29)
Tertiary education (=1 if an individual reported having tertiary education, 0 otherwise)				
Age	34 (11)	35 (11)	36 (14)	31 (13)
Marital status				
Marital status (=1 if an individual reported to be married, 0 otherwise)	0.62 (0.48)	0.71 (0.45)	0.63 (0.48)	0.56 (0.50)
Area of residence				
Rural area (1 if an individual reported to be living in the rural area, 0 otherwise	0.47 (0.50)	0.48 (0.50)	0.94 (0.24)	0.65 (0.48)
Intsrumental variables				
Percentage of people in the district who slept under a bed net	28.59(14.91)	29.8(15.46)	25.33 (14.25)	27.46 (15.53)
Percentage of children fully immunized in the district	69.9 (18.15)	66.15 (20.27)	67.79 (20.13)	65.00 (21.60)
Sample size	4225 (24%)	2456 (14%)	5291 (30%)	5651 (32%)

Source: Author, computations based on the KIHBS 2005/06 (Republic of Kenya, 2007) Standard deviations in parenthesis

Table 4-2: Descriptive Statistics of Variables Included in the Earnings Equation-Male Sample

Variables	Wage employment	Non-agricultural self-employment	Agricultural self-employment	Not working
Health Status				
Chronic illness (=1 if an individual reported having chronic illness, 0 if otherwise)	0.09 (0.28)	0.11 (0.31)	0.10 (0.31)	0.11 (0.31)
Acute illness (=1 if an individual reported having acute illness, 0 otherwise	0.18 (0.39)	0.20 (0.40)	0.16 (0.37)	0.16 (0.36)
Education				
No formal education (=1 if an individual reported to have no formal education, 0 otherwise)	0.25 (0.43)	0.26 (0.44)	0.41(0.49)	0.35 (0.48)
Primary education (=1 if an individual reported having primary education, 0 otherwise)	0.26 (0.44)	0.33 (0.47)	0.34 (0.48)	0.33 (0.47)
Secondary education (=1 if an individual reported having secondary education, 0 otherwise)	0.28 (0.45)	0.17 (0.38)	0.07 (0.26)	0.10 (0.30)
Tertiary education (=1 if an individual reported having tertiary education, 0 otherwise)	0.20 (0.40)	0.23 (0.42)	0.17 (0.38)	0.22 (0.41)
Age	34 (11)	36 (11)	35 (14)	31 (13)
Marital status				
Marital status (=1 if an individual reported to be married, 0 otherwise)	0.69 (0.46)	0.75 (0.43)	0.59 (0.49)	0.40 (0.49)
Area of residence				
Rural area (1 if an individual reported to be living in the rural area, 0 otherwise	0.49 (0.50)	0.47 (0.50)	0.94 (0.23)	0.68 (0.47)
Sample size	2883 (34%)	1238 (15%)	2514 (30%)	1770 (21%)

Source: Author, computations based on the KIHBS 2005/06 (Republic of Kenya, 2007) Standard deviations in parenthesis

Table 4-3: Descriptive Statistics of Variables Included in the Earnings Equation-Female Sample

Variables	Wage employment	Non-agricultural self-employment	Agricultural self-employment	Not working
Health Status				
Chronic illness (=1 if an individual reported having chronic illness, 0 if otherwise)	0.12 (0.33)	0.20(0.40)	0.16 (0.37)	0.17 (0.37)
Acute illness (=1 if an individual reported having acute illness, 0 otherwise	0.23 (0.42)	0.26 (0.44)	0.26 (0.44)	0.24 (0.43)
Education	0.23 (0.42)	0.33 (0.47)	0.48 (0.50)	0.42 (0.49)
No formal education (=1 if an individual reported to have no formal education, 0 otherwise)				
Primary education (=1 if an individual reported having primary education, 0 otherwise)	0.26 (0.44)	0.35 (0.48)	0.35 (0.48)	0.33 (0.47)
Secondary education (=1 if an individual reported having secondary education, 0 otherwise)	0.19 (0.39)	0.21 (0.41)	0.13 (0.33)	0.17 (0.38)
Tertiary education (=1 if an individual reported having tertiary education, 0 otherwise)	0.33 (0.47)	0.12 (0.32)	0.04 (0.19)	0.08 (0.28)
Age	33 (10)	35 (11)	37 (13)	31 (12)
Marital status				
Marital status (=1 if an individual reported to be married, 0 otherwise)	0.48 (0.50)	0.68 (0.47)	0.67 (0.47)	0.63 (048)
Area of residence				
Rural area (1 if an individual reported to be living in the rural area, 0 otherwise	0.43 (0.50)	0.49 (0.50)	0.94 (0.24)	0.63 (0.48)
Sample size	1342 (15%)	1218 (13%)	2777 (30%)	3881 (42%)

Source: Author, computations based on the KIHBS 2005/06 (Republic of Kenya, 2007) Standard deviations in parenthesis

4.4. Results and discussions

This section presents results of the effect of health status on earnings. The study considered earnings of individuals in wage employment, in non-agricultural self-employment and in agricultural self-employment. We control for sample selection bias using the BFG approach, control for endogeneity and unobserved heterogeneity using control function approach.

We start with testing for poolability of data, that is, whether it is appropriate to estimate the male and female sample separately. The null hypothesis was that there is no statistical difference in estimated coefficients in the male and female equations. To do the test, each explanatory variable was interacted with the gender dummy. A test for the joint significance of the interaction terms was then conducted. For wage employment and when illness is measured by chronic illness, the F statistic with 9 degrees of freedom equals 11.41 (p value=0.000). When illness is measured by acute illness, the F statistic with 9 degrees of freedom equals 14.03 (p value= 0.000). Thus the null hypothesis is rejected in both cases. Estimating the male and female sample separately is appropriate. Details of the test are provided in Appendix 3 Table A12.

For the agricultural self-employment earnings and when illness is measured using chronic illness, the F statistic with 9 degrees of freedom equals 4.73 (p-value =0.000). When illness is measured by acute illness, the F statistic with 9 degrees of freedom equals 5.37 (p-value =0.000). Thus the null hypothesis is not rejected. For non-agricultural self-employment earnings, the F statistic with 9 degrees of freedom is 1.30 and 1.25 for the acute and chronic illness respectively with p values of 0.236 and 0.264 respectively. This implies that we do not reject the null hypothesis that there is no statistical difference in the estimated coefficients in the male and female equations. For non-agricultural self-employment therefore, the pooled results are appropriate. Details of the test are provided in Appendix 3 Table A12.

Table 4-4 presents results on the strength and relevance of the instrumental variables for chronic and acute illness. Acute illness is instrumented for by the proportion of individuals in the district of residence who slept under a mosquito net while chronic illness is instrumented for using the proportion of children in the district of residence who were fully immunized. The p - values show that we reject the null hypothesis that the instrumental variables are unimportant in

explaining the variations in illness implying that the instrumental variables are relevant. The F statistic is above the cutoff point of 10 proposed by Staiger and Stock (1997) except for chronic illness, male sample. Details of first stage results on determinants of health status are in Appendix 3 table A13.

Table 4-4: F Statistics for Significance of Identifying Instrumental Variables

Instruments	Acute illness			Chronic illness		
	Full sample	Male	Female	Full sample	Male	Female
Joint F test for Ho: coefficients on instruments =0	114.42 (0.000)	63.73 (0.000)	52.02 (0.000)	36.74 (0.000)	9.21 (0.000)	29.15 (0.000)
R-squared	0.029	0.024	0.023	0.045	0.029	0.054
Partial R-Squared	0.007	0.009	0.006	0.002	0.012	0.003

P value in parenthesis

Tables 4-5 and 4-6 present results of the effect of chronic illness and acute illness on labor earnings respectively. The first three columns of these tables present OLS estimates of wage employment earnings function, agricultural self- employment earnings function and non-agricultural self-employment earnings function. These results show that acute illness only significantly affects wage employment earnings but not non-agricultural and agricultural self-employment earnings. Acute illness reduces the log of wage employment earnings by 0.16. The coefficient of chronic illness remains insignificant in the earnings equations of all the three types of employment. These results are however likely to be biased due to potential endogeneity, selection bias and unobserved individual heterogeneity.

Control function approach allows for testing of presence of endogeneity. If the coefficient of the residual term (V in equation 4.7) is significant then there is endogeneity. Both chronic and acute illness residuals are significant in the wage employment equations indicating that both chronic and acute illnesses are endogenous. The coefficient of the interaction of both chronic and acute illnesses and their residuals ($H \times V$ in equation 4.7) are significant. This indicates the presence of unobserved heterogeneity. Controlling for selection bias was important as indicated by significant coefficients of some of the inverse mills ratios (λ_s in equation 4.7)

Once we control for endogeneity, unobserved heterogeneity and selection bias, we find that both chronic and acute illnesses have significant and negative effects on earnings at 5% and 1% levels of significance respectively. Acute illness reduces log of wage employment earnings by 2.16 while chronic illness reduces log of wage employment earnings by 5.57. We uncover no significant effect of illness on agricultural and non-agricultural self-employment earnings (Table 4-5 and 4-6, columns 4 to 9). The computation of earnings penalty of ill health following Halvorsen and Palmquist (1980) shows that acute illness reduces earnings by 88 percentage points while chronic illness reduces earnings by 99.6 percentage points[4].

The results of the analysis by gender show that chronic illness significantly reduces both men and womenôs wage employment earnings while acute illness has no significant affect earnings. The effect of chronic illness on earnings is higher for men than for women and reduces log of menôs wage employment earnings by 3.36 and log of womenôs wage employment earnings by 3. This means men and women with chronic illness earn lower than those not ill by 96.6% and 95% respectively. The results are presented in Appendix 3 table A14 to A17.

The results suggest that it was necessary to control for endogeneity, unobserved heterogeneity and sample selection bias. This is because the coefficient of chronic illness which did not significantly influence wage employment earnings in the OLS model now does after controlling for endogeneity, unobserved heterogeneity and sample selection. We also observe an increase in magnitude of the coefficient of chronic and acute illness once we control for these estimation issues.

The findings of negative effect of illness on earnings of wage workers support findings by Kioko et al. (2013) who found that an increase in malaria prevalence reduces log of monthly wages by 3.81 in Kenya. The results also support findings by Schultz and Tansel (2007) who found that a disabled day was associated with a 33% and 26% reduction in wages in Côte d'Ivoire and Ghana respectively. Contrary to the findings in this study, Gambin (2005) found that the effect

[4] Halvorsen and Palmquist (1980) suggest that in semilogarithimic equations, the coefficients of dummy variables should not be interpreted directly but instead we should use the formula $g = (e^c - 1) * 100$ where c is the coefficient of the dummy variable.

of chronic illness on wages was higher for women than men.

The negative effect of illness on earnings in wage employment is expected given that illness may affect an individualôs capacity to fulfill job requirements hence their productivity. Employers may discriminate against ill individuals by offering them low wages irrespective of their productivity (Johnson and Lambrinos, 1985). Moreover, individuals working in wage employment (usually characterized by employment benefits) may be willing to accept lower wages in return for non wage benefits such as medical cover (Cai, 2009).

Age is used as a proxy for experience. Age has a positive and significant effect on earnings. Age squared has a negative effect. This supports findings in the labor market literature, which suggests that earnings should increase with experience up to a certain point beyond which a negative effect sets in as people grow older and their productivity starts to decline. This implies that earnings increase with age but at a decreasing rate. For self employment earnings, we do not observe the decreasing effect of age and the coefficients are insignificant. Such unconventional signs have been reported in other studies especially for informal and self employment sectors (see Nyaga, 2010 and Dimova et al., 2010).

The results further show that education has a positive and significant effect on earnings in the three employment types. The positive effect of education increases as we move from primary to secondary to tertiary education. The positive effect of education on earnings is expected given that education is usually viewed as a component of human capital that increases an individualôs productivity and hence earnings. This finding supports result of previous studies in Kenya (Wambugu, 2011; Nyaga, 2010; Kabubo-Mariara, 2003).

Like many studies of African labor markets, the results indicate that males have higher earnings than females in all the three employment types. The gender effect is however only significant for wage employment. Men earned between 48% - 84% more than women. Attempts to explain gender-wage gap in Kenya (e.g. Kabubo-Mariara, 2003) suggests that this could be because of gender discrimination.

There is a negative association between earnings in wage employment and agricultural self-employment and being married but a positive association between being married and earnings in the non-agricultural self-employment. The coefficient of the marital status dummy is however only significant for wage employment. To get more insight into the effect of marital status on earnings we look at the gender disaggregated results. For men, generally, being married is associated with positive effect on earnings in both wage employment and agricultural self-employment and negative effect on earnings in the non-agricultural self-employment. For women, however, being married is associated with a negative effect on earnings in wage employment and agricultural self-employment and a positive effect on non-agricultural self-employment earnings. This supports findings by Kabubo-Mariara (2003) and Paternostro and Sahn (1999) but contradicts the finding by Wambugu (2011) who found a positive effect of being married on womenôs wages in the public sector.

The positive relationship between menôs earnings in wage employment and in agricultural self-employment may be explained by a number of factors (Haberfeld and Cohen, 1991). First, by providing advice on work related matters and supporting husbands emotionally, wives may increase the husbandôs earnings. Second, there may be a positive relationship between men who earn more and likelihood of getting married. Three, employers may pay married men more because they are considered stable, responsible and more productive. The negative relationship between womenôs earnings and marital status may be explained by the fact that married women may have children leading to loss of both productivity and job experience, and may prefer jobs with flexible work hours and may face employer discrimination (Budig and England, 2001).

Living in rural areas has negative effects on earnings in all the three employment types. The negative effect of the rural dummy in wage employment equation could be because most individuals employed in the rural areas are in jobs such as teaching and nursing which do not usually attract high wages. Urban areas on the other hand are where most large industries and multinational organizations are located and such usually pay high wages. Similarly non-agricultural self-employment activities tend to be more popular and perform well in urban areas. The rural dummy is not significant in the agricultural self-employment earnings equation. Nyaga (2010) also found that rural residence is associated with lower earnings across the sectors.

The selection terms tell us whether individuals have been allocated in the ñappropriateò employment type based on their unobserved characteristics (see Dimova and Gand, 2007; Dimova et al., 2010). A negative selectivity term of say wage employment in earnings equation for non-agricultural self-employment indicates that individuals in the non-agricultural self-employment earn lower than an individual chosen at random due to allocation of individuals with better unobservable characteristics out of non-agricultural self-employment into wage employment. We observe a positive and significant wage employment selection term in the wage employment and agricultural self-employment earnings equations. This indicates that individuals who are better off in wage employment based on their unobserved characteristics end up being allocated into wage employment. The positive wage employment selection term in the agricultural self-employment earnings equation indicates that individuals in the agricultural self-employment earn more because based on their unobservable characteristics they are better here than in wage employment.

These selectivity terms based on the BFG method allow a richer interpretation of selection terms than in previous studies for Kenya that control for selectivity bias. In particular, this approach allows us to highlight mismatch in the labor market in Kenya. Such information would provide a starting point for designing appropriate policy to deal with such mismatch.

The negative and significant non-agricultural self-employment selection term in the wage employment earnings equation indicates that the lower earnings of individuals in wage employment compared to others taken at random is because based on their unobserved characteristics they would have been better off in non-agricultural self-employment. Similarly the negative agricultural self-employment selection term in non-agricultural self-employment earnings equation indicates individuals earning lower in non-agricultural self-employment because based on their unobserved characteristics they would have been better off in the agricultural self-employment. .

Generally we therefore observe a situation where some individuals are in employment types that are not óappropriateô for them based on their unobserved characteristics. The selection term indicates some mismatch in the allocation of labor into various employment types. Some individuals are doing worse in wage employment because they would be better off in non-

agricultural self-employment while others are doing worse in non-agricultural self-employment since they would be better off in the agricultural self-employment.

The findings support Dimova et al. (2010) who found in Urban West Africa evidence of workers being allocated into inappropriate sectors of employment based on their unobserved characteristics. For example they found that based on unobserved skills, workers who would have performed better in the formal sector ended up working in the informal self employment sector in Ouagadougou, Bamako, and Dakar. Other studies (Atamanov and Van den Berg, 2011; Sengupta, 2011; Dimova and Gang, 2004) also use the BFG approach to study determinants of earnings and find mismatch in the allocation of labor across various sectors of employment.

Table 4-5: Estimates of the Effect of Acute Illness on Log of Monthly Earnings

Variables	OLS			Two-stage residual inclusion (2SRI)			Control function approach		
	Wage employment	Self - agricultural	Self non - agricultural	Wage employment	Self agricultural	Self non - agricultural	Wage employment	Self agricultural	Self non-agricultural
Acute illness	-0.1650***	-0.1502	-0.2465	-1.3734***	-2.7732	4.2323	-2.1593***	-4.5084***	3.3056
	[0.038]	[0.108]	[0.150]	[0.358]	[2.676]	[5.103]	[0.807]	[1.662]	[4.428]
Acute illness residual				1.1904***	2.6129	-4.2559	0.9350*	1.7343	-4.1693
				[0.349]	[2.601]	[4.949]	[0.499]	[1.695]	[3.994]
Acute illness* acute illness residual							1.3168*	3.3685**	1.0848
							[0.716]	[1.690]	[1.927]
Age	0.0808***	0.0345	-0.0007	0.1198***	0.0919	0.0251	0.1195***	0.0784	0.0175
	[0.011]	[0.030]	[0.039]	[0.031]	[0.128]	[0.209]	[0.043]	[0.111]	[0.268]
Age squared	-0.0008***	-0.0001	0	-0.0013***	-0.0008	-0.0008	-0.0013**	-0.0006	-0.0007
	[0.000]	[0.000]	[0.000]	[0.000]	[0.002]	[0.003]	[0.001]	[0.001]	[0.003]
Gender (male=1)	0.3147***	0.5003***	0.3290**	0.6137***	0.7530*	0.5743	0.6125***	0.6578	0.5244
	[0.033]	[0.094]	[0.135]	[0.149]	[0.444]	[1.031]	[0.230]	[0.500]	[1.048]
Education dummies (No formal education is the reference category)									
Primary education	0.2945***	0.4485***	0.3949***	0.2254***	0.3614**	0.5463***	0.2241***	0.3658**	0.5376*
	[0.039]	[0.116]	[0.150]	[0.072]	[0.164]	[0.154]	[0.069]	[0.180]	[0.298]
Secondary education	0.7554***	0.7800***	0.4445**	0.7021***	0.6564*	0.9474*	0.7047***	0.6531***	0.9158**
	[0.046]	[0.134]	[0.215]	[0.065]	[0.360]	[0.499]	[0.064]	[0.230]	[0.390]
Tertiary education	1.3488***	1.3156***	1.0554***	1.9805***	1.8035***	1.755	1.9836***	1.6442***	1.6725
	[0.044]	[0.181]	[0.246]	[0.168]	[0.628]	[1.564]	[0.271]	[0.568]	[1.179]
Marital status	0.0955**	0.0954	0.2737	-0.2094***	-0.1867	0.6807*	-0.2124**	-0.133	0.6689
(Married =1)	[0.039]	[0.115]	[0.181]	[0.067]	[0.379]	[0.349]	[0.093]	[0.340]	[0.426]
Rural area	-0.4936***	-0.6053***	-0.0603	-0.6699***	-0.626	-4.9457*	-0.6836***	-0.412	-4.689***
	[0.029]	[0.100]	[0.418]	[0.106]	[1.138]	[2.764]	[0.225]	[0.531]	[1.782]
IMR_Wage				0.7250***	4.0999	-4.4418	0.7230**	3.7594*	-4.5045

employment				[0.235]	[5.197]	[6.844]	[0.305]	[2.209]	[6.927]
IMR_self non				-3.5098***	-0.552	7.2796	-3.5283***	-0.3593	6.9164
agricultural				[0.916]	[1.288]	[6.964]	[1.061]	[0.901]	[8.901]
IMR _ self agricultural				-1.0243**	1.2774	-3.8480**	-1.0739	1.8978	-3.6869**
employment				[0.451]	[3.949]	[1.806]	[0.688]	[1.835]	[1.438]
IMR_ not working				-0.5436	1.1652	-0.7757	-0.5335	1.437	-0.7889
				[0.533]	[3.336]	[3.953]	[0.717]	[2.505]	[4.127]
Constant	6.0346***	6.6695***	6.7162***	3.6260***	9.2631	12.3448***	3.5804**	9.1419*	12.0715**
	[0.175]	[0.505]	[0.801]	[0.794]	[6.113]	[3.453]	[1.538]	[4.681]	[5.750]
Observations	3310	280	584						
F	329.86***	4.57***	27.08***						
R squared	0.4710	0.1219	0.1219						

Robust standard errors in brackets ***, ** , *: significant at 1%, 5% and 10% respectively IMR = Inverse Millôs Ratio

Table 4-6: Estimates of the Effect of Chronic Illness on Log of Monthly Earnings

Variables	OLS			Two-stage residual inclusion (2SRI)			Control function approach		
	Wage employment	Self agricultural	Self non - agricultural	Wage employment	Self agricultural	Self non-agricultural	Wage employment	Self agricultural	Self non-agricultural
Chronic illness	-0.063	-0.1986	-0.0327	-3.5801**	-2.8471	7.7905	-5.5733**	-3.3726	9.7389
	[0.052]	[0.135]	[0.213]	[1.401]	[5.843]	[7.989]	[2.543]	[2.903]	[6.453]
Chronic illness residual				3.4202**	2.5241	-7.5154	3.1921**	-0.3414	-7.1078
				[1.368]	[5.921]	[7.941]	[1.535]	[2.722]	[5.369]
Chronic illness* chronic illness residual							2.5775**	4.053	-2.8522
							[1.271]	[3.010]	[4.741]
Age	0.0890***	0.0502	-0.0262	0.1182***	-0.0059	-0.0634	0.1208**	0.0081	-0.0115
	[0.012]	[0.032]	[0.048]	[0.029]	[0.109]	[0.197]	[0.049]	[0.097]	[0.220]
Age squared	-0.0009***	-0.0003	0.0004	-0.0011***	0.0004	0	-0.0011**	0.0002	-0.0006
	[0.000]	[0.000]	[0.001]	[0.000]	[0.001]	[0.002]	[0.001]	[0.001]	[0.003]
Gender (male=1)	0.2976***	0.5401***	0.2750*	0.3795**	0.5074	0.6498	0.3960**	0.5898	0.759
	[0.035]	[0.098]	[0.155]	[0.155]	[0.524]	[0.861]	[0.173]	[0.547]	[1.059]
Education dummies (No formal education is the reference category)									
Primary education	0.2824***	0.3635***	0.4273**	0.1736**	0.2782	0.6642*	0.1704**	0.3511*	0.6642*
	[0.042]	[0.121]	[0.180]	[0.079]	[0.237]	[0.402]	[0.076]	[0.180]	[0.354]
Secondary education	0.7592***	0.5602***	0.7061***	0.5712***	0.4695	1.3757***	0.5691***	0.6027***	1.3358***
	[0.048]	[0.140]	[0.225]	[0.104]	[0.385]	[0.516]	[0.123]	[0.225]	[0.488]
Tertiary education	1.3497***	1.4176***	1.1635***	1.6478***	1.8493**	2.6942***	1.6652***	1.7313***	2.5793
	[0.047]	[0.189]	[0.275]	[0.205]	[0.827]	[0.842]	[0.224]	[0.439]	[1.709]
Marital status	0.1218***	0.2162*	0.2649	-0.1673	-0.3168	0.5782	-0.1825	-0.1114	0.6157
(Married =1)	[0.041]	[0.115]	[0.220]	[0.117]	[0.544]	[0.464]	[0.127]	[0.336]	[0.441]
Rural area	-0.5138***	-0.7156***	-0.0152	-0.4724*	0.1679	-4.4253***	-0.4829**	-0.0852	-4.1836***
	[0.031]	[0.107]	[0.389]	[0.268]	[1.056]	[1.527]	[0.200]	[0.640]	[1.607]
IMR_wage				0.4652	5.4767	-4.4942	0.4569	3.9018*	-4.233

employment				[0.307]	[4.505]	[5.562]	[0.336]	[2.080]	[9.747]
IMR_non agricultural				-2.7655***	-1.0163	-0.4599	-2.8483***	-0.5104	0.8579
Self employment				[1.041]	[1.481]	[5.209]	[0.708]	[0.857]	[5.025]
IMR _ agricultural				-0.4399	3.8867	-4.5476***	-0.5197	3.0118	-4.1541**
Self employment				[0.944]	[2.629]	[1.469]	[0.658]	[1.906]	[1.774]
IMR_ not working				-0.5323	4.0697	-2.508	-0.6709	3.0268	-3.0279
				[0.715]	[3.422]	[4.981]	[0.805]	[2.483]	[5.971]
Constant	5.9122***	6.4535***	7.0607***	4.2948***	13.5930**	12.0850***	4.1256***	11.1284**	10.7313***
	[0.186]	[0.550]	[0.937]	[1.049]	[6.887]	[4.350]	[1.556]	[4.602]	[3.533]
Observations	2941	225	528						
F	305.81***	3.32***	29.08***						
R squared	0.4814	0.1053	0.3602						

Robust standard errors in brackets ***, ** , *: significant at 1%, 5% and 10% respectively IMR = Inverse Millôs Ratio

4.5. Summary, conclusion and policy implication

Summary and conclusion

Health, like education is viewed as a form of human capital (Grossman, 1972) that affects an individualôs productivity by affecting his/her capacity to fulfill job requirements hence earnings (Becker, 1962; Mushkin, 1962; Schultz, 1961). Healthy workers are thought to be in good mental and physical state that may positively affect productivity and hence wages. Workers in ill health may therefore earn less in form of wages, which has implications for economic growth, poverty reduction, and income inequality. This is particularly of concern since the number of people reporting illness in Kenya has been rising.

Although some studies have analyzed the relationship between health and productivity in Kenya (Fox et al., 2004; Kioko et al., 2013), such studies only focus on HIV/AIDS and malaria yet other diseases including chronic illness may negatively affect wages. Further, the effect of illness on productivity and earnings may also differ by gender (Gumbin, 2005). Yet, this aspect has not been taken into account in existing studies for Kenya. Further, these studies consider only wage employment and the agricultural employment in isolation without taking into account selectivity into various employment types. According to Glick and Sahn (1998), the impact of health on earnings may vary according to type of employment and it is important to control for sample selection bias.

This essay examines the effect of acute and chronic illness on earnings in wage employment, in agricultural self-employment and in non-agricultural self-employment using the 2005/6 Kenya Integrated Household Budget Survey (KIHBS) data. The estimation problems that were encountered are selection bias, endogeneity of the health variable and unobserved heterogeneity. To control for endogeneity and unobserved heterogeneity, control function approach was used. Selection bias was controlled for using the BFG approach (Bourguignon et al., 2007). Chronic illness was instrumented for by the proportion of children in the district who were fully immunized while acute illness was instrumented for by proportion of individuals in the district who slept under a mosquito net. Transfers are used to identify the selection equation. Education, age, marital status and regional dummies are included in the model as control variables.

Tests indicated that the instrumental variables were strong and relevant. We find that chronic and acute illnesses are endogenous in wage employment earning equations and that failure to control for endogeneity would bias downwards the effect of health on earnings. Heterogeneity was also found to exist and like endogeneity, failure to control for the same would bias the effect of health on earnings downwards. Controlling for selection bias was appropriate as the coefficients of some inverse mills ratio were significant.

After controlling for selection bias, endogeneity and heterogeneity, we found that chronic and acute illnesses significantly reduce earnings in wage employment. Compared to their healthy counterparts, chronically ill workers earn 99.6 percent less while those with acute illness earn 88.5 percent less compared to individuals who report no illness. The effect of chronic illness on earnings is higher for men than for women. Chronically ill men earn 96.5 percent less and chronically ill women earn 95 percent less compared to those who report no illness. Education was also found to positively and significantly affect earnings and that the higher the level of education, the higher the education effect. Age, marital status and area of residence were also found to significantly affect earnings

Illness negatively affects earnings in wage employment. Since many Kenyans rely on labor income, reduced earnings have implications for poverty levels for those in ill health. This is worsened by the fact that such individuals also face challenge of meeting costs associated with health care. Other than facing reduced earnings, ill individuals also have to pay health care costs. This may worsen not only their standard of living but also affect income distribution. This works against the first Millennium Development Goal of eradicating extreme poverty and hunger. With the negative effect of illness on earnings, this may further move the country away from this target. Therefore, as a way of dealing with poverty, promoting economic growth, and reducing inequality, the health of the population needs to be promoted.

Policy implications

Results from this essay suggest that illness negatively affects earnings. Workers who suffer from acute and chronic illnesses earn less compared to those who report no illness. Policy makers need to know that there is productivity loss due to illness. In doing cost benefit analysis of various health interventions, policy makers need to factor in the negative effects of illness on

productivity. The government needs to intensify its effort of improving health status of the population. Chronically ill individuals earn almost 100% less compared to individuals who report no illness yet currently few interventions (like antiretroviral drugs for HIV/AIDs patients) target chronic illness. The government can invest in the management of chronic illness through provision of subsidized medication and awareness creation on availability of such medication. Awareness creation on proper diet and lifestyle change required to manage such diseases is crucial and should be done. This should go hand in hand with management of acute illnesses.

Education is also a key variable affecting wages earned. The effect of education increases with the level of education with highest return being realized for tertiary education. There is need for more interventions targeting tertiary education, for instance increased access to loans. Men seem also to have an advantage in terms of wages over their female counterparts. Previous studies (e.g. Kabubo-Mariara, 2003) found wage discrimination in Kenya. Anti discrimination laws should be strengthened.

Areas of future research

Future research on illness and earnings can examine the effect of specific types of illnesses (e.g. diabetes) on earnings. Illness may also affect earnings of the elderly differently from the way it affects earnings of the young. Future studies can therefore examine the effect of illness for earnings of different age groups. Findings in this thesis suggest that ill individuals earn less than their non ill counterparts. Future studies can examine whether there is wage discrimination against the ill individuals. Further, studies can also examine whether the effect of illness differs along the wage distribution and also consider other dimensions of health and other measure of productivity such as firm/farm output.

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CHAPTER 5: SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

5.1. Summary and conclusions

Introduction

Majority Kenyans derive income from labor. Statistics show that the burden of disease in Kenya is high and rising. Grossman (1972) views health as a durable capital stock that produces an output of healthy time. Ill health therefore affects the amount of time individuals have for market and non market activities and thereby affects labor force participation. By reducing hours available for work, ill health may cause individuals to prefer certain employment types that have flexible working hours. The general weaknesses associated with illness may also cause individual to prefer working in certain types of employment given the variations in nature of work. Further, ill health may affect individualsô capacity to fulfill job requirements which may affect their productivity and earnings.

This thesis investigates the effect of ill health on labor market outcomes in Kenya. The first essay examines the effect of illness on labor force participation. The second essay analyzes the effect of illness on employment status. The third and final essay studies the relationship between illness and earnings.

Data used in this thesis is derived from the 2005/6 Kenya Integrated Household Budget Survey (Republic of Kenya, 2007), a nationally representative survey. This study focuses on individuals aged between 18 years and 64 years who are not full time students. This group is referred to as the economically active group.

Health status is measured by morbidity and two types of illnesses are considered; acute and chronic illness. Other than health status, other variables are included as control variables. These are age, education, marital status, gender, regional dummies, transfers, area of residence and presence of children below 5 years in a household.

Illness and labor force participation

The first essay estimated the effect of illness on labor force participation. Theory suggests that illness may reduce an individualôs healthy time hence affecting their labor force participation (Grossman, 1972). Ill individuals may also prefer leisure to work (Cai and Kalb, 2006). Illness

is equally said to reduce productivity and hence may reduce wages earned (Leibenstein, 1957; Becker, 1962; Mushkin, 1962; Schultz, 1961). This reduction in wages may cause the wages to fall below the reservation wage thereby causing ill individuals to exit the labor force. Further, illness may affect an individualôs expected life horizon hence affecting labor supply decisions (Suhrcke et al., 2005). Non participation implies lost income and has adverse welfare implications.

The essay, therefore, examined the relationship between illness and labor force participation given the potential negative effect of illness on participation and the rising disease burden in Kenya. Specifically, we estimated the effect of chronic illness and acute illness on labor force participation and then examined whether the effect of illness on labor force participation varied by gender. Policy implications were also derived

The study recognized that illness may be endogenous in labor force participation models and that there may be unobserved individual heterogeneity in the health labor force participation relationship. There are three potential sources of endogeneity: simultaneity between the health variable and labor force participation, measurement and reporting error and omitted variable bias. Heterogeneity arises from potential non linear interaction between the health variables and unobservable factors causing the effect of health on labor force participation to vary by individual workers. To test and control for endogeneity and heterogeneity we use control function approach estimation procedure. This approach requires use of instrumental variables. We instrumented for the illness variables using distance to the nearest weekly market and number of health facilities in the district. Results suggest absence of heterogeneity and that the health variables are exogenous. Thus, probit estimates are relied on.

The results indicate that both acute and chronic illnesses reduce the likelihood of individuals participating in the labor market. The effect of chronic illness is larger: acute and chronic illnesses reduce participation by 2 and 8 percentage points respectively. Women are more likely than men to reduce participation due to illness. While the likelihood of women reducing participation due to acute and chronic illnesses is 3 and 10 percentage points respectively, the likelihood of men reducing participation due to chronic and acute illness is 2 and 5 percentage

points respectively. Simulations show that reducing chronic and acute illness by between 2 to 5 percent increases labor force participation by between 4 to 50 percent.

Tertiary education significantly affects participation in the labor market: it increases the likelihood of participating in the labor market by 8 percentage points. The effect of tertiary education on participation is higher for women than men; it increases womenôs and menôs participation by 13 and 2 percentage points respectively. Other variables that significantly influence participation include age, marital status, presence of children below 5 years in the household, areas of residence and regional dummies.

Results from this essay indicate that both acute and chronic illnesses negatively affect labor force participation. Since many Kenyans rely on labor income, failure to participate in the labor force has implications for poverty, economic growth and inequality.

This essay contributed to literature by providing empirical evidence from Kenya on the relationship between illness and labor force participation. The analysis was disaggregated by gender and from this we found that the effect of illness was higher for women than men. Also the effect of chronic illness on labor force participation was larger than the effect of acute illness. This information is important for the government to come up with appropriate policies to promote labor force participation.

Illness and employment status

The second essay examined the relationship between illness and employment status. The essay was motivated by the fact that a country is said to be growing if the share of workers in wage employment is increasing which spurs further economic growth and improvements in standard of living (World Bank, 1995). According to labor market statistics in Kenya, the share of wage employment in total employment has decreased over time from 28.7 percent in 2000 to 18.54 percent in 2012. Self employment as a share of total employment has, however, risen from 70.42 percent in 2000 to 73.8 percent in 2012 (Republic of Kenya, 2006; 2013).

Labor should be allowed to flow across employment types and constrains to this process have implications for the transformation process and hence on economic growth (Agnor, 1996).

Grossman (1972) argues that illness may reduce the amount of time an individual has for market activities. This may cause individuals to prefer jobs with flexible working hours thus affecting allocation and reallocation of labor among sectors. This is of concern since the burden of illness in Kenya is high and rising.

This essay therefore examines the relationship between illness and employment sector participation. Specifically the essay analyzes the effect of chronic and acute illnesses on participation in wage employment, in non-agricultural self-employment and in agricultural self-employment. Estimations were also carried out differently for men and women to test whether the effect of illness on employment status varies by gender. Policy implications were derived. To achieve these objectives, multinomial probit models were estimated because multinomial logit model failed the test of independence of irrelevant alternatives.

The results indicate that chronic illness significantly reduces chance of wage employment and agricultural self-employment. Relative to individuals who do not report illness, those who report chronic illness are 4.7 and 3.7 percentage points less likely to participate in wage employment and in agricultural self-employment. The effect of chronic illness on womenôs chance of wage employment and agricultural self-employment is even higher at 5 and 4.7 percentage points respectively. For men however, the effect is insignificant though negative for all types of employment. Further, acute illness does not significantly affect the likelihood of wage employment, agricultural self-employment and non-agricultural self-employment. This suggests that reducing chronic illness by between 2 to 5 percent, increases wage and agricultural self employment by between 10 to 25 percent.

Beside illness, other variables also affect labor allocation. Education especially tertiary education increases chance of wage employment. Men and women with tertiary education are 20 and 32 percentage points respectively more likely to be in wage employment compared to their counterparts with no formal education. Tertiary education however reduces likelihood of individuals being in self employment. Other variables that significantly influence employment include gender, marital status, age, area of residence and presence of children below 5 years in a household.

Chronic illness reduces chance of individuals being in wage employment and in agricultural self-employment. This is of concern since one aspect of increased growth of a country is increased share of workforce in the wage employment (World Bank, 1995). This constraint on labor allocation process therefore has implications for economic growth.

Wage employment is usually characterized by job security and benefits such as pension plan and health insurance (Agenor, 1996). Chronically ill individuals are less likely to be in wage employment however. They are also less likely to be in agricultural self-employment. The option left is the non-agricultural self-employment. According to Banerjee and Duflo (2007), many of the poor in Africa report to be involved in non-agricultural self-employment. Thus by constraining individuals employment in wage and agricultural self-employment, illness also affects poverty and economic growth.

The essay contributes to literature by providing evidence from Kenya on the relationship between illness and employment status. The analysis is conducted separately for men and women. A novel finding is that chronic illness only significantly influences womenôs and not menôs employment status. We further find that chronic and not acute illness significantly influences womenôs employment status.

Illness and earnings

The third and final essay focused on illness and earnings. Health is considered as a component of human capital that can influence an individualôs capacity to fulfill job requirements and hence their productivity and earnings (Becker, 1962; Mushkin, 1962; Schultz, 1961; Grossman, 1972). Workers in ill health may also be discriminated against by being offered lower wages (Johnson and Lambrinos, 1985). Similarly ill workers may accept lower wages in exchange for other benefits such as medical cover (Cai, 2009). The potentially negative effect of illness on earnings and the fact that the number of people reporting illness in Kenya is high and rising may have repercussions for welfare of the Kenyan population.

The essay addressed four objectives. The first was to examine the relationship between chronic illness and earnings in wage employment, in agricultural self-employment and in non-

agricultural self-employment. The second was to examine the relationship between acute illness and earnings in wage employment, in agricultural self-employment and in non-agricultural self-employment. The third was to investigate whether the effect of illness on earnings varies by gender. Finally policy implications were derived.

In estimating the effect of illness on wages, there were four estimation issues considered: endogeneity of the health variable, heterogeneity and selection bias. Selection bias occurs because earnings are only observed for the employed. To deal with selection bias, we use the BFG approach. The employment allocation equation is identified using non labor income - transfers. Health is potentially endogenous in the earnings function. This may occur mainly for three reasons; simultaneity bias, omitted variables and measurement and reporting errors. Unobserved heterogeneity occurs if there is non linear interaction between the unobservable factors and the endogeneous variables causing the effect of the endogeneous variables on the dependent variable to vary by individuals. To deal with endogeneity and unobserved heterogeneity, the control function approach estimation procedure was used.

Chronic illness was instrumented for by the proportion of children in the district who were fully immunized while acute illness was instrumented for by proportion of individuals in the district who slept under a mosquito net. The instrumental variables were both strong and relevant. We found that both acute and chronic illnesses were endogenous in wage employment earnings equation. We also found presence of heterogeneity. Controlling for selection bias was necessary as some of the coefficients of the inverse mills ratio were significant. Failure to control for endogeneity, sample selection bias and unobserved heterogeneity biases downwards the effect of illness on earnings.

Both acute and chronic illnesses had negative and significant effect on earnings in wage employment. Chronically ill individuals earn 99.6 percent less in wage employment compared to those who report no illness. Individuals with acute illness earn 88.5 percent less than those who report no illness in wage employment. When the analysis is done by gender, only chronic illness significantly influences earnings in wage employment and the effect is higher for men than for women. Chronically ill women earn 95 percent less compared to those who report no illness,

while chronically ill men earn 96.5 percent less than those who report no illness. Education also significantly influences earnings. The effect of education on earnings increases with the level of education. Other variables that significantly influence earnings include age, marital status, gender and area of residence.

Results indicate that individuals in ill health earn lower than those who report no illness. This may have implications for poverty reduction and economic growth since many Kenyans rely on labor income. Similarly, since illness also comes with other costs such as health care costs, reduced wages associated with illness may worsen distribution of income.

The essay contributes to the literature in five ways. First, we provide empirical literature from Kenya on the relationship between illness and earnings. The analysis is done separately for men and women. Second, the effect of chronic illness which involves long term disability and acute illness which involves short term disability are considered. Third, we consider the effect of illness on earnings in wage employment earnings, non-agricultural self-employment and agricultural self-employment. Fourth, we use the BFG method to control for sample selection bias. Monte Carlo experiments showed that this approach performed better than previous approaches (Bourguignon et al., 2007). Finally this essay controls for potential unobserved heterogeneity using control function approach.

5.2. Policy implications

The findings in this essay suggest that tertiary education, illness and other personal characteristics affect an individualôs labor market outcomes. Chronic illness especially has more disabling effects than acute illness and the effect of illness is mainly higher for women than men. There is need for the government to compliment education and health policies to promote labor market outcomes. Policies aimed at increasing access to tertiary education will increase labor market outcomes. The government should invest in management of acute and chronic illnesses as a way of promoting labor market outcomes. Chronic illnesses can be managed through lifestyle, proper diet and medication, making this information available may reduce the disease incidence and prevalence. Provision of management drugs should also be expanded to keep people in the labor force and to improve their productivity. The negative effect of illness is higher for women than men, therefore there is need to focus on gender in health policy.

5.3. Areas of further research

Future studies on illness and labor market outcomes should consider the effect of specific types of diseases such as diabetes, high blood pressure, HIV/AIDS on labor market outcomes to allow for specific policy recommendations. Studies can also disaggregate the effect of illness on labor market outcomes by age groups and by spatial distribution. It is also important to examine whether there is discrimination in the labor market against the ill individuals. Further, future studies on developing countries should consider estimating the effect of illness on employment status using panel data sets that allows for tracking of individuals as they move from one employment state to another following change in their health status.

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APPENDIX 1: EFFECT OF ILLNESS ON LABOR FORCE PARTICIPATION

Table A1: Test of Statistical Difference between Coefficients in the Gender Models

Dependent variable: Labor Force Participation

	Health status =Chronic illness	Health status = acute illness
Acute illness		-0.0866**
		[0.041]
Chronic illness	-0.2588***	
	[0.053]	
Gender (Male=1)		1.4302***
		[0.285]
Age	0.1138***	0.1531***
	[0.009]	[0.010]
Age squared	-0.0012***	-0.0017***
	[0.000]	[0.000]
Primary education	0.0741*	0.0489
	[0.044]	[0.042]
Secondary education	0.0549	0.0431
	[0.056]	[0.053]
Tertiary education	0.3867***	0.4087***
	[0.068]	[0.067]
Married dummy	-0.4077***	-0.4887***
	[0.043]	[0.042]
1 child (0-5 years)	-0.1536***	-0.0573
	[0.044]	[0.042]
Two children (0-5 years)	-0.1801***	-0.1371***
	[0.050]	[0.048]
Rural area	0.3503***	0.3607***
	[0.042]	[0.041]
Central region	0.3259***	0.4423***
	[0.088]	[0.088]
Coastal region	-0.4684***	-0.3717***
	[0.090]	[0.089]
Eastern region	0.0466	0.1481*
	[0.085]	[0.084]
North Eastern region	-1.0509***	-0.6521***
	[0.252]	[0.232]
Nyanza region	0.2160**	0.2721***
	[0.085]	[0.083]
Rift valley region	0.021	0.0872
	[0.081]	[0.080]
Western region	-0.0329	0.039
	[0.090]	[0.088]
Transfers	-0.1632***	-0.1556***
	[0.040]	[0.039]
Interaction terms		
Maled*Acute illness		-0.0111
		[0.071]

Maled*Chronic illness	-0.0115	
	[0.091]	
Maled*Age	0.0348***	-0.0295*
	[0.008]	[0.016]
Maled*Age squared	-0.0007***	0.0001
	[0.000]	[0.000]
Maled*Primary education	-0.1197*	-0.0706
	[0.071]	[0.068]
Maled*Secondary education	-0.0588	-0.0673
	[0.087]	[0.082]
Maled*Tertiary education	-0.1341	-0.2773***
	[0.107]	[0.101]
Maled*Marital status dummy	0.8258***	0.9213***
	[0.077]	[0.077]
Maled* One child (0-5 years)	0.1831**	0.1280*
	[0.074]	[0.071]
Maled* Two children (0-5 years)	0.1334	0.0828
	[0.084]	[0.080]
Maled*Rural area	-0.2654***	-0.3091***
	[0.069]	[0.065]
Maled*Central region	0.0819	-0.218
	[0.140]	[0.150]
Maled*Coastal region	0.3237**	0.069
	[0.132]	[0.143]
Maled*Eastern region	0.1195	-0.1872
	[0.130]	[0.140]
Maled*North eastern region	0.1906	-0.4564
	[0.290]	[0.280]
Maled*Nyanza region	-0.1287	-0.3798***
	[0.127]	[0.138]
maled*Rift valley region	0.1416	-0.1205
	[0.122]	[0.134]
Maled*Western region	0.0047	-0.2562*
	[0.139]	[0.146]
Maled*Transfers	0.1416**	0.089
	[0.063]	[0.061]
Constant	-1.6165***	-2.3854***
	[0.143]	[0.179]
Observations	11,230	12,451
$\chi^2(37)$	1692.92	1932.39
R^2	0.1663	0.1708

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1 Maled is male dummy

Table A2: Estimates of Effect of Acute Illness on Labor Force Participation, Coefficients

	Probit (coefficients)			Control function approach					
				(a)			(b)		
	Full sample	Male	Female	Full sample	Male	Female	Full sample	Male	Female
Acute illness	-0.0851**	-0.0977*	-0.0866**	-0.9972	-1.0249	-0.782	-0.831	-0.7677	-0.6569
	[0.033]	[0.057]	[0.041]	[0.682]	[1.080]	[0.885]	[0.706]	[1.158]	[0.912]
Acute illness residual				0.9347	0.9965	0.6942	1.0336	1.1093	0.7819
				[0.683]	[1.082]	[0.886]	[0.691]	[1.092]	[0.901]
Acute illness* predicted acute illness residual							-0.3523	-0.4664	-0.2914
							[0.389]	[0.719]	[0.526]
Age	0.1580***	0.1236***	0.1531***	0.1678***	0.1347***	0.1591***	0.1679***	0.1351***	0.1592***
	[0.008]	[0.012]	[0.010]	[0.010]	[0.016]	[0.014]	[0.010]	[0.016]	[0.014]
Age squared	-0.0019***	-0.0016***	-0.0017***	-0.0019***	-0.0017***	-0.0017***	-0.0019***	-0.0017***	-0.0017***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Gender (Male=1)	0.7820***			0.6978***			0.6954***		
	[0.028]			[0.059]			[0.059]		
Education dummies (no education is the reference category)									
Primary education	0.0295	-0.0217	0.0489	0.0194	-0.0223	0.0449	0.0192	-0.0227	0.0444
	[0.033]	[0.053]	[0.042]	[0.038]	[0.061]	[0.050]	[0.038]	[0.061]	[0.050]
Secondary education	0.0215	-0.0242	0.0431	-0.0313	-0.023	-0.0353	-0.0326	-0.0259	-0.0358
	[0.040]	[0.063]	[0.053]	[0.054]	[0.086]	[0.072]	[0.054]	[0.086]	[0.072]
Tertiary education	0.2980***	0.1314*	0.4087***	0.2706***	0.0844	0.4228***	0.2705***	0.0835	0.4218***
	[0.050]	[0.076]	[0.067]	[0.067]	[0.103]	[0.090]	[0.067]	[0.103]	[0.090]
Marital status	-0.2287***	0.4326***	-0.4887***	-0.2427***	0.4038***	-0.5054***	-0.2415***	0.4042***	-0.5045***
(Married =1)	[0.034]	[0.064]	[0.042]	[0.041]	[0.077]	[0.051]	[0.041]	[0.077]	[0.051]
Presence of children 0-5 years (No children is the reference category)									
1 child 0-5 years	0.0062	0.0707	-0.0573	0.0545	0.1276**	-0.0131	0.055	0.1277**	-0.0124
	[0.033]	[0.057]	[0.042]	[0.037]	[0.065]	[0.048]	[0.037]	[0.065]	[0.048]

2 or more children 0-5 years	-0.0781**	-0.0542	-0.1371***	-0.0930*	-0.0704	-0.1437**	-0.0937*	-0.0718	-0.1444**
	[0.037]	[0.064]	[0.048]	[0.049]	[0.082]	[0.063]	[0.049]	[0.082]	[0.063]
Transfers	-0.1155***	-0.0667	-0.1556***	-0.0964***	-0.0501	-0.1393***	-0.0962***	-0.0491	-0.1393***
	[0.030]	[0.048]	[0.039]	[0.036]	[0.059]	[0.046]	[0.036]	[0.059]	[0.046]
Rural area	0.2228***	0.0517	0.3607***	0.1992***	0.0159	0.3574***	0.1976***	0.0147	0.3561***
	[0.031]	[0.051]	[0.041]	[0.042]	[0.068]	[0.054]	[0.042]	[0.068]	[0.054]
Region (Nairobi region is the reference)									
Central region	0.3542***	0.2243*	0.4423***	0.3589***	0.2570*	0.4237***	0.3591***	0.2555*	0.4246***
	[0.069]	[0.122]	[0.088]	[0.083]	[0.148]	[0.105]	[0.083]	[0.148]	[0.106]
Coast region	-0.3252***	-0.3027***	-0.3717***	-0.3377***	-0.3013**	-0.4380***	-0.3358***	-0.2995**	-0.4355***
	[0.066]	[0.111]	[0.089]	[0.083]	[0.141]	[0.113]	[0.083]	[0.141]	[0.113]
Eastern region	0.0719	-0.0392	0.1481*	0.1386	0.0112	0.1983	0.1431	0.0165	0.2022
	[0.065]	[0.113]	[0.084]	[0.101]	[0.171]	[0.131]	[0.101]	[0.171]	[0.132]
North Eastern region	-0.8794***	-1.1085***	-0.6521***	-0.8619***	-1.1106***	-0.6004**	-0.8719***	-1.1224***	-0.5994**
	[0.125]	[0.156]	[0.232]	[0.152]	[0.195]	[0.284]	[0.153]	[0.197]	[0.285]
Nyanza region	0.1219*	-0.1077	0.2721***	0.3358**	0.0391	0.4912***	0.3386**	0.0431	0.4934***
	[0.064]	[0.110]	[0.083]	[0.137]	[0.225]	[0.177]	[0.137]	[0.225]	[0.177]
Rift Valley region	0.041	-0.0333	0.0872	0.0636	-0.036	0.1115	0.0657	-0.0332	0.1133
	[0.061]	[0.108]	[0.080]	[0.077]	[0.136]	[0.101]	[0.077]	[0.136]	[0.101]
Western region	-0.0599	-0.2172*	0.039	0.0782	-0.0918	0.1378	0.0805	-0.0879	0.1393
	[0.068]	[0.116]	[0.088]	[0.161]	[0.262]	[0.209]	[0.161]	[0.262]	[0.209]
Constant	-2.4482***	-0.9552***	-2.3854***	-2.4880***	-1.0877***	-2.4074***	-2.4711***	-1.0789***	-2.3906***
	[0.137]	[0.222]	[0.179]	[0.156]	[0.263]	[0.204]	[0.157]	[0.264]	[0.207]
Observations	12,451	6,440	6,011	9,815	5,058	4,757	9,815	5,058	4,757
χ^2	1679.99	448.3	778.34	1134.69	359.06	675.8	1343.61	359.14	676.02
R	0.153	0.1036	0.1125	0.1561	0.1053	0.1241	0.1561	0.1053	0.1241

Robust standard errors in brackets ***, ** , *: significant at 1%, 5% and 10% respectively

Table A3: Estimates of Effect of Chronic Illness on Labor Force Participation, Coefficients

	Probit (coefficients)			Control function approach					
				(a)			(b)		
Chronic illness	-0.2523***	-0.2668***	-0.2624***	-0.852	-1.2709	-0.391	-0.7421	-1.6558	-0.4692
	[0.043]	[0.072]	[0.053]	[0.795]	[1.285]	[1.010]	[0.858]	[1.391]	[1.115]
Chronic illness residual				0.565	0.9549	0.0935	0.5908	0.8803	0.0741
				[0.797]	[1.285]	[1.014]	[0.802]	[1.293]	[1.020]
Chronic illness*predicted chronic illness residual							-0.1631	0.5338	0.12
							[0.500]	[0.817]	[0.719]
Age	0.1439***	0.1015***	0.1479***	0.1488***	0.1077***	0.1493***	0.1489***	0.1070***	0.1491***
	[0.008]	[0.012]	[0.011]	[0.009]	[0.015]	[0.013]	[0.009]	[0.015]	[0.013]
Age squared	-0.0017***	-0.0014***	-0.0017***	-0.0017***	-0.0014***	-0.0017***	-0.0017***	-0.0013***	-0.0017***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Gender (Male=1)	0.7760***			0.7056***			0.7057***		
	[0.029]			[0.058]			[0.058]		
Education dummies (no education is the reference category)									
Primary education	0.0356	-0.0629	0.0871*	0.0358	-0.0448	0.0949	0.0361	-0.0452	0.0947
	[0.034]	[0.055]	[0.045]	[0.047]	[0.074]	[0.061]	[0.047]	[0.074]	[0.061]
Secondary education	0.0391	-0.0117	0.069	0.0107	0.0182	0.0164	0.0105	0.0198	0.0165
	[0.042]	[0.065]	[0.056]	[0.065]	[0.103]	[0.086]	[0.065]	[0.103]	[0.086]
Tertiary education	0.3388***	0.2419***	0.3978***	0.3358***	0.2261**	0.4309***	0.3361***	0.2261**	0.4307***
	[0.051]	[0.082]	[0.068]	[0.073]	[0.115]	[0.095]	[0.073]	[0.115]	[0.095]
Marital status	-0.1612***	0.5251***	-0.4483***	-0.2185***	0.4171***	-0.4792***	-0.2175***	0.4154***	-0.4797***
(Married =1)	[0.035]	[0.067]	[0.044]	[0.044]	[0.081]	[0.056]	[0.044]	[0.081]	[0.056]
Presence of children 0-5 years (No children is the reference category)									
1 child 0-5 years	-0.0581*	0.0201	-0.1417***	0.0045	0.1056	-0.0913*	0.0043	0.1068	-0.0913*
	[0.034]	[0.059]	[0.045]	[0.040]	[0.067]	[0.052]	[0.040]	[0.067]	[0.052]
2 or more children 0-5 years	-0.0863**	-0.0454	-0.1657***	-0.0934**	-0.0376	-0.1761***	-0.0932**	-0.0381	-0.1760***

	[0.039]	[0.066]	[0.051]	[0.044]	[0.074]	[0.058]	[0.044]	[0.074]	[0.058]
Transfers	-0.1011***	-0.0586	-0.1413***	-0.0713*	-0.0254	-0.1202**	-0.0713*	-0.0259	-0.1202**
	[0.031]	[0.050]	[0.040]	[0.039]	[0.063]	[0.050]	[0.039]	[0.063]	[0.050]
Rural area	0.2219***	0.0692	0.3599***	0.2400***	0.0943	0.3785***	0.2399***	0.0953	0.3786***
	[0.033]	[0.053]	[0.043]	[0.037]	[0.060]	[0.049]	[0.037]	[0.060]	[0.049]
Region (Nairobi region is the reference)									
Central region	0.3422***	0.2191*	0.4179***	0.2880***	0.1453	0.3792***	0.2877***	0.1466	0.3794***
	[0.070]	[0.124]	[0.090]	[0.087]	[0.152]	[0.113]	[0.087]	[0.152]	[0.113]
Coast region	-0.3236***	-0.3234***	-0.3686***	-0.3981***	-0.4002***	-0.4763***	-0.3985***	-0.3987***	-0.4762***
	[0.067]	[0.114]	[0.091]	[0.080]	[0.137]	[0.110]	[0.080]	[0.137]	[0.110]
Eastern region	0.0793	-0.0353	0.1418*	0.0427	-0.1106	0.1296	0.0426	-0.1112	0.1297
	[0.067]	[0.117]	[0.086]	[0.078]	[0.138]	[0.102]	[0.078]	[0.138]	[0.102]
North Eastern region	-0.8976***	-1.0784***	-0.9158***	-0.8546***	-1.0826***	-0.8278***	-0.8576***	-1.0749***	-0.8265***
	[0.124]	[0.159]	[0.252]	[0.149]	[0.195]	[0.304]	[0.150]	[0.196]	[0.304]
Nyanza region	0.1543**	-0.1163	0.3195***	0.2590**	-0.0513	0.4294***	0.2577**	-0.0483	0.4306***
	[0.066]	[0.114]	[0.086]	[0.103]	[0.174]	[0.132]	[0.103]	[0.174]	[0.132]
Rift Valley region	0.0715	-0.033	0.1175	0.0494	-0.0983	0.1215	0.0491	-0.0983	0.1218
	[0.063]	[0.111]	[0.082]	[0.075]	[0.132]	[0.098]	[0.075]	[0.132]	[0.098]
Western region	-0.0404	-0.2255*	0.0654	-0.065	-0.2355	0.0152	-0.0656	-0.2347	0.0157
	[0.071]	[0.123]	[0.091]	[0.097]	[0.168]	[0.125]	[0.098]	[0.168]	[0.125]
Constant	-2.2357***	-0.6091***	-2.2960***	-2.2862***	-0.7390***	-2.3492***	-2.2854***	-0.7372***	-2.3491***
	[0.141]	[0.230]	[0.185]	[0.162]	[0.265]	[0.214]	[0.162]	[0.265]	[0.214]
Observations	11,230	5,880	5,350	8,804	4,604	4,200	8,804	4,604	4,200
χ^2	1493	406.99	671.33	1174.30	317.12	592.26	1175.28	317.62	592.38
R	0.1465	0.1032	0.1068	0.1481	0.0993	0.1201	0.1481	0.0994	0.1201

Robust standard errors in brackets ***, ** , *: significant at 1%, 5% and 10% respectively

Table A4: Estimates of the Determinants of Chronic and Acute Illnesses, Coefficients

Variables	Probit estimates					
	Chronic illness			Acute illness		
	Full sample	Male	Female	Full sample	Male	Female
Age	0.0264***	-0.0045	0.0441***	0.0289***	0.0341***	0.0196*
	[0.010]	[0.016]	[0.014]	[0.008]	[0.013]	[0.012]
Age squared	0	0.0003*	-0.0002	-0.0003**	-0.0004**	-0.0001
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Gender (Male=1)	-0.3010***			-0.2696***		
	[0.037]			[0.030]		
Education dummies (No education is the reference category)						
Primary education	-0.1362***	-0.1112*	-0.1530**	-0.0399	-0.0628	-0.0214
	[0.044]	[0.067]	[0.059]	[0.036]	[0.054]	[0.048]
Secondary education	-0.2763***	-0.1994**	-0.3367***	-0.1519***	-0.2156***	-0.0926
	[0.056]	[0.080]	[0.079]	[0.044]	[0.064]	[0.062]
Tertiary education	-0.2302***	-0.1785**	-0.2600***	-0.1587***	-0.1349**	-0.2053***
	[0.060]	[0.084]	[0.087]	[0.050]	[0.069]	[0.075]
Marital status	-0.0852*	0.0259	-0.1155**	0.0760**	0.1135*	0.0629
(Married =1)	[0.046]	[0.088]	[0.056]	[0.037]	[0.066]	[0.047]
Presence of children 0-5 years (No children is the reference category)						
One child	0.0501	0.0757	0.0291	-0.0044	-0.0492	0.0291
	[0.043]	[0.065]	[0.059]	[0.036]	[0.053]	[0.048]
Two or more children	-0.0523	0.0762	-0.1563**	-0.1420***	-0.1904***	-0.1031*
	[0.051]	[0.075]	[0.070]	[0.041]	[0.063]	[0.055]
Rural area	-0.0145	0.0755	-0.0775	-0.1275***	-0.1863***	-0.0713
	[0.043]	[0.066]	[0.058]	[0.034]	[0.049]	[0.047]
Region (Nairobi region is the reference)						
Central region	-0.3588***	-0.4048**	-0.3386**	-0.9338***	-0.8523**	-1.0505***
	[0.111]	[0.162]	[0.153]	[0.268]	[0.386]	[0.373]

Coastal region	-0.2768**	-0.4518***	-0.1505	-0.7366***	-0.5929	-0.8853**
	[0.118]	[0.174]	[0.162]	[0.261]	[0.375]	[0.363]
Eastern region	-0.1726	-0.2662*	-0.1289	-0.5662**	-0.3953	-0.7412**
	[0.109]	[0.160]	[0.147]	[0.265]	[0.382]	[0.368]
North Eastern region	-0.7890**		-0.2373	-1.4531***	-1.7059***	-1.1635**
	[0.316]		[0.416]	[0.360]	[0.556]	[0.514]
Nyanza region	0.2150*	0.1023	0.2784*	-0.3059	-0.1087	-0.5058
	[0.110]	[0.161]	[0.150]	[0.261]	[0.376]	[0.363]
Rift valley region	-0.2184**	-0.2673*	-0.2197	-0.7953***	-0.5959	-0.9979***
	[0.106]	[0.155]	[0.145]	[0.268]	[0.386]	[0.372]
Western region	0.0797	-0.0492	0.1541	-0.2751	-0.0268	-0.5271
	[0.117]	[0.172]	[0.159]	[0.275]	[0.395]	[0.382]
Transfers	0.1017**	0.1667***	0.0442	0.0690**	0.0643	0.0745*
	[0.040]	[0.060]	[0.055]	[0.032]	[0.047]	[0.045]
Instruments						
Distance to weekly market	-0.0010***	-0.0007**	-0.0013***	-0.0006***	-0.0006**	-0.0005**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Number of health facilities	-0.0024***	-0.0016	-0.0032***	-0.0017***	-0.0014**	-0.0020***
	[0.001]	[0.001]	[0.001]	[0.000]	[0.001]	[0.001]
Constant	-1.4900***	-1.3717***	-1.6712***	-0.5204*	-0.9774**	-0.2638
	[0.212]	[0.322]	[0.292]	[0.312]	[0.458]	[0.432]
χ^2	451.64	165.89	263.31	495.75	244	194.9
R	0.0781	0.06	0.08	0.05	0.05	0.038
Observations	8,809	4,536	4,203	9,821	5,060	4,761

Robust standard errors in brackets ***, ** , *: significant at 1%, 5% and 10% respectively

APPENDIX 2: EFFECT OF ILLNESS ON EMPLOYMENT STATUS

Hausman tests of Independence of Irrelevant Alternatives (IIA) assumption

Null hypothesis: Odds (Outcome-J vs Outcome-K) are independentof other alternatives.

Table A5: Hausman test, Acute Illness

Omitted	χ^2	Degree of freedom	p> χ^2	Evidence
Wage employment	-286.266	13	1.000	For Ho
Non-agricultural self-employment	-324.335	13	1.000	For Ho
Agricultural self-employment	579.189	12	0.000	Against Ho
Not working	802.636	24	0.000	Against Ho

Table A6: Hausman test, Chronic Illness

Omitted	χ^2	Degree of freedom	p> χ^2	Evidence
Wage employment	-246.296	13	1.000	For Ho
Non-agricultural self-employment	717.329	12	0.000	Against Ho
Agricultural self-employment	0.163	24	1.000	For Ho
Not working	820.667	24	0.000	Against Ho

Likelihood ratio for combining outcome categories

Null hypothesis: All coefficients except intercepts associated with given pair of outcomes are zero (i.e., categories can be collapsed).

Table A7: LR Test for Combining Employment Outcome Categories, Acute Illness

Categories tested	χ^2	**Degrees of freedom**	$p > \chi^2$
Wage employment-non-agricultural self-employment	311.337	12	0.0000
Wage employment ï agricultural self-employment	1961.867	12	0.0000
Wage employment-Not working	1517.676	12	0.0000
Non-agricultural self-employment ï agricultural self-employment	1475.92	12	0.0000
Non-agricultural self-employment -Not working	800.385	12	0.0000
Agricultural self-employmentï Not working	1475.526	12	0.0000

Table A8: LR Test for Combining Employment Outcome Categories, Chronic Illness

Categories tested	χ^2	Degrees of freedom	$p > \chi^2$
Wage employment-non-agricultural self-employment	303.952	12	0.0000
Wage employment ï agricultural self-employment	1764.063	12	0.0000
Wage employment-Not working	1316.955	12	0.0000
Non-agricultural self-employment ï agricultural self - employment	1314.780	12	0.0000
Non-agricultural self-employment -Not working	668.383	12	0.0000
Agricultural self-employmentï Not working	1310.324	12	0.0000

Table A9: Test of Statistical Difference between Coefficients in the Gender Models

Dependent variable: types of employments

The null hypothesis: Interaction terms are jointly equal to zero

	Health status=chronic illness			**Health status=acute illness**		
Chronic illness	-0.3998***	-0.0952	-0.3055***			
	[0.091]	[0.087]	[0.082]			
Acute illness				-0.0827	-0.0359	-0.0945
				[0.069]	[0.070]	[0.063]
Gender (Male=1)	0.2117***	0.2095***	0.1272***	0.2298***	0.2099***	0.1218***
	[0.019]	[0.019]	[0.016]	[0.018]	[0.018]	[0.016]
Age	-0.0025***	-0.0024***	-0.0013***	-0.0027***	-0.0024***	-0.0011***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Age squared	1.5801***	1.9357***	2.1182***	1.5835***	1.4820***	1.7329***
	[0.414]	[0.449]	[0.385]	[0.398]	[0.433]	[0.371]
Primary education	0.1904**	0.1136	0.1524**	0.1392*	0.1231*	0.1156*
	[0.078]	[0.077]	[0.067]	[0.073]	[0.073]	[0.063]
Secondary education	0.3033***	-0.0089	-0.0168	0.1700**	0.0841	-0.0859
	[0.091]	[0.094]	[0.088]	[0.086]	[0.088]	[0.082]
Tertiary education	1.1767***	-0.0807	-0.3331***	1.1096***	0.0447	-0.2950**
	[0.098]	[0.111]	[0.118]	[0.095]	[0.108]	[0.115]
Married dummy	-0.8168***	-0.097	-0.1715**	-0.8659***	-0.1715**	-0.1515**
	[0.069]	[0.072]	[0.067]	[0.066]	[0.069]	[0.064]
1 child (0-5 years)	-0.117	-0.1501**	-0.2763***	-0.1019	-0.0334	-0.1759***
	[0.073]	[0.076]	[0.071]	[0.069]	[0.072]	[0.067]
Two or more children (0-5 years)	-0.2533***	-0.1853**	-0.1761**	-0.3185***	-0.1715**	-0.1217*
	[0.088]	[0.088]	[0.075]	[0.083]	[0.084]	[0.071]
Rural area	-0.0837	-0.3055***	1.8294***	-0.1037*	-0.2931***	1.8138***
	[0.065]	[0.067]	[0.074]	[0.061]	[0.064]	[0.070]
Transfers	0.0266	0.0409	-0.3146***	-0.0392	-0.019	-0.3064***
	[0.067]	[0.069]	[0.062]	[0.063]	[0.066]	[0.059]
Maled*Chronic illness	0.1943	-0.0828	0.1006			

	[0.133]	[0.138]	[0.129]			
Maled*Acute illness				0.1248	0.1298	0.0819
				[0.100]	[0.106]	[0.100]
Maled*Age	-0.0445*	-0.0978***	-0.0972***	-0.0470*	-0.0640**	-0.0688***
	[0.025]	[0.027]	[0.023]	[0.024]	[0.026]	[0.022]
Maled*Age squared	0.0003	0.0010***	0.0010***	0.0003	0.0005	0.0006**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Maled*Primary education	-0.2689**	-0.1433	-0.2311**	-0.2262**	-0.0897	-0.1147
	[0.107]	[0.113]	[0.098]	[0.101]	[0.107]	[0.094]
Maled*Secondary education	-0.3892***	0.0128	-0.1234	-0.2870**	-0.1399	-0.0022
	[0.123]	[0.132]	[0.123]	[0.117]	[0.125]	[0.117]
Maled* Tertiary education	-0.5856***	0.1773	0.0347	-0.6137***	-0.0762	-0.0367
	[0.138]	[0.156]	[0.161]	[0.132]	[0.149]	[0.155]
Maled* Marital status dummy	1.6424***	1.1723***	0.7548***	1.6179***	1.1019***	0.6414***
	[0.108]	[0.119]	[0.111]	[0.103]	[0.114]	[0.107]
Maled* One child (0-5 years)	0.0086	0.2037*	0.1369	0.0453	0.1905*	0.0704
	[0.104]	[0.111]	[0.105]	[0.099]	[0.106]	[0.100]
Maled* Two or more children (0-5 years)	-0.0688	0.0118	0.1102	-0.0243	0.0762	0.085
	[0.122]	[0.128]	[0.113]	[0.116]	[0.123]	[0.108]
Maled* Rural area	-0.2169**	-0.0198	-0.2842***	-0.2139**	-0.0852	-0.2953***
	[0.089]	[0.096]	[0.107]	[0.085]	[0.092]	[0.101]
Maled* Transfers	0.0084	-0.0578	0.0843	0.0113	-0.0133	0.0498
	[0.091]	[0.098]	[0.089]	[0.087]	[0.094]	[0.085]
Constant	-4.1124***	-4.3929***	-3.6388***	-4.3003***	-4.4475***	-3.6142***
	[0.303]	[0.312]	[0.267]	[0.292]	[0.301]	[0.255]
Observations	11,230	11,230	11,230	12,451	12,451	12,451
χ^2	3691.35	3691.35	3691.35	4187.99	4187.99	4187.99

Robust standard errors in brackets ***, ** , *: significant at 1%, 5% and 10% respectively Maled is male dummy

Table A10: Estimates of Effect of Chronic Illness on Employment Status, Coefficients

	Full sample			Male			Female		
	Wage employment	Self agricultural	Self non agricultural	Wage employment	Self agricultural	Self non agricultural	Wage employment	Self agricultural	Self non agricultural
Chronic illness	-0.2911***	-0.1196*	-0.2557***	-0.2054**	-0.1780*	-0.2049**	-0.3998***	-0.0952	-0.3055***
	[0.064]	[0.067]	[0.062]	[0.096]	[0.107]	[0.099]	[0.091]	[0.087]	[0.082]
Age	0.2143***	0.1811***	0.0915***	0.1672***	0.1118***	0.0300*	0.2117***	0.2095***	0.1272***
	[0.012]	[0.013]	[0.011]	[0.017]	[0.019]	[0.016]	[0.019]	[0.019]	[0.016]
Age squared	-0.0026***	-0.0021***	-0.0009***	-0.0022***	-0.0014***	-0.0003	-0.0025***	-0.0024***	-0.0013***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Gender: Male =1	1.0357***	0.5703***	0.3784***						
	[0.042]	[0.046]	[0.042]						
Primary education	0.0871*	0.0686	0.0546	-0.0785	-0.0297	-0.0788	0.1904**	0.1136	0.1524**
	[0.052]	[0.056]	[0.048]	[0.073]	[0.082]	[0.072]	[0.078]	[0.077]	[0.067]
Secondary education	0.1030*	0.0168	-0.0724	-0.0859	0.0038	-0.1403	0.3033***	-0.0089	-0.0168
	[0.060]	[0.065]	[0.061]	[0.083]	[0.093]	[0.086]	[0.091]	[0.094]	[0.088]
Tertiary education	0.8573***	0.0527	-0.2847***	0.5912***	0.0966	-0.2984***	1.1767***	-0.0807	-0.3331***
	[0.067]	[0.076]	[0.079]	[0.096]	[0.109]	[0.110]	[0.098]	[0.111]	[0.118]
Married	-0.1250**	0.2974***	0.0388	0.8255***	1.0753***	0.5833***	-0.8168***	-0.097	-0.1715**
	[0.051]	[0.055]	[0.051]	[0.083]	[0.094]	[0.089]	[0.069]	[0.072]	[0.067]
1 child (0-5 years)	-0.0807	-0.0196	-0.1996***	-0.1084	0.0536	-0.1394*	-0.117	-0.1501**	-0.2763***
	[0.050]	[0.054]	[0.051]	[0.073]	[0.081]	[0.078]	[0.073]	[0.076]	[0.071]
2 or more children	-0.2260***	-0.1389**	-0.1076*	-0.3222***	-0.1735*	-0.0659	-0.2533***	-0.1853**	-0.1761**
(0-5 years)	[0.058]	[0.063]	[0.055]	[0.084]	[0.094]	[0.084]	[0.088]	[0.088]	[0.075]
Rural area	-0.2292***	-0.3179***	1.6865***	-0.3007***	-0.3254***	1.5452***	-0.0837	-0.3055***	1.8294***
	[0.044]	[0.047]	[0.053]	[0.062]	[0.069]	[0.077]	[0.065]	[0.067]	[0.074]
Transfers	0.0248	0.0079	-0.2677***	0.035	-0.0169	-0.2303***	0.0266	0.0409	-0.3146***

	[0.044]	[0.048]	[0.044]	[0.062]	[0.070]	[0.064]	[0.067]	[0.069]	[0.062]
Constant	-4.3354***	-4.1232***	-3.0192***	-2.5323***	-2.4572***	-1.5206***	-4.1124***	-4.3929***	-3.6388***
	[0.201]	[0.219]	[0.189]	[0.281]	[0.323]	[0.278]	[0.303]	[0.312]	[0.267]
χ^2	3691.35***			1684.63***			1754.31***		
Observations	11,230	11,230	11,230	5,880	5,880	5,880	5,350	5,350	5,350

Standard errors in brackets*** p<0.01, ** p<0.05, * p<0.1

Table A11: Estimates of the Effect of Acute Illness on Employment Status, Coefficients

	Full sample			Male			Female		
	Wage employment	Self agricultural	Self non agricultural	Wage employment	Self agricultural	Self non agricultural	Wage employment	Self agricultural	Self non agricultural
Acute illness	-0.0246	0.0184	-0.0585	0.042	0.0938	-0.0126	-0.0827	-0.0359	-0.0945
	[0.048]	[0.052]	[0.049]	[0.073]	[0.081]	[0.078]	[0.069]	[0.070]	[0.063]
Age	0.2307***	0.1999***	0.1026***	0.1828***	0.1458***	0.0530***	0.2298***	0.2099***	0.1218***
	[0.012]	[0.013]	[0.011]	[0.016]	[0.018]	[0.016]	[0.018]	[0.018]	[0.016]
Age squared	-0.0028***	-0.0023***	-0.0010***	-0.0024***	-0.0019***	-0.0005***	-0.0027***	-0.0024***	-0.0011***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Gender: Male=1	1.0484***	0.6150***	0.3868***						
	[0.040]	[0.043]	[0.040]						
Primary education	0.0523	0.1015*	0.0657	-0.087	0.0334	0.0009	0.1392*	0.1231*	0.1156*
	[0.049]	[0.053]	[0.046]	[0.070]	[0.078]	[0.070]	[0.073]	[0.073]	[0.063]
Secondary education	0.0361	0.0297	-0.0798	-0.1171	-0.0558	-0.0881	0.1700**	0.0841	-0.0859
	[0.057]	[0.062]	[0.058]	[0.080]	[0.090]	[0.083]	[0.086]	[0.088]	[0.082]
Tertiary education	0.7951***	0.0516	-0.2873***	0.4959***	-0.0315	-0.3317***	1.1096***	0.0447	-0.2950**
	[0.065]	[0.073]	[0.076]	[0.091]	[0.104]	[0.104]	[0.095]	[0.108]	[0.115]
Married	-0.2027***	0.1891***	-0.0006	0.7520***	0.9303***	0.4899***	-0.8659***	-0.1715**	-0.1515**
	[0.049]	[0.053]	[0.049]	[0.080]	[0.090]	[0.086]	[0.066]	[0.069]	[0.064]
1 child (0-5 years)	-0.0462	0.0828	-0.1405***	-0.0566	0.1571**	-0.1055	-0.1019	-0.0334	-0.1759***
	[0.048]	[0.052]	[0.049]	[0.071]	[0.078]	[0.075]	[0.069]	[0.072]	[0.067]
2 or more children	-0.2737***	-0.0995*	-0.0774	-0.3428***	-0.0953	-0.0367	-0.3185***	-0.1715**	-0.1217*
(0-5 years)	[0.056]	[0.060]	[0.052]	[0.082]	[0.090]	[0.082]	[0.083]	[0.084]	[0.071]
Rural area	-0.2390***	-0.3320***	1.6708***	-0.3176***	-0.3783***	1.5185***	-0.1037*	-0.2931***	1.8138***
	[0.041]	[0.045]	[0.050]	[0.059]	[0.066]	[0.073]	[0.061]	[0.064]	[0.070]
Transfers	-0.0423	-0.0303	-0.2785***	-0.0279	-0.0323	-0.2565***	-0.0392	-0.019	-0.3064***
	[0.042]	[0.046]	[0.042]	[0.060]	[0.067]	[0.062]	[0.063]	[0.066]	[0.059]

Constant	-4.5265***	-4.4466***	-3.2104***	-2.7167***	-2.9655***	-1.8813***	-4.3003***	-4.4475***	-3.6142***
	[0.193]	[0.212]	[0.182]	[0.271]	[0.311]	[0.269]	[0.292]	[0.301]	[0.255]
χ^2	4187.99***			1859.16***			1984.32***		
Observations	12,451	12,451	12,451	6,440	6,440	6,440	6,011	6,011	6,011

Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

APPENDIX 3: EFFECT OF ILLNESS ON EARNINGS

Table A12: Test of Statistical Difference between Coefficients in the Gender Models

Dependent variable: log of monthly wages

Null hypothesis: The interaction terms are jointly equal to zero

Variables	OLS estimates					
	Wage employment	Agricultural self-employment	Non-agricultural self-employment	Wage employment	Agricultural self-employment	Non-agricultural self - employment
Acute illness	-0.1755**	-0.1308	-0.063			
	[0.069]	[0.178]	[0.231]			
Chronic illness				-0.0423	-0.2489*	0.3442
				[0.090]	[0.148]	[0.274]
Age	0.0586***	0.0062	-0.003	0.0694***	0.0496	-0.0517
	[0.020]	[0.043]	[0.064]	[0.021]	[0.039]	[0.080]
Age squared	-0.0004	0.0003	-0.0001	-0.0006*	-0.0004	0.0007
	[0.000]	[0.001]	[0.001]	[0.000]	[0.001]	[0.001]
Gender (Male=1)	0.0922	-0.1127	0.0211	0.1086	0.5048	-0.76
	[0.375]	[1.019]	[1.685]	[0.398]	[1.085]	[1.759]
Education dummies (No formal education is the reference category)						
Primary education	0.3786***	0.4030**	0.4154*	0.3693***	0.3331**	0.6188**
	[0.068]	[0.172]	[0.247]	[0.073]	[0.160]	[0.293]
Secondary education	0.8628***	0.8924***	0.8018**	0.8547***	0.6019***	1.0625***
	[0.088]	[0.195]	[0.359]	[0.093]	[0.194]	[0.369]
Tertiary education	1.5665***	1.1019***	1.6283***	1.5473***	1.1530***	1.4562**
	[0.083]	[0.288]	[0.458]	[0.084]	[0.264]	[0.657]
Marital status	0.0483	-0.1804	0.0297	0.083	-0.0628	0.2984
(Married =1)	[0.063]	[0.160]	[0.284]	[0.066]	[0.146]	[0.440]

Rural area	-0.5277***	-0.4123***	-0.1161	-0.5661***	-0.5137***	-0.3617
	[0.055]	[0.146]	[0.710]	[0.056]	[0.147]	[0.543]
Interaction terms						
Maled* Chronic illness				-0.0439	0.0576	-0.7558*
				[0.110]	[0.293]	[0.398]
Maled* Acute illness	0.0208	-0.0946	-0.3219			
	[0.082]	[0.223]	[0.309]			
Maled* Age	0.0246	0.0275	0.004	0.0216	-0.0189	0.0483
	[0.024]	[0.060]	[0.082]	[0.026]	[0.062]	[0.099]
Maled* Age squared	-0.0004	-0.0004	0.0001	-0.0004	0.0003	-0.0007
	[0.000]	[0.001]	[0.001]	[0.000]	[0.001]	[0.001]
Maled* Primary education	-0.1229	0.0629	-0.0157	-0.1226	0.0725	-0.3821
	[0.083]	[0.234]	[0.314]	[0.089]	[0.241]	[0.365]
Maled* secondary education	-0.1541	-0.2167	-0.5287	-0.135	-0.0731	-0.6601
	[0.103]	[0.269]	[0.448]	[0.108]	[0.277]	[0.453]
Maled* Tertiary education	-0.3208***	0.2938	-0.7519	-0.2890***	0.3803	-0.395
	[0.097]	[0.368]	[0.536]	[0.101]	[0.365]	[0.730]
Maled* Marital status dummy	0.0882	0.5181**	0.3764	0.0736	0.5302**	-0.0084
	[0.080]	[0.230]	[0.381]	[0.085]	[0.241]	[0.526]
Maled*Rural area	0.0542	-0.3436*	-0.0481	0.0775	-0.3588*	0.7544
	[0.065]	[0.200]	[0.883]	[0.067]	[0.211]	[0.724]
Constant	6.2571***	7.2921***	7.0204***	6.1033***	6.7194***	7.5404***
	[0.300]	[0.734]	[1.354]	[0.317]	[0.710]	[1.400]
Observations	3,310	584	280	2,941	528	225
R^2	0.474	0.333	0.139	0.484	0.375	0.139

Robust standard errors in brackets ***, ** , *: significant at 1%, 5% and 10% respectively Maled is male dummy

Table A13: Estimates of Determinants of Chronic and Acute Illness

	Chronic illness			Acute illness		
	Full sample	Male	Female	Full sample	Male	Female
Age	0.0243***	-0.0018	0.0357***	0.0238***	0.0201*	0.0236**
	[0.009]	[0.014]	[0.012]	[0.007]	[0.011]	[0.010]
Age squared	0.00003	0.0003	-0.0001	-0.0002*	-0.0002	-0.0002
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Gender (Male=1)	-0.2886***			-0.2443***		
	[0.032]			[0.026]		
Education dummies (No education is the reference category)						
Primary education	-0.1458***	-0.0993*	-0.1794***	-0.0603*	-0.073	-0.0474
	[0.038]	[0.057]	[0.051]	[0.031]	[0.047]	[0.043]
Secondary education	-0.3345***	-0.2370***	-0.4171***	-0.1867***	-0.2462***	-0.1256**
	[0.049]	[0.069]	[0.070]	[0.039]	[0.056]	[0.054]
Tertiary education	-0.2899***	-0.2553***	-0.3017***	-0.2204***	-0.1856***	-0.2772***
	[0.052]	[0.073]	[0.075]	[0.043]	[0.059]	[0.065]
Marital status	-0.0351	0.0949	-0.0696	0.0658**	0.0822	0.0591
(Married =1)	[0.039]	[0.072]	[0.048]	[0.032]	[0.055]	[0.040]
Rural area	-0.0326	0.0205	-0.0737	-0.0262	-0.0923**	0.0331
	[0.034]	[0.051]	[0.048]	[0.029]	[0.041]	[0.040]
Percentage of children in the district fully	-0.0052***	-0.0036***	-0.0065***			
immunized	[0.001]	[0.001]	[0.001]			
Percentage of people in the district				0.0096***	0.0103***	0.0090***
who slept under a moquito net				[0.001]	[0.001]	[0.001]
Constant	-1.2822***	-1.2775***	-1.3670***	-1.4565***	-1.5992***	-1.4913***
	[0.156]	[0.242]	[0.212]	[0.126]	[0.196]	[0.172]
χ^2	425.3	139.39	255.49	339.65	144.79	124.3
R	0.055	0.037	0.059	0.027	0.024	0.019

Robust standard errors in brackets ***, ** , *: significant at 1%, 5% and 10% respectively

Table A14: Estimates of Effect of Acute Illness on Earnings-Male Sample

Variables	OLS			Two-stage residual inclusion (2SRI)			Control function approach		
	Wage employment	Agricultural self-employment	Non-agricultural self-employment	Wage employment	Agricultural self-employment	Non - agricultural self - employment	Wage employment	Agricultural self - employment	Non-agricultural self - employment
Acute illness	-0.1547***	-0.2253*	-0.3849*	-0.9859	0.3538	-0.244	-1.5218	-3.1615	-1.6084
	[0.045]	[0.135]	[0.204]	[0.712]	[3.614]	[8.970]	[1.200]	[7.131]	[12.186]
Acute illness				0.8296	-0.5458	0.0248	0.6709	-1.9424	-0.44
residual				[0.743]	[3.514]	[8.845]	[0.728]	[6.049]	[15.057]
Acute illness* predicted							0.8609	6.1502	2.3344
acute illness residual							[1.206]	[4.146]	[7.548]
Age	0.0832***	0.0337	0.001	0.1440***	-0.0152	0.1017	0.1427***	-0.0283	0.1046
	[0.014]	[0.042]	[0.051]	[0.040]	[0.146]	[0.632]	[0.034]	[0.168]	[0.421]
Age squared	-0.0008***	-0.0001	0	-0.0017***	0.0005	-0.0019	-0.0016***	0.0007	-0.0019
	[0.000]	[0.001]	[0.001]	[0.001]	[0.002]	[0.009]	[0.000]	[0.002]	[0.007]
Education dummies (No formal education is the reference category)									
Primary education	0.2556***	0.4659***	0.3997**	0.1514**	0.5617***	0.1794	0.1520**	0.5791	0.1689
	[0.048]	[0.158]	[0.193]	[0.069]	[0.164]	[0.440]	[0.074]	[0.498]	[0.572]
Secondary education	0.7087***	0.6756***	0.273	0.6371***	0.7606***	0.4696	0.6391***	0.7344**	0.4688
	[0.053]	[0.185]	[0.267]	[0.050]	[0.206]	[0.839]	[0.064]	[0.327]	[0.637]
Tertiary education	1.2457***	1.3957***	0.8764***	1.7408***	1.0811	3.4063	1.7348***	0.8408	3.4331
	[0.051]	[0.228]	[0.276]	[0.223]	[0.659]	[5.129]	[0.131]	[1.249]	[5.290]
Marital status	0.1366***	0.3377**	0.4062	0.12	0.3567	-0.3357	0.1168	0.3337	-0.2973
(Married =1)	[0.050]	[0.165]	[0.253]	[0.173]	[1.084]	[1.526]	[0.180]	[1.102]	[0.859]
Rural area	-0.4735***	-0.7559***	-0.1642	-0.9677**	-1.0134	-4.6343	-0.9602***	-0.5095	-4.8016
	[0.035]	[0.136]	[0.523]	[0.397]	[1.249]	[7.819]	[0.237]	[0.926]	[7.408]
IMR wage employment				0.4290**	-2.134	7.6431	0.4331*	-1.6899	7.4851
				[0.203]	[3.928]	[18.310]	[0.228]	[5.470]	[22.638]

IMR_non agricultural				-2.9876***	0.745	-4.7831	-2.9572***	1.1866	-4.9543
Self employment				[1.000]	[2.287]	[12.200]	[0.807]	[3.666]	[11.361]
IMR _ agricultural				-2.0126	-0.8279	-3.2165	-1.9783**	1.2062	-3.4075
Self employment				[1.332]	[3.459]	[4.239]	[0.944]	[3.343]	[4.421]
IMR_ not working				-1.2088	0.6361	6.4159	-1.1696	1.593	6.1108
				[0.930]	[3.978]	[8.599]	[0.981]	[3.309]	[9.077]
Constant	6.3493***	7.1794***	7.0415***	3.7390***	6.0217	16.3759**	3.7568***	6.2348	16.3439
	[0.225]	[0.705]	[0.998]	[1.336]	[8.253]	[7.765]	[0.908]	[9.761]	[10.486]
Observations	2265	160	349						
F	220.82***	2.46***	19.56***						
R squared	0.4486	0.1034	0.3395						

Robust standard errors in brackets ***, ** , *: significant at 1%, 5% and 10% respectively IMR = Inverse Millôs Ratio

Table A15: Estimates of Effect of Chronic Illness on Earnings-Male Sample

Variables	OLS			Two-stage residual inclusion (2SRI)			Control function approach		
	Wage employment	Agricultural self-employment	Non-agricultural self-employment	Wage employment	Agricultural self-employment	Non-agricultural self-employment	Wage employment	Agricultural self-employment	Non-agricultural self-employment
Chronic illness	-0.0863	-0.1913	-0.4117	-3.3619**	5.9098	-17.3761	-5.3503	7.0012	-18.166
	[0.064]	[0.252]	[0.287]	[1.418]	[13.037]	[14.821]	[3.546]	[10.634]	[14.371]
Chronic illness residual				3.2571**	-6.0414	17.1486	3.3143	-7.3213	11.7379
				[1.434]	[12.880]	[14.919]	[2.492]	[8.413]	[11.358]
Chronic illness*predicted chronic illness residual							2.1769	0.2329	7.1985
							[1.817]	[4.628]	[6.160]
Age	0.0910***	0.0308	-0.0033	0.1385***	-0.0986	0.401	0.1416***	-0.0876	0.2401
	[0.015]	[0.048]	[0.057]	[0.034]	[0.079]	[0.463]	[0.042]	[0.151]	[0.429]
Age squared	-0.0010***	-0.0001	0	-0.0014***	0.0012	-0.0047	-0.0014***	0.001	-0.0028
	[0.000]	[0.001]	[0.001]	[0.001]	[0.001]	[0.006]	[0.000]	[0.002]	[0.005]
Education dummies (No formal education is the reference category)									
Primary education	0.2467***	0.4056**	0.2367	0.1157	0.6234	-0.3348	0.1018	0.6607	-0.1729
	[0.050]	[0.180]	[0.217]	[0.074]	[0.762]	[0.644]	[0.078]	[0.417]	[0.410]
Secondary education	0.7198***	0.5288***	0.4024	0.4724***	0.893	-0.4511	0.4521**	0.9869	-0.1833
	[0.055]	[0.198]	[0.260]	[0.130]	[1.067]	[1.298]	[0.198]	[0.730]	[0.762]
Tertiary education	1.2583***	1.5333***	1.0612***	1.4065***	1.9725***	3.9136*	1.4237***	1.9228***	3.3266**
	[0.056]	[0.252]	[0.314]	[0.188]	[0.542]	[2.153]	[0.257]	[0.473]	[1.315]
Marital status	0.1566***	0.4674**	0.29	0.056	-0.7568	-0.522	0.0479	-0.3655	-0.7464
(Married =1)	[0.055]	[0.191]	[0.286]	[0.231]	[1.919]	[2.593]	[0.189]	[1.261]	[1.987]
Rural area	-0.4886***	-0.8725***	0.3927	-0.7147**	-0.3516	-5.6373	-0.7371**	-0.3967	-4.5869
	[0.037]	[0.151]	[0.475]	[0.339]	[1.404]	[7.450]	[0.361]	[1.392]	[3.492]

IMR_wage				0.1813	-2.3862	12.679	0.1749	-2.5434	8.7051
employment				[0.286]	[6.124]	[15.851]	[0.407]	[7.256]	[9.103]
IMR_non agricultural				-2.3718**	-2.1276	-10.1495	-2.6143	-1.4608	-9.6865
employment				[1.104]	[3.425]	[19.455]	[2.541]	[1.731]	[13.367]
IMR _ agricultural				-1.2476	-1.7236	-4.2909	-1.4065	-1.3097	-3.8893
employment				[1.249]	[4.585]	[5.226]	[1.647]	[5.634]	[2.385]
IMR_ not working				-0.984	2.1952	3.0587	-1.1293	1.4296	3.4912
				[1.031]	[4.442]	[8.603]	[1.193]	[4.988]	[7.720]
Constant	6.2118***	7.2242***	6.7803***	4.3841***	11.3561	13.8914*	4.1950**	9.8569	13.8136**
	[0.240]	[0.819]	[1.057]	[1.099]	[8.946]	[8.295]	[1.821]	[6.957]	[6.630]
Observations	2017	137	298						
F	202.77***	2.07***	20.12***						
R squared	0.4619	0.0953	0.3740						

Robust standard errors in brackets ***, ** , *: significant at 1%, 5% and 10% respectively IMR = Inverse Millôs Ratio

Table A16: Estimates of Effect of Acute Illness on Earnings-Female Sample

Variables	OLS			Two-stage residual inclusion (2SRI)			Control function approach		
	Wage employment	Agricultural self-employment	Non-agricultural self - employment	Wage employment	Agricultural self-employment	Non-agricultural self-employment	Wage employment	Agricultural self-employment	Non-agricultural self-employment
Acute illness	-0.1755**	-0.1308	-0.063	-1.1936	-3.7242	18.0894	-1.99	-3.6684	11.1722
	[0.069]	[0.179]	[0.232]	[1.193]	[2.463]	[11.550]	[1.990]	[4.020]	[12.281]
Acute illness				1.0027	3.609	-17.5691	0.7185	3.8552	-24.599
residual				[1.217]	[2.292]	[11.215]	[1.454]	[3.097]	[22.043]
Acute illness* predicted							1.4145	-0.4046	18.994
acute illness residual							[1.494]	[3.124]	[20.366]
Age	0.0586***	0.0062	-0.003	0.0044	-0.1056	0.3231	0.0122	-0.1295	0.2893
	[0.020]	[0.043]	[0.065]	[0.066]	[0.328]	[0.802]	[0.041]	[0.284]	[0.594]
Age squared	-0.0004	0.0003	-0.0001	0.0002	0.0018	-0.0059	0.0001	0.002	-0.0057
	[0.000]	[0.001]	[0.001]	[0.001]	[0.004]	[0.009]	[0.000]	[0.003]	[0.007]
Education dummies (No formal education is the reference category)									
Primary education	0.3786***	0.4030**	0.4154*	0.3155***	0.1756	0.8366	0.3185***	0.1592	0.8679
	[0.068]	[0.173]	[0.249]	[0.070]	[0.324]	[0.777]	[0.102]	[0.215]	[0.619]
Secondary education	0.8628***	0.8924***	0.8018**	0.7806***	0.5895*	3.1487**	0.7964***	0.5738**	3.3944*
	[0.088]	[0.196]	[0.361]	[0.134]	[0.335]	[1.409]	[0.110]	[0.273]	[1.824]
Tertiary education	1.5665***	1.1019***	1.6283***	2.2727***	2.0771**	4.7784**	2.3479***	2.1795***	4.6272
	[0.083]	[0.289]	[0.461]	[0.675]	[0.863]	[2.112]	[0.514]	[0.579]	[4.238]
Marital status	0.0483	-0.1804	0.0297	-0.3781	-0.7461*	0.0356	-0.4275	-0.7892	0.2113
(Married =1)	[0.063]	[0.160]	[0.286]	[0.445]	[0.437]	[1.846]	[0.321]	[0.511]	[1.795]
Rural area	-0.5277***	-0.4123***	-0.1161	-0.1786	0.0225	-19.854**	-0.2506	0.2502	-21.4654*
	[0.055]	[0.147]	[0.714]	[0.510]	[1.170]	[9.529]	[0.451]	[1.107]	[12.347]
IMR_wage				0.5776	-1.1866	-5.4369	0.6407	0.0091	-7.3391
employment				[0.790]	[3.567]	[12.015]	[0.657]	[3.286]	[14.388]

IMR_non agricultural				-4.8361**	-2.983	38.4366	-4.9553***	-3.1173**	41.9267*
Self employment				[2.142]	[2.064]	[23.848]	[1.283]	[1.257]	[24.865]
IMR _ agricultural				-0.2948	-4.3208*	-9.3532**	-0.4805	-3.217	-10.2101*
Self employment				[1.320]	[2.224]	[3.820]	[1.137]	[3.896]	[5.308]
IMR_ not working				0.1861	-4.9748	1.8845	0.125	-3.6766	2.611
				[0.987]	[5.533]	[10.522]	[0.634]	[4.581]	[10.361]
Constant	6.2571***	7.2921***	7.0204***	5.7622***	10.474	28.9818*	5.4329***	12.3409	30.4469
	[0.300]	[0.737]	[1.362]	[1.938]	[11.755]	[16.226]	[1.362]	[8.116]	[21.054]
Observations	1045	120	235						
F	121.39***	2.32***	6.28***						
R squared	0.4933	0.1062	0.2134						

Robust standard errors in brackets ***, ** , *: significant at 1%, 5% and 10% respectively IMR = Inverse Millôs Ratio

Table A17: Estimates of Effect of Chronic Illness on Earnings-Female Sample

Variables	OLS			Two-stage residual inclusion (2SRI)			Control function approach		
	Wage employment	Agricultural self-employment	Non-agricultural self-employment	Wage employment	Agricultural self-employment	Non-agricultural self - employment	Wage employment	Agricultural self-employment	Non-agricultural self-employment
Chronic illness	-0.0423	-0.2489*	0.3442	-3.0029**	-13.1911**	16.5371	-4.4193*	-12.0738	17.2706
	[0.090]	[0.149]	[0.277]	[1.523]	[5.145]	[15.794]	[2.426]	[7.882]	[10.583]
Chronic illness residual				2.8846*	12.5837**	-15.6556	2.5494**	7.2579	-11.3637
				[1.514]	[5.299]	[15.092]	[1.007]	[8.112]	[7.573]
Chronic illness*predicted chronic illness residual							2.0907	5.3590**	-6.6973
							[2.441]	[2.137]	[7.816]
Age	0.0694***	0.0496	-0.0517	0.0302	-0.2848	-0.0861	0.0245	-0.2385	0.2029
	[0.021]	[0.039]	[0.081]	[0.083]	[0.187]	[0.712]	[0.090]	[0.149]	[0.730]
Age squared	-0.0006*	-0.0004	0.0007	0.0001	0.0042**	0	0.0002	0.0035**	-0.0032
	[0.000]	[0.001]	[0.001]	[0.001]	[0.002]	[0.008]	[0.001]	[0.002]	[0.008]
Education dummies (No formal education is the reference category)									
Primary education	0.3693***	0.3331**	0.6188**	0.2386*	-0.1256	1.074	0.2458***	-0.0382	1.0867**
	[0.074]	[0.160]	[0.296]	[0.124]	[0.343]	[0.665]	[0.075]	[0.289]	[0.527]
Secondary education	0.8547***	0.6019***	1.0625***	0.6466***	0.4028	1.7998**	0.6555***	0.4645	1.7096*
	[0.093]	[0.194]	[0.374]	[0.231]	[0.614]	[0.731]	[0.185]	[0.506]	[0.961]
Tertiary education	1.5473***	1.1530***	1.4562**	1.5545**	3.5181***	0.7884	1.5785***	2.6652***	1.5923
	[0.084]	[0.264]	[0.666]	[0.716]	[1.097]	[5.769]	[0.513]	[0.852]	[4.884]
Marital status	0.083	-0.0628	0.2984	-0.0731	-1.5300***	1.5072	-0.0822	-0.9433**	0.6814
(Married =1)	[0.066]	[0.147]	[0.445]	[0.459]	[0.361]	[3.213]	[0.351]	[0.479]	[2.621]
Rural area	-0.5661***	-0.5137***	-0.3617	-0.054	0.8299	-3.4173	-0.0682	0.2655	-2.7139
	[0.056]	[0.147]	[0.549]	[0.422]	[0.834]	[4.326]	[0.364]	[1.107]	[3.308]

IMR_wage				-0.1252	8.6904***	-7.7167	-0.1366	4.9833	-2.1682
employment				[0.595]	[2.590]	[18.784]	[0.485]	[3.785]	[15.282]
IMR_non agricultural				-2.5783*	-4.1201***	6.8852	-2.7202**	-3.1010***	8.7225
Self employment				[1.348]	[1.401]	[12.189]	[1.223]	[1.015]	[9.652]
IMR _ agricultural				0.1767	1.6536	-2.1638	0.0799	0.1758	-0.8884
Self employment				[1.396]	[3.355]	[3.740]	[1.004]	[3.784]	[4.002]
IMR_ not working				-0.49	4.9478	-0.9547	-0.5033	3.4048	-2.8464
				[1.637]	[3.145]	[13.416]	[1.305]	[3.563]	[13.716]
Constant	6.1033***	6.7194***	7.5404***	6.3473**	24.9255***	9.5507	6.3534**	19.9332***	4.2823
	[0.318]	[0.711]	[1.417]	[2.928]	[5.637]	[13.564]	[2.592]	[5.282]	[13.734]
Observations	924	88	230						
F	122.74***	1.84***	7.99***						
R squared	0.5052	0.1638	0.2224						

Robust standard errors in brackets ***, ** , *: significant at 1%, 5% and 10% respectively IMR = Inverse Millôs Ratio