ESSAYS ON HIV/AIDS, EXPORTS AND POVERTY IN KENYAN MANUFACTURING

NANCY NELIMA NAFULA MWANGE

SCHOOL OF ECONOMICS

UNIVERSITY OF NAIROBI

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DECLARATION

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

Signature..... Date 24th November 2011

Nancy Nelima Nafula Mwange

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

Signature..... Date 25/11/2011

Professor Germano Mwabu

School of Economics

University of Nairobi

Signature..... Date 2011-11-25

Dr. Anthony Wambugu

School of Economics

University of Nairobi

Signature..... Date 25/11/2011

Dr. Damiano Kulundu Manda

School of Economics

University of Nairobi

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ABBREVIATIONS AND ACRONYMS

2SPS	Two Stage Predictor Substitution
2SRI	Two Stage Residual Inclusion
AIDS	Acquired Immune Deficiency Syndrome
ART	Anti-retroviral Therapy
BMI	Body Mass Index
COMESA	Common Market for Eastern and Southern Africa
CFA	Control Function Approach
FGT	Foster Greer and Thorbecke
GDP	Gross Domestic Product
GHS	General Health Status
GIPA	Greater Involvement of People living with HIV and AIDS
GoK	Government of Kenya
HIV	Human Immune-deficiency Virus
IIV	Imperfect Instrumental Variable
IS	Import Substitution
IV	Instrumental Variables
KAIS	Kenya AIDS Indicator Survey
KDHS	Kenya Demographic and Health Survey
KIHBS	Kenya Integrated Household and Budget Survey
KNASP	Kenya National AIDS Strategic Plan
KNBS	Kenya National Bureau of Statistics
LPM	Linear Probability Model
NASCOP	National AIDS/STD Control Program
NACC	National AIDS Control Council
OLS	Ordinary Least Squares
OVC	Orphans and Vulnerable Children
RPED	Regional Program for Enterprise Development
TFP	Total Factor Productivity

ABSTRACT

Empirical investigations exploring the nexus between poverty, exports, health and labour productivity in manufacturing sectors of developing countries are rare. Existing analysis has mainly centered on performance of firms with very limited analysis on the connection between health, exporting and the well-being of workers. It is in this context that the current thesis was undertaken to examine the linkages between employees' HIV/AIDS concerns (proxy for mental health), export competitiveness and the poverty status of the labour force in Kenyan manufacturing industry.

The study empirically examines productivity and welfare effects of mental health capital, a complement to human capital. The thesis consists of three linked essays. The first essay evaluates the effects of mental health on firm revenues and wages of workers. The second essay establishes the link between mental health and total factor productivity and the consequent effects of productivity on exports. Mental health is assumed to affect total factor productivity through training of workers. The third essay analyses the impact of exports on the poverty status of the workers. The importance of improved mental health in exporting lies in the role mental health plays in the trainability and productivity of manufacturing workers. We assume that if output is produced efficiently, a firm is more likely to engage in exporting since production efficiency makes it competitive in international trade. Exporting firms in turn, are more likely to pay their workers higher wages and hence lift them out of poverty.

Using the cross-sectional data for 2002/3 from Kenyan manufacturing firms, the thesis demonstrates that firm expenditures on medical care improve the mental health of workers, which in turn results in increased productivity of the labour employed by manufacturing firms. Heckman selection models and the control function estimation techniques are used to address heterogeneity and sample selectivity problems encountered in the models of impact analyses in situations such as the ones studied in the thesis. Importantly, the thesis demonstrates that total factor productivity matters for export propensity and export intensity, and that exporting is a viable strategy for poverty reduction.

CHAPTER ONE

1 BACKGROUND AND CONTEXT

1.0 Introduction

Global estimates for 2002 show that over 40 million people were infected with HIV virus, yet only 1 percent have access to the life saving antiretroviral medications (Guinness *et al.*, 2003, Koenig *et al.*, 2004). Nevertheless, concerted efforts to scale up HIV care have increased the numbers of people diagnosed with and treated for HIV/AIDS. Estimates for 2010 show that the global prevalence has declined to about 33.3 million people (United Nations Programme on HIV/AIDS, 2010). Despite the decline in the prevalence, the total number of people tested for HIV globally remains low. An estimated 80 percent of the people who are HIV-infected worldwide are not aware of their status (United Nations Programme on HIV/AIDS, 2010).

More than 68 percent of the people infected with HIV/AIDS live in sub-Saharan Africa where AIDS has remained the leading cause of death. The low and middle income countries account for 67 percent of the global HIV/AIDS infections with only a third of those who need treatment, receiving combination antiretroviral therapies (United Nations Programme on HIV/AIDS, 2010). In sub-Saharan Africa, where HIV/AIDS has overwhelmed the health systems, HIV/AIDS has been associated with long term physical pain and suffering especially among the infected.

Besides inflicting physical pain, HIV/AIDS imposes a significant psychological, emotional and behavioural burden to both the infected and the affected. Individuals infected with HIV often suffer from depression and anxiety as they adjust to the impact of the diagnosis of being infected. Similarly, those who live and work with HIV/AIDS infected individuals also experience some form of mental distress as a result of fear of being infected or too much workload due to slowdown of the infected workers (Chipimo and Fylkesnes, 2009, Montgomery *et al.*, 2003, Phaswana-Mafuya and Peltzer, 2005). As

a result the state of their mental health is dis-stabilised. Further evidence shows that HIV/AIDS infection is also associated with high risk of suicide or attempted suicide (Byrne and Petrak, 2006, World Health Organisation, 2008).

Despite the general acceptance that HIV/AIDS affects both physical and mental health (Chipimo and Fylkesnes, 2009, World Health Organisation, 2008), little rigorous empirical research on the firm level economic effects of HIV/AIDS (e.g Fox *et al.*, 2004, Habyarimana *et al.*, 2007, Thirumurthy *et al.*, 2006, 2007) has been published in the literature on HIV/AIDS and development in Africa. While these studies focus on HIV/AIDS and physical health, there are no empirical studies that focus on HIV/AIDS and mental health yet, mental capital is an important complement to human capital in the production process (Weehuizen, 2008). Although in some production processes, mental capital and other forms of capital may be substitutable, however, this substitutability is not perfect.

In Kenya, the spread of HIV/AIDS is a threat to employment objectives and the labour market. HIV/AIDS has weakened the human capital base (has led to poor mental health and poor physical health), a situation that undermines efforts to reduce poverty through improvements in labour productivity. Although the prevalence rates have been on the decline from a peak of 14 percent in 1999, to about 6 percent in 2005 (NASCOP, 2006), the most recent estimates have shown an upward infection trend of up to 7.4 percent (Republic of Kenya, 2009). The maturity of old infections and the risk of new infections present a threat to a vast majority of the productive population. Urban areas record higher prevalence levels of about 8.4 percent compared to 6.7 percent in the case of rural areas. Women in urban areas record a significantly higher prevalence of HIV (10 percent) relative to 7.8 percent for men (Republic of Kenya, 2009). In this context the concerns about HIV/AIDS (our proxy for mental health) could have adverse effects on firm productivity and consequently on poverty reduction efforts of the government and its development partners.

However, despite the potential adverse impact of HIV/AIDS on the mental health, its

economic consequence in Kenya is largely unknown as little empirical evidence exists on this issue. This study fills this gap by undertaking a detailed economic analysis relating HIV/AIDS to productivity, export competitiveness and poverty status in Kenyan manufacturing.

The manufacturing sector plays a significant role in terms of its contribution to employment creation in both formal and informal sector and consequent economic growth. Its contribution to Gross Domestic Product (GDP) was about 9.0 percent by the end of 2009. The sector is critical in transforming Kenya into a newly industrialised country as envisaged in the Vision 2030 policy framework (Republic of Kenya, 2009).

Although the empirical analyses in this thesis are undertaken using data for Kenya, the essays add value to the scant literature on mental health and mental capital and to a wider economic literature in several key aspects. First, it complements studies e.g. Weehuizen (2008) that have developed the conceptual framework of the economic analysis of mental health which shows that mental health is a factor of production that can significantly affect total factor productivity (TFP) and economic growth. Second, the essays adapt existing econometric techniques in creative ways thus making it possible to deal with the common problems of endogeneity and heterogeneity in the estimation of causal effects. Third, the essays show that the control function approach can be used to consistently estimate structural models of effects of mental health capital on performance of firms.

1.1 The structure of the Kenyan manufacturing sector

1.1.1 Introduction

Manufacturing sector is the main channel through which a country integrates into the world markets through trade. Kenya's manufacturing sector is one of the leading sectors in terms of its contribution to GDP. It is fairly large by regional standards, accounting for about 9.0 percent of GDP by the year 2009. The sector also contributes about 14 percent of wage employment and is one of the major sources of income particularly among the

urban population (Republic of Kenya, 2010). In 2009, the sector's performance declined to 2.0 percent after registering a growth of 3.6 percent in 2008.

Besides the domestic market, the Kenyan manufacturing sector produces for export market under the Common Market for Eastern and Southern Africa, the East African Community and African Growth and Opportunity Act trading arrangements and is subject to foreign competition. A major component of the output has traditionally been in agro-processing industries but the sector has also seen increased investment in textile industry under the Export Processing Zones, which mainly target the US market.

The long term national planning strategy, The Kenya Vision 2030, which covers the period 2008-2030 aims to transform Kenya into a newly industrialised middle income country by the year 2030. The strategy identifies the manufacturing sector as one of the main economic pillars of development. Manufacturing for exports is a major element in strategies for industrial growth in the developing world. The East Asian miracle is a success story of countries which have underscored the importance of manufactured exports in their strategies for expanding the industrial production and for overall growth. Kenya is one of the African countries that have adopted a policy of manufacturing export promotion.

The policy of outward orientation is associated with a number of positive factors necessary for growth. For instance, increased international competition may enhance the productivity of firms and thus promote growth. Further, economies of scale accruing from expansion may also be beneficial to firm growth. These benefits are also associated with stable macro-economic environment.

Kenyan manufacturing

The manufacturing sector has undergone several transformations in its policy environment since independence. First, Kenya pursued the import substitution strategy immediately after attaining independence. This strategy was meant to not only promote

industrialization, but to reduce its dependence on primary production and also improve the balance of payments position. The import substitution strategy, implemented mainly through joint ownership of government and private sector, was based on policies such as favourable import tariffs for imported inputs, outright import bans and skewed foreign exchange allocations. Import-substituting manufacturing grew rapidly during the 1970s increasing the share of manufacturing in modern economy from about 8.4 percent to 13 percent at constant prices during the decade (Graner and Isaksson, 2002). A detailed review of IS can be found in Abala (2009).

The 1980s and 1990s saw the era of structural adjustment programmes. These reforms were in response to the devastating effects of economic decline coupled with the 1979 oil price shocks. Despite the attempt to revive the macro economic environment, accelerated liberalization through the 1990s further exposed Kenya's uncompetitive industries to cheaper imports. The sector saw rising labour unit costs, low factor productivity, heavy reliance on imported intermediate and capital equipments with weak domestic linkages, effects of difficult Kenya-donor relations and macroeconomic instability, poor infrastructure, limited access to financing especially for micro enterprises and weak property rights (Levin and Ndung'u, 2002).

1.1.2 Employment in the manufacturing sector

Employment creation is the centre-piece of Kenya's economic policy, in which manufacturing sector is expected to play a critical role. The manufacturing sector encompasses open air, informal, small-scale productive activities particularly in towns and trading centres, largely spurred by search for self-employment opportunities. The formal manufacturing sector is comprised of large and small to medium industries. Kenya's comparative advantage lies in labour-intensive manufacturing activities.

The Export Processing Zone has been the main driver of employment creation in the manufacturing industry since the late 1990s and early 2000s. Growth in direct formal employment accounted for 0.5 percent, from 264,100 persons in 2008 to 265,300 persons

in 2009. Employment in export processing zone accounted for 16 percent of total employment in the manufacturing sector in 2004, having declined by 1.4 percent from 39,111 persons to 38,560 persons in 2004 (Were, 2006). The direct formal employment in the Export Processing Zone has since decline from 30,200 persons in 2008 to 30,100 persons by the end of 2009 (Republic of Kenya, 2010).

The share of wage employment in manufacturing sector (excluding public sector manufacturing activities) as a percent of total private sector wage employment has stagnated at around 20 percent since 1980. However, total wage employment in manufacturing sector is estimated to have increased from 146,400 persons in 1981 to 242,000 persons in 2004, a 65 percent increase. Informal manufacturing activities continued to create more jobs than the modern sector. The number of persons engaged in informal manufacturing activities is estimated to have increased from 418,300 in 1993 to 1,276,300 persons in 2004. Overall, manufacturing sector has the second highest number of people engaged in informal activities after wholesale and retail trade, hotels and restaurants sector.

The evolution of employment in Kenya during the era of globalisation since the 1990s differs substantially with the employment experiences of developing world in Asia, particularly in East and South Asian countries. Contrary to the shrinking formal sector employment in the former, there has been sustained high formal sector employment growth in the latter countries, resulting in increases in employment in the manufacturing sector.

1.2 HIV/AIDS prevalence, knowledge, awareness and policy context

1.2.1 HIV/AIDS prevalence

In 2003 it was estimated that about 1.2 million people were infected with HIV/AIDS in Kenya, and more than 1.5 million had so far died of the disease as at that date, leaving

behind over 1 million orphans (Republic of Kenya, 2006). Current estimates indicate that more than 1.4 million adults out of a population of about 40 million are living with HIV/AIDS (Republic of Kenya, 2008). In addition, a large number of children are living with parents who are ill such that the children are the primary care givers of their parents, young siblings and other dependants.

Since 1984, when the first case of HIV/AIDS was diagnosed in Kenya, the disease spread rapidly, reaching an estimated national prevalence rate of 13.4 percent in 2000 (NASCOP, 2001). In 2003, the adult (15–49 years) prevalence rate was 6.7 percent (Republic of Kenya, 2003). However, since then, the prevalence rate has increased to 7.4 percent (Republic of Kenya, 2009). Further analysis shows that the prevalence rates were 9.0 percent in urban areas, and 7.0 percent in rural areas. Although the prevalence rate in rural areas is lower than in urban areas, the greatest burden is in the rural areas. About 70 percent of those infected live in the rural areas where the socio-economic conditions are worsening due to poverty and unemployment. This has strained the already inadequate and ill-equipped health facilities, with over 50 percent of public hospital beds being occupied by patients with HIV/AIDS and related infections (Republic of Kenya, 2009).

It is estimated that many more persons living with HIV/AIDS stay at home, are unable to access health care and are overstretching the households' ability to cope.

Table 1-1: HIV prevalence among 15-49 year olds by Province (percent)

Province	**2003**	**2005**	**2007**
Nairobi	9.9	10.0	9.3
Central	4.9	5.0	4.2
Coast	5.8	6.1	8.1
Eastern	4.0	3.4	4.9
North Eastern	0.0	2.0	1.3
Nyanza	15.1	10.8	15.4
Rift-Valley	5.3	4.1	7.4
Western	4.9	4.7	5.7
Total	**6.7**	**5.9**	**7.8**

Source: Republic of Kenya (2006, , 2008).

There are marked differences in HIV prevalence rates by province as shown in Table 1-1. Nyanza and Nairobi Provinces exhibit the highest rates throughout the period followed by Coast and Rift Valley Provinces. All the other provinces follow, with North Eastern having the lowest rates. In addition, prevalence rates show marked variations across sub-groups of the population. For example, among youth aged 15-24, women are 4 times more likely to be infected than men (6.1 percent for the men sample compared to 1.5 percent in a women sub-sample). A higher proportion of Kenyans aged 30-34 are currently infected with HIV compared to any other age category.

1.2.2 Knowledge and awareness

According to national reports (Republic of Kenya, 2003, 2009), a vast majority of adults in Kenya, are very well informed about HIV/AIDS and the prevention measures of abstinence, faithfulness and use of condoms. However, this is not the case for men and women aged 15-19 years. This is attributed to lack of information, education and communication materials especially on sexual and reproductive health necessary to enable them to avoid infection. Despite the low prevalence in North-eastern Province, HIV/AIDS awareness is lowest among the non-educated women (93 percent) and all adults (86 percent) and all women (94 percent) within the province.

Despite the fact that HIV testing is an important step towards discovery of one's status, many individuals do not take up the test. According to the Kenya AIDS Indicator Survey (KAIS), as many as 4 out of 5 HIV-infected persons do not know their status. About 57 percent of the laboratory-confirmed HIV-infected individuals reported that they had never tested for HIV. Another 26 percent reported themselves as negative based on their last test, but turned out to be positive when tested during the KAIS (Republic of Kenya, 2009). It is likely that some of these individuals knew their true HIV status but were reluctant to share their results during the interview. The two groups, i.e., never tested for HIV and those who have tested but misreported as uninfected, constitute about 80 percent of all HIV-infected individuals.

1.2.3 The policy context

Since HIV/AIDS was first diagnosed in Kenya in 1984, no significant, formal, overall policy existed until the development of Sessional Paper No. 4 of 1997 on "AIDS in Kenya". The policy recommended a multi-sectoral approach to HIV programming. Two years later, the Government of Kenya (GoK) declared the HIV epidemic a national disaster. The National AIDS Control Council (NACC) was then established under the office of the president to coordinate a multi-sectoral response to the epidemic. The GoK in partnership with all stakeholders, (including civil society, private sector and development partners) developed the first Kenya National HIV/AIDS Strategic Plan (KNASP) for 2000-2005.

The second KNASP 2005/06-2009/10 was developed with exemplary participation from Government and stakeholders, in line with the "Three Ones" principles i.e., one national action framework, one national coordinating body and one national monitoring and evaluation system. The KNASP II provided a clear vision, goals and targets that were critical in strengthening, coordinating and overall management of the national response to HIV. The KNASP II focussed on three priority areas namely: preventing new infections, improving the quality of life of people who are infected or affected by HIV and mitigating the socio-economic impact of HIV.

The HIV Prevention and Control Act of 2006, gazetted on January 2, 2007, covers various issues on practices and procedures, responsibilities and service provision but neither addresses overall policy issues nor those highlighted by the new evidence-informed KNASP III, covering the period 2009/10 to 2012/13. The KNASP III is expected to strengthen new approaches to AIDS prevention, care and treatment and also fully align with the new national, long-term development strategy, Kenya Vision 2030. The Vision 2030 is anchored in three pillars namely, economic, social and political. Under the social pillar, HIV is listed as one of the preventable diseases that continue to exert a heavy toll on the Kenyan population. Consequently, it is impossible for Kenya to achieve sustained economic growth as outlined in Vision 2030, without sustaining a healthy population.

Further, the Medium Term Plan for 2008-2012, the first in a series of successive five-year medium term plans to implement Vision 2030, acknowledges that HIV continues to pose serious health and socio-economic challenges.

Under KNASP III four impact results to be achieved by 2013 include; 50 percent reduction in new infections, 25 percent reduction in AIDS related mortality, a reduction in HIV related morbidity and a reduction in socio-economic impact of HIV at household and community level.

Other policies and guidelines include; the National Orphans and Vulnerable Children Policy, 2005 and the National Plan of Action 2007-2010, the National code of Practice on HIV in the workplace, Greater Involvement of People living with HIV and AIDS (GIPA) guidelines and a best practice Home and Community Based Care Framework and Strategy, among others.

1.3 The research problem

Many people in the world are infected with HIV and yet, they are not aware of their status. Over 68 percent of the world's 33.3 million people living with HIV/AIDS are in sub-Saharan Africa. Nearly two thirds of the people living with HIV/AIDS in low and middle income countries have no access to antiretroviral therapy. This has led to unprecedented AIDS related deaths accounting for about 77 percent of all deaths in sub-Saharan Africa (United Nations Programme on HIV/AIDS, 2010).

Besides the human cost, HIV/AIDS is having relentless effects on Africa's economic development and yet the continent's ability to cope with the pandemic is diminishing. The spread of HIV/AIDS is being aided by stigma and discrimination, which have kept the disease underground in many countries for a long time, discouraging persons from being tested and seeking treatment (United Nations Programme on HIV/AIDS, 2010, Waxman *et al.*, 2007).

)ne consequence of ill-health associated with HIV/AIDS is that it affects both the hysical and mental health of the infected and affected persons. Worries regarding IIV/AIDS affect the stock of health which determines the total amount of time an ıdividual can spend to produce money earnings and commodities (Grossman, 1972). 'hese worries/concerns (proxy for mental health) have been identified as factors which ould reduce labour productivity, work effort and discourage the maintenance of human nd social capital (Chipimo and Fylkesnes, 2009, Reichman *et al.*, 2009, Weehuizen, 008, World Health Organisation, 2010).

'o the extent that HIV/AIDS mortality and morbidity is a cause for worry/concern among ıe workers in the manufacturing sector in Kenya, some of those who express "concern" bout HIV/AIDS may well be infected. Others infected or not, may perceive they are lready infected, either as a result of their own sexual behaviour or what they know or uspect about their spouse. They may also perceive that they are at great risk of infection nd death in the future. And still others perceive that they are not at risk, perhaps because hey have not themselves engaged in extramarital sex and believe their spouse has been aithful. Others not infected may still "worry" because they have close family members or ellow workers who are infected and may perceive they are at risk of infection (see e.g. Montgomery et al., 2003).

Previous studies have analysed the link between HIV/AIDS, physical health and ɔroductivity (Biggs and Shah, 1997, Ellis and Terwin, 2005, Liu *et al.*, 2004, Maclaine, 2008, Rosen *et al.*, 2007, Rosen *et al.*, 2004, Were and Nafula, 2003). Several other ɜtudies have shown that subjective measures of disease-related worries are significantly ɜssociated with mental distress (Goulia *et al.*, 2010, Schnur *et al.*, 2006, Weehuizen, 2008) ɜnd could be a source of distraction on the mental health capital (one of the many inputs into production) which could then adversely affect labour productivity (Chatterji *et al.*, 2007, Ettner *et al.*, 1997, Montgomery *et al.*, 2003, Oathes *et al.*, 2010). In this case the economic effects of "worry" on productivity are envisaged to come from the state of mind of the workers, time reduction due to absenteeism and from physical illness due to mental

distress.

In the manufacturing sector, the potential economic consequences associated with mental distractions include loss of efficiency, lack of competitiveness and decline in profitability. While this may be true, no attempt, to the best of my knowledge, has been made to link "worries" about a disease to economic outcomes. The aim of this study is to explore the economic consequences of HIV/AIDS concerns (proxy for mental health), with special emphasis on the effects on labour productivity, export competitiveness and poverty reduction, outcomes which may affect the realisation of government policies as contained in the Kenya Vision 2030.

1.4 Significance and relevance of the thesis

HIV/AIDS is a real phenomenon that affects more than 68 percent of the population in sub-Saharan Africa. In this context the workers' concern about health risks associated with HIV/AIDS is assumed to be a key variable affecting their mental health status. Mental health can be seen as having a well-being aspect as well as a productivity component. For example, in Australia, mental health has been identified with positive aspects such as the 'the ability to think and learn, and the ability to understand and live with [one's] own emotions and the reactions of others to one's activities (Welsh and Berry, 2009).

HIV/AIDS could be detrimental to the performance of firms and to poverty reduction efforts for several reasons. First, because manufacturing firms in sub-Saharan Africa employ a substantial proportion of the urban labour force, any factor that affects the quality of urban workers would negatively affect industrial growth. Second, to the extent that mental capital complements human capital, utilization of human capital as an input would be reduced by problems associated with HIV/AIDS mortality, morbidity and stigma. Third, because ill-health induced by HIV is irreversible and poses a risk of mortality, including suicide, the potential loss in productivity as a result of mortality and days lost due to poor mental health can be substantial.

Moreover, irreversibility of poor health associated with HIV is important in the analysis of wealth dynamics. It is difficult for a firm to remain competitive if its workforce is affected or infected by HIV/AIDS. Besides the poor physical health, poor mental health, such as psychological distress, depression or anxiety may limit ability to work, which may mean less output per worker, reduced sales and diminished profitability. Social capital, labour relations and employee morale could also be adversely affected when employees are contending with HIV/AIDS.

Despite the potential adverse consequences of poor mental health, little is known in Africa, Kenya included, about the economic consequences that are associated with labour productivity, export competitiveness and poverty status of the industrial labour force (Chipimo and Fylkesnes, 2009). Previous research provides little evidence on relationship between "worries" and diseases (Chipimo and Fylkesnes, 2009 for HIV/AIDS, Goulia *et al.*, 2010 for Swine flu, Noel-Miller, 2003 for HIV/AIDS, Schnur *et al.*, 2006 for prostate cancer) with measurement aspects of "worry" having been well documented. The present study examines the economic consequences of "concerns" about HIV/AIDS, a topic that has not been studied before. This study makes an important empirical contribution not only to an understanding of the impact of poor health on labour productivity of the firms, but also to the design of policies for encouraging investments in the maintenance of health human capital and poverty reduction.

Despite the subjective nature of worry, it can have large measurable economic and social consequences that are worth investigating. This study is the first of its kind to explore the effect of disease-related "worry" on economic outcomes in an African context using Kenyan data.

1.5 Outline of the thesis

The thesis is organised in five chapters. Chapters 2, 3 and 4 address one research question each. They comprise the three essays in this thesis. Each essay consists of literature review, data and methodology used, data analysis and conclusions. The linkages among

chapters are diagrammatically shown in Annex Figure 1.

Chapter 2 seeks to answer the first research question: that is, what is the impact of HIV/AIDS concerns on the firm's revenue and wages of workers. The focus of this chapter is on the measurement of effects of HIV concerns (proxy for mental health) on wages (proxy for labour productivity) and on firm performance (proxied by sales revenue), while recognising that the most important complement to human capital is the mental capital. Chapter 3 focuses on the evaluation of mental health capital on exporting propensity and exporting intensity. The impacts of mental health on exports are through its effect on total factor productivity (TFP). It is assumed that mental health capital affects TFP through its effects on training of workers. Chapter 4 investigates the role of exporting on poverty in the manufacturing industry while chapter 5 concludes the thesis.

CHAPTER TWO

2 MENTAL HEALTH CAPITAL AND FIRM PERFORMANCE

2.0 Introduction

This chapter evaluates the relationship between mental health capital (as proxied by worries about HIV/AIDS) and firm performance. Firm performance is measured using firm sales revenue and workers' wages. In this context, workers' worry about HIV/AIDS at the work place is used as a proxy for mental health. The chapter consists of three sections: Section 2.1 contains a review of literature; data and methodological approaches are discussed in sections 2.2 through 2.5; section 2.6 contains empirical results and their discussions; and section 2.7 summarises and concludes the study. The section on the literature review is organised in four sub-sections, namely, definitions of concepts, health measurement issues and related theoretical considerations and the empirical evidence on "worry" and its economic consequences.

2.1 Mental health capital: definitions, measurement and theory

The World Health Organisation's definition of general health can be invoked to define mental health as '[a] state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity'(World Health Organisation, 2005). Mental health is assumed to be part of general health, which in turn is a part of human capital.

Past studies have considered the capabilities of human beings and their skills as capital. Smith (1776), Say (1821) and List (1841) considered skills and acquired abilities of human beings as human capital, whereas von Thunen, Senior, Walras, Marshall and Fisher considered human beings as capital (Teixeira, 2002). Human capital is a widely used concept with complex and varying definitions. Human capital encompasses a wide set of investments that potentially influence the well-being and productivity of individuals, firms, and nations (Mincer, 1996, Mwabu, 2007). These include investments in formal education, health and nutrition as well as vocational training acquired outside the formal

education system.

Mwabu (2007) has synthesized recent literature on health human capital. Theoretically, mental health is a subset of human capital, and this aspect of health has received little attention from researchers (Weehuizen, 2008).

Mental health capital includes a person's cognitive skills and emotional feelings. It includes the brain's ability to process information (i.e., encompasses learning and thinking) and also includes emotional intelligence-interactions with the thinking of others and brain resilience in the face of stress (Weehuizen, 2008).

Health capital as argued in Grossman (1972), differs from other forms of capital. While a person's stock of knowledge affects his market and non-market productivity, the stock of health determines the total amount of time he can spend producing money earnings and commodities (Grossman, 1972). In this thesis a similar definition is adopted for health with "worries" regarding HIV/AIDS (as expressed by workers in Kenyan manufacturing) being used as a proxy for mental health. In this thesis, "worry" about HIV/AIDS is synonymous with "concern" about HIV/AIDS.

Table 2-1 shows frequency of worry regarding HIV/AIDS as reported by workers in the manufacturing firms in Kenya. Workers concerns about HIV/AIDS refer to the worries about health risks associated with HIV/AIDS. Worries affect the mental health capital embodied in a worker. The economic effect of worry associated with HIV/AIDS comes not only through the work effort but also via the impact it has on the mental health. The question asked to manufacturing workers at the time of data collection was: Is HIV/AIDS an important concern to you? The response was given on a scale of 1-5, with "not a concern" taking the value 1, small concern = 2, moderate concern = 3, big concern = 4 and very big concern = 5.

Table 2-1: Reported worries about HIV/AIDS from interviews with workers; by levels of firms' expenditure on workers' health care in Kenya, 2002/3

Indicator of worry	**Total (N=1234)**	**Firms with medical care expenditure per person>Ksh 10,000**	**Firms with medical care expenditure per person<=Ksh 10,000**
Worry about HIV/AIDS	1,142 (92.5)	473 (38.0)	761 (62.0)
Degree of worry			
Not a concern	92 (7.46)	42 (8.88)	50 (6.57)
Small concern	25 (2.03)	6 (1.27)	19 (2.50)
Moderate concern	80 (6.48)	31 (6.55)	49 (6.44)
Big concern	412 (33.39)	167 (35.31)	245 (32.19)
Very big concern	625 (50.65)	227 (47.99)	398 (52.30)
Degree of concern (mean ± standard deviation)			
Whole sample	4.18 ± 0.06	4.12±0.11	4.21±0.08
Worried only	4.43 ± 0.04	4.43±0.07	4.44±0.05

Source: Own compilation using RPED data 2002/3.

Note: The numbers in parentheses are percentages.

When firms provide for medical care or medical insurance of their workers, the workers tend to worry less about their health and to be concerned less about anticipated health threat. Table 2-1 shows that workers in firms where medical cover is generously provided by the firms worry less about HIV/AIDS (38.0 percent) compared with workers in firms where either very little or no medical cover is provided by the firm (62.0 percent). The biggest concern accounts for about 48.0 percent of the former and 52.3 percent of the latter, respectively. The differences are notable at nearly all levels of worry. These results are similar to those from a study by Keeler *et al.*, (1987) on worries about disease conditions (see Table 2-2).

Due to data limitations, we invoke assumptions to help explain our data. We assume that workers express concerns about HIV/AIDS as a result of risks of exposure to HIV/AIDS or due to their *positive* HIV-status or that of their family members or fellow workers (Oathes *et al.*, 2010). These worries are assumed to affect both the mental health capital of workers and social capital (see Siisiäinen, 2000 for a definition of social capital) of the firm. The concerns are taken to be *real* if they are based on AIDS diagnosis, HIV positive

status, or on HIV infections of family members or fellow workers. They are *imaginary* if they are based on *fear* of HIV/AIDS due to misinformation or stigma. Irrespective of whether concerns about HIV/AIDS are real or imaginary, they are assumed to have real-life economic consequences. The psychological and mental effects of such worries on labour productivity, exports and poverty are analyzed in this thesis.

It is worth noting that worry as a health condition has been the subject of many studies within the field of health economics (Chipimo and Fylkesnes, 2009, Goulia *et al.*, 2010, Keeler *et al.*, 1987, Noel-Miller, 2003, Schnur *et al.*, 2006). For instance, Keeler *et al.*, (1987) in their paper on "effects of cost sharing on physiological health, health practices and worry", defined worry by asking the question: During the past three months, how much has your hay fever worried you? (Not at all = 0, a little = 1, somewhat = 2, a great deal = 3). They found that people without the ability to pay (under free health care plan) were generally more likely to be worried about the health conditions studied than those with ability to pay (those under cost sharing health plan) see Table 2-2.

Table 2-2: Self reported worries and mean levels for selected health conditions from exit interviews, by type of health insurance plan, USA

	Percent reporting worry due to condition			Mean level of worry*		
Health Condition	**Cost sharing health plan**	**Free health plan**	**t-test**	**Cost sharing health plan**	**Free health plan**	**t-test**
Phlegm production, chronic bronchitis, or emphysema	6.8	8.3	2.27	1.23	1.27	0.56
Hay fever	9.6	10.0	1.32	1.35	1.36	0.20
Chest pain§	14.1	15.2	0.19	1.41	1.43	0.18
Varicose veins!!	7.9	10.9	1.55	1.30	1.41	1.17
Chronic joint disorders§	25.9	25.8	-0.42	1.56	1.66	1.22
Dyspepsia	8.9	9.7	0.03	1.50	1.56	0.73
Vision disorders§	36.1	36.4	-0.44	1.36	1.28	-1.52
Kidney disease!!	7.4	10.1	1.12	1.52	1.50	-0.13
Acne**	13.0	14.7	0.52	1.36	1.36	0.06
Shortness of breath, enlarged heart, or heart failure£	16.4	14.7	0.05	1.49	1.40	-0.60
Haemorrhoids	6.6	7.7	1.55	1.21	1.24	0.47

Source: Keeler et al (1987).

Notes: *mean level of worry is based on those people who reported worrying at least a little about the condition at exit interviews, 1 = a little worry, 2 = some worry, 3 = a great deal of worry.

§limited to persons 35 years of age or older, !!limited to females, **limited to persons under 45 years of age, £limited to persons 45 years of age or older.

Chipimo and Fylkesnes (2009) in their study on mental distress in the general population in Zambia used data from a sample of 4466 participants. They constructed informative indices of HIV risk and worry which combined responses to the questions concerning self perceived risk of HIV infection. They asked the following question: In your situation, do you think that you are at risk of getting HIV? 1 = you are not at risk, 2 = the risk is moderate or 3 = the risk is high or 4 = the risk is very high). The supplementary question was: Do you worry about being HIV infected (How worried are you about actually being infected by HIV/AIDS? 1 = always worried, 2 = sometimes worried or 3 = seldom worried or 4 = never worried).

Using maximum likelihood estimation method, Chipimo and Fylkesnes (2009) found that self-rated health and self-perceived HIV risk and worry of being HIV infected were important mediators between HIV infection and mental distress. They found that the effect of HIV infection on mental distress was both direct and indirect, but particularly strong through the indirect effects of health ratings and self perceived risk as well as worries about HIV infection. They conclude a strong effect of HIV infection on mental distress.

In another study by Goulia *et al.*,(2010) on "general hospital staff worries, perceived sufficiency of information and associated psychological distress during the A/H1N1 (swine flu) Influenza pandemic" a self-reported questionnaire was administered, along with a request for demographic characteristics. The variable on worry was dichotomised (Yes/No) and the degree of worry and concern was scored on a 9-point Likert scale from 1 = I have very little worry to, 9 = I am very much worried. Perceived risk of being infected was scored 1 = very low and 9 = very high.

The results show that about 56.7 percent of the health workers, reported to have been worried about the swine flu. The degree of anxiety was moderately high with the most frequent concern being infection of family and friends and the health consequences of the disease (54.9 percent). The worry and degree of worry were significantly associated with intended absenteeism ($P<0.0005$), restriction of social contacts ($P<0.0005$), psychological

distress (P=0.036). They concluded that worry is an independent correlate of psychological distress.

Similarly, Schnur *et al.*, (2006) in their study on "perceived risk and worry about prostate cancer: A proposed conceptual framework" assessed perceived risk of prostate cancer using the question: "How likely do you think it is that you will develop prostate cancer in your life time?" Participants were asked to respond on a scale of 0% (not at all) to 100% (extremely). They found that the measure had good test-retest reliability (measure of consistency of psychological test) of about 0.85 and construct validity (measures what it is intended to measure).

Numerous factors including emotional, psychological, physical health and mental health are important attributes of one's behaviours at work. For instance, an individual with poor mental and physical health may not only suffer poor quality of life and decreased economic position, but also morbidity has additional social and economic costs for the society as a whole.

2.1.1 Measurement of health status

Health unlike other indicators of human capital such as education and nutrition is multidimensional such that, measurement error in health is likely to be related to income and labour market outcomes. There is consensus in the literature that the number of years of schooling is a reasonably good indicator of educational attainment. However, no similar agreement exists for health indicators, in part because health is fundamentally multidimensional (Strauss and Thomas, 1998). Moreover, different dimensions of health are likely to have different effects on one's productivity and labour supply.

For this reason, several measures of health status have been used in the empirical literature in the field of health economics. They include self-reported general health status, self-reported morbidities, limitations to normal activities, measures of physical functioning, and nutrient-based health measures and these encompasses both health outputs

(anthropometrics) and inputs (nutrient intakes). Most household surveys rely on interviews with respondents who provide an assessment of their own health status. This is because comprehensive clinical evaluations of health status are too expensive for large samples.

According to Schultz and Tansel (1997), epidemiological measurement of morbidity focuses on two questions. First, which self-reported questions on health status reliably replicate the distribution of clinically confirmed indicators of health status? Second, which self-reported indicators of health status have the greatest 'power' to statistically test hypothesis about relationships of health status and economic outcomes? A third question, on adjudication, arises when the two requirements come into conflict. An added problem for low-income countries is that most of the established health measures have been founded on studies of the aged in developed countries. The problem of measurement of acute spells of morbidity among the prime-age adults in a low-income country may differ from that of the elderly in higher income countries.

Within the class of self-evaluation measures, the general health status (GHS) has mostly been used (see e.g., Chipimo and Fylkesnes, 2009, Goulia *et al.*, 2010). Respondents rate their health on a scale ranging from excellent to poor. Some advocates have argued that GHS is the best single health index available despite the fact that this self-evaluation may reflect perceptions. GHS suffers from two key drawbacks. First, a respondent is asked to rate his or her health in one of four or five discrete categories ranging from excellent to poor health. Such a small number of discrete categories may not be adequate given the complexity and diversity of individual health status and hence the need for simultaneous application of multiple indicators. Second, "good" health may not mean the same thing to all people and respondents are not provided with established metric against which to compare their own health status and there is seldom an explicit reference group. Because questions about GHS are typically vague, we have no idea whether the respondent is rating his health relative to national average, to his neighbour, or to other reference groups.

Moreover, self-evaluations reflect perceptions on health. While important, perceptions are likely to be related to values and can be conditioned by background, beliefs and prior health information, all of which are systematically related to socio-economic outcomes, including wages and income. Information about the respondent's own health is likely to be correlated with the extent of use of health facilities. Since people assume they are in better health unless informed to the contrary, those who have little exposure to health facilities are likely to report themselves to be in better health. Hence measurement error in GHS will be systematically related to income and wages.

Self-reported morbidity, illness and "normal" activity refers to survey questions about illness or specific symptoms such as fevers, and diarrhoea during a reference period (e.g., Chipimo and Fylkesnes, 2009, Schnur *et al.*, 2006). As with GHS, these evaluations are difficult to interpret if what is deemed an illness or a symptom is not the same thing for all respondents. As with GHS, these indicators are likely to be measured with error that is correlated with use of the health system and thus with income and price of health services. Another commonly used variant of self-reported illness is to ask whether any days of "normal" activity were lost to ill health. The limitation of this indicator is that people whose opportunity cost of time is high will have less incentive to miss activities and will therefore appear to be in better health than those with lower value of time (conditional on a particular "true" health status). In general, it will be difficult to separate true health status from measurement error. The measurement error is likely to be correlated with socio-economic behaviours and outcomes, such as labour-force participation, productivity and wages.

Nutrient-based indicators such as the body mass index (BMI) have the advantage of having a high probability of replicating clinically proven conditions. However, such indices may not be appropriate for assessing illnesses related to HIV/AIDS. Heightened levels of weight loss in HIV patients render nutritional status and illness non-separable. Such non-separability can affect return to nutrition as measured by the BMI.

Self-reported functional activity limitations are also reliable indicators of clinically confirmed health status. This is especially so when they relate to more specific functional activity limitations (Schultz and Tansel, 1997, Stewart *et al.*, 1987).

Some studies have found that self-reported health status predicts subsequent mortality better than do clinical examinations (Frank and Gertler, 1991, Schultz and Tansel, 1997). The argument for this is that, while self-reporting considers mental status of every individual in the sample, clinically performed evaluation does not capture information from the mentally ill individuals who did not seek medical care and they will appear as "mentally healthy" in the data. Regardless of whether self-reports or clinical measures of health status are better predictors of worker productivity, both are likely to be subject to measurement error.

The Quality of Life Interview (QoLI) is a structured self-report tool. It contains a global measure of life satisfaction, plus measures of objective and subjective quality of life in the domain of living situation, daily activities, family and social interactions, finances, work and school, legal and safety issues, and health. In this survey, information is obtained from respondents about their objective quality of life and their level of satisfaction in each life area, pairing objective and subjective results for each person. The QoL mental health measures include: the Oregon Quality of Life Questionnaire, the Lancashire Quality of Life Profile and Manchester Short Assessment of Quality of Life (Wallcraft, 2011). They are often used alongside other measures.

The Lancashire Quality of Life Profile provides objective and subjective ratings of QoL across a range of domains. Subjective QoL is measured by asking service users to rate their satisfaction with each separate life domain on a 7-point Likert scale: 1-Can't be worse, 2-Displeased, 3-Mostly dissatisfied, 4- Mixed feelings, 5-Mostly satisfied, 6-Pleased, 7-Can't be better. The Lancashire Quality of Life Profile also uses Bradburn's Affect Balance Scale and Rosen Berg's self-esteem scale. The Manchester Short Assessment of Quality of Life is a shortened form of Lancashire Quality of Life Profile. It

takes 3-5 minutes to administer

The 36-item Short-Form (SF-36) health survey is a general health measure, meant to be comprehensive but easy and practical to use, including concepts widely used in health surveys such as physical, social and role functioning, mental health and general perceptions of health. The SF-36 is a 5-item mental health scale with items from each of the four major mental health dimensions (anxiety, depression, loss of behavioural or emotional control and psychological well-being). Scores range from 0-100 with higher scores representing better mental health (Wallcraft, 2011, Welsh and Berry, 2009).

The EuroQol (5D) is a brief, standardised, generic measure of health related quality of life that provides a profile of patient function and a global health state rating. It assesses outcome in 5 broad areas (mobility, self-care, activities, pain, and psychological functioning i.e. anxiety/depression). Each item has three possible response options (no problems, some or moderate problems and extreme problems) that allow the patient to ordinarily rate their current state with respect to each of the 5 domains. In addition, EQ-5D includes a global rating of current health using visual analogue scale (VAS) ranging from 0 (worst imaginable) to 100 (best imaginable) (Dorman et al., 1999, Mathews and May, 2007).

However, our data set does not capture a variety of quality of life measures described above. Instead it has only one question that captures the workers' concerns regarding HIV/AIDS. Given the data limitations on the health related quality of life measures, this study utilised the responses on the concerns about HIV/AIDS to proxy for mental health status. This is a better measure compared with that constructed from answers obtained when individuals are asked to state if they have AIDS or are HIV positive.

The concerns regarding HIV/AIDS refer to worries expressed by workers as a result of the risks of exposure to HIV/AIDS, or about their positive HIV-status or that of their family members or fellow workers. The concerns are real if based on AIDS diagnosis, HIV

positive status, or infections of family members or fellow workers with HIV/AIDS, but are imaginary if based on fear of HIV/AIDS due to misinformation or stigma. Moreover, the health and economic effects of both fears might be the same. The extreme case of this fear in the case of health is when real or imaginary fear leads to suicide. In our case using GHS as a measure of health is applicable since it is complicated to measure mental health status.

2.1.2 Theoretical considerations on mental health, human capital and labour productivity

Loss of human capital through illness and consequent death as a result of HIV/AIDS are thought to account for most of the loss in labour productivity among workers (Fox *et al.*, 2004, Kessler *et al.*, 1999, Morris *et al.*, 2000, Rosen *et al.*, 2004, Smith and Whiteside, 1995). Labour productivity is, according to the Ricardian theory of international trade, an important determinant of trade between countries. Four different effects of human capital on labour productivity are reported in various economic literatures: worker effect, allocative effect, diffusion effect and research effect (Corvers, 1994). The first two effects underpin the relevance of human capital for productivity level, whereas the latter two underscore the relevance of human capital for productivity growth.

Welch (1970) deals with the worker-effect of an individual's education on own productivity. He assumes that firms produce only one good with the production factor education, and that other resources are given. The worker effect refers to the positive marginal product of education with respect to that particular good. Workers with a higher level of education are assumed to be more efficient in working with the resources at hand, i.e., these workers produce more physical output. In other words, education increases the effective labour input from the hours worked. Similarly, a healthy workforce shifts the production possibility curve outwards.

Many studies identify human capital as a pre-condition for and often a determinant of economic performance and international competitiveness. According to Welch (1970), the worker effect is presumably related to the complexity of the physical production process.

The more complex the production technique is the more 'room' is left for the worker effect to improve the (technical) efficiency of production. Second, the allocative-effect points to the greater productivity of healthy and better educated workers in allocating all inputs factors to the production process between the alternative uses (Welch, 1970).

Health is an important form of human capital (Becker, 2007, Mwabu, 2007, Rosenzweig and Schultz, 1983, Schultz, 2005). It can enhance workers' productivity by increasing their physical capacities, such as strength and endurance, as well as their mental capacities, such as cognitive functioning and reasoning ability. Mental health is a source of utility and also a factor of production (mental health capital). Poor mental health as a result of negative attitudes towards HIV/AIDS (infected or not), have negative effects on the mental functioning ability of an individual.

We argue that negative attitudes towards health have negative effects on mental functioning. It is therefore reasonable to hypothesize that these differences in mental health would have different effects on healthy days for work and on worker efficiency or effort level. We expect to find a positive relationship between good mental health and productivity for both unskilled and skilled workers. Similarly, microeconomic evidence of the link between good mental health and productivity is increasing (see Strauss and Thomas, 1998, Weehuizen, 2008).

The productivity of a worker is a function of things that occur at the workplace in addition to his or her formal schooling, age, and other innate characteristics. In particular, it is generally agreed that the worker's productivity depends on the worker's firm-specific training, interaction with other workers (social capital) and management, morale, and motivation (Brown and Medoff, 1978). HIV/AIDS concerns can affect each of these factors.

Similarly, mental health capital plays an important role in the formation and effective use of human capital. In an analogy with the "complementarity's hypothesis" as in Griliches,

(1969) where human capital is perceived as complementary to physical capital, we argue that mental health capital is complementary to human capital (Weehuizen, 2008). Further, mental capital determines the formation, optimal allocation and effective use of human capital. A high level of human capital with a low level of mental health capital will not have much productive effect, just as a high level of physical capital does not have much effect without the necessary human capital to operate it and therefore realize its productive potential.

2.1.3 Empirical evidence

The economic impact of HIV/AIDS has primarily been studied at two levels, the macroeconomic level (accounts for overall impact on the economy) and microeconomic (the household and sector or industry) level. At the macroeconomic level the impact has been estimated in several countries. In Kenya, using administrative data for various years, (Were and Nafula, 2003) explored the different channels through which HIV/AIDS affects economic growth. They use a macro-economic model to run simulations for the Kenyan economy. The key channels were productivity, labour supply, accumulation of human, physical and social capital and the gender inequality channel. Their results show that HIV/AIDS, through its effects on labour productivity and loss of earnings, affect economic growth.

Haacker (2002) analysed the impact of HIV/AIDS on the economies of Southern Africa. He explored the role of HIV/AIDS on the public sector, formal education sector, the workplace, and the training, experience and productivity of the labour force. Based on simulations using a simple open economy neoclassical growth framework, a decline in GDP per capita of 2 percent due to HIV/AIDS is predicted, on average, in the long-term across Southern Africa.

The impact of HIV/AIDS on individual households has also been estimated in sub-Saharan Africa countries including Cote d' Ivoire, Uganda, Tanzania and Ethiopia among others. At this level, it has been shown that up to 67 percent decrease in average income

can be associated with one HIV infected member because of the negative multiplier effects of an HIV case. Morris, *et al.*, (2000) using data from South Africa analysed the economic impact of HIV infection in a cohort of rural agricultural workers from the perspective of that industry. The study found that about 58 percent of those infected were still active in the workforce.

Some micro level research on consequences and impacts of HIV/AIDS on the industrial sector has been conducted and published (Biggs and Shah, 1997, Greener, 1997, Guinness *et al.*, 2003, Liu *et al.*, 2004). However, most evidence was either drawn from case studies of single, high-profile, multinational firms (World Economic Forum, 2007) or was compiled from large qualitative surveys (Bloom *et al.*, 2006, Ellis and Terwin, 2005).
Further, studies concerning the impact of HIV/AIDS on profitability of businesses in Africa have had mixed results. Studies completed in South Africa (Morris *et al.*, 2000) and Kenya (Roberts et al, 1996) suggest that the economic impact of HIV/AIDS on profitability was likely to be substantial. On the contrary, studies in Zambia (Smith and Whiteside, 1995), Malawi (Jones, 1996) and Botswana (Greener, 1997) indicate that the impact of HIV/AIDS on profitability was not substantial.

Fox *et al.*, (2004) analysed retrospective data and provide some of the first empirical estimates of the impact of HIV/AIDS-related morbidity on labour productivity. They found decreases in worker productivity among rural Kenyan tea pickers in the last two years prior to leaving the firm for AIDS related sickness or death. In a study by Phaswana-Mafuya and Peltzer, (2005) staff members indicated that the prevalence of HIV/AIDS among their colleagues had impacted negatively on their duties at work such that it led to increase in workload, poor quality of service, low morale, high absenteeism, and frustration due to sick or absent staff members.

Previous studies found that the morale of teachers who are not infected is likely to fall as they deal with sicknesses, and the mortality of their colleagues, relatives and friends (Coombe, 2000). Thirumurthy, *et al.*,(2006) found sizeable increases in labour supply in

patients in the first six to nine months after initiation of treatment in a sample of rural households in Kenya, suggesting direct association between HIV infection and labour productivity, that could have spill over effects on healthy workers through the channels suggested by Coombe (2000).

Epidemiologic data suggest that some chronic conditions such as allergies, ulcers and depression strongly affect short-term work disability. Kessler, *et al.*, (1999) analyse data from National Comorbidity Survey (1990-1992) and the Midlife Development in the United States survey 1996, to estimate the short-term work disability associated with thirty-day major depression. They found that depressed workers have 1.5 and 3.2 more short-term work disability days in a thirty-day period than other workers, with a salary-equivalent productivity loss averaging between $182 and $395 (45 percent and 98 percent of treatment cost respectively, which could be offset by increased work productivity associated with symptom remission). These workplace costs were nearly as large as the direct costs of successful depression treatment. They suggest that encouraging depressed workers to obtain treatment might be cost-effective for some employers.

Similarly, a recent study conducted in a tea estate in Kenya (Larson *et al.*, 2009) shows that improvements in health resulting from antiretroviral therapy allows individuals to return to work and earn substantial income. These improvements were also associated with reduced impaired presenteeism, which is the loss in productivity when an ill or disabled individual attends work but accomplishes less at his or her usual tasks or shifts to other, possibly less valuable, tasks.

Even with controls for differences in early life experiences such as schooling, studies have shown that persons with a psychiatric disorder may experience lower productivity on the job as a result of impaired concentration, reduced cognitive abilities, or absenteeism. Poor productivity may translate into lower labour-force participation rates through the offered wage rate (Ettner *et al.*, 1997).

Chatterji, *et al.*, (2007) using data for National Latino and Asian American Study investigated the extent to which psychiatric disorders and mental distress affect labour market outcomes among the ethnic minorities of Latino and Asian descent. They find that psychiatric disorders and mental distress are associated with detrimental effects on employment and absenteeism. These results are similar to effects found in previous analysis of mostly white, American born populations. Among Asians, they find mixed evidence. Their findings suggest that reducing disparities and expanding access to effective treatment may have significant labour market benefits.

Studies of the impact of mental health on labour market outcomes generally show that poor mental health adversely affects employment indicators and the estimated impacts differ by gender and disorder. Ojeda *et al.*, (2010) examine the relationship between nativity, mental health and labour supply. They use data from National Survey on Drug Use and Health for 2002. They use two indicators to measure mental health. First is respondent's score resulting from answers to a six-item validated scale, the K6, (the K6's measure of mental illness reflects a 12-month diagnosis of an anxiety disorder, or mood disorder, or non-affective psychosis). This is later coded as a dummy taking 0/1 reflecting absence or presence of mental illness. The second indicator of mental health is based on symptoms of mania and delusion. They use instrumental variables approach, to address possible reverse causality from labour market conditions to mental health status. They also estimate a multivariate logistic regression model separately for men and women using maximum likelihood methods. They found that mental health affects labour supply, but not uniformly across immigrant and gender groups.

Studies related to health production function of infants show that the first trimester prenatal care is an important determinant of infant's birth weight. In particular, Reichman, *et al.*, (2009) using United States data for Fragile Families and Child Wellbeing Survey 1998-2000, finds that sexually transmitted diseases during pregnancy and pre-existing mental illness are strongly and independently related to abnormal infant conditions and low birth weight, respectively. From a policy point of view, poor health at birth (low birth

weight) often leads to subsequent health and developmental problems, poor school performance and adverse adult labour market outcomes, which in turn adversely affect the trade competitiveness of firms (Case *et al.*, 2005, Case *et al.*, 2002) . They suggest that addressing sexual and mental health issues prior to conception, rather than during the confines of a pregnancy, may not only enhance the well-being of the mothers, but may also improve the health of their children and their labour productivity in adult life.

Related to health, is a study which examines the individual demographic consequences of concerns regarding HIV/AIDS in Malawi. Using longitudinal data for Malawi for 1998-2001, Noel-Miller, (2003) examines if and how rural Malawians alter their child bearing as a consequence of concerns regarding the HIV/AIDS epidemic. She used conditional probabilities and multivariate ordered cumulative logit regression to estimate the relationship. She found that high levels of worry regarding HIV/AIDS negatively impact on the rate of childbearing in Malawi.

2.1.4 Overview of the literature

Studies on HIV/AIDS have been conducted widely especially in sub-Saharan Africa where HIV/AIDS is the number one killer. Both macro-economic and micro-economic studies conducted have mainly used the HIV/AIDS prevalence variable to analyse the impact on the economic variable. The impact of HIV/AIDS on the economic growth has been well analysed. Similarly the impact of HIV/AIDS on individual households has been undertaken with a few studies focusing on the impact on labour productivity. While HIV/AIDS has received much attention in the last decade, its direct measurement has been criticised due to the stigma and discrimination associated with the disease.

Moreover, there are indirect effects associated with HIV/AIDS which have been ignored in previous studies that have analysed the economic consequences of HIV/AIDS. However, a few studies have measured the indirect effects of illnesses using the variable "concerns regarding and worry about a given illness". The two concepts of "worry and concern" have been used interchangeably in these studies. These concepts are however, synonymous. Concerns about illnesses have been studied before, with the measurement

aspects of worry having been well documented. However, the economic consequences of concerns about illnesses have never been studied to the best of my knowledge. The aim of this essay is to link worry about illness (HIV/AIDS), also proxy to mental health, to labour productivity (wages and revenue) of the firm. To the best of my knowledge, this potential linkage has not been studied before.

2.2 Measurement model

The relevant theory in the ensuing analysis is based on the model of health human capital (Rosenzweig and Schultz, 1983) supplemented by the mental capital models (Weehuizen, 2008). The models as reviewed in the literature, guide the estimations in the thesis.

2.2.1 The production of health and health inputs

The literature on health economics has emphasised that individual health heterogeneity can bias direct estimation of health production functions, that seek to characterize the technological relationship between health inputs and health outcomes We refer to our first stage measurement equation as a health production function since we view firms as producing the mental health capital of workers by investing in factors which reduce the prevalence of poor mental health (increase good mental health). Firms do this by spending on medical care needs of the workers. This means that mental health is endogenous to the outputs produced by firms using the mental health capital of workers. To workers, mental health is both a source of utility and higher productivity, but in the ensuing analysis, the utility benefit of mental health is ignored. However, even in that analysis, we cannot causally relate mental health directly to labour productivity due to the endogeneity of mental health in an equation that measures performance of firms. We overcome this problem by using an instrument for mental health of workers.

Following the health production literature, the instrument that is suitable for predicting the health human capital is the price of health inputs. We use expenditure on medical care by the firm as an instrument for mental health which, as already indicated, is expressed in

terms of workers' concerns about HIV/AIDS. The firms' medical care expenditure is exogenous to workers because an individual worker cannot influence this expenditure.

In accordance with Grossman's (1972) model, we assume that each individual worker has a mental health production function of the form described in Strauss and Thomas (1998):

$$H = H(N, L; A, B, D, \mu, e_h) \quad \ldots\ldots (1)$$

Where

H represents our measure of mental health capital. It depends on a vector of health inputs, N, and labour supply, L. The variable, N can be thought of as the firms' medical care expenditure on health needs of its workforce. We assume that actual health is increasing in health inputs. The technology underlying the health production function is likely to vary with other socio-demographic characteristics, A, such as gender; in addition to family background, B, such as parental health, and environmental factors, including local public health infrastructure and treatment practices, as well as the disease environment, D. The two sources of unobservables are the inherent healthiness of the individual, μ, (is not observed in social economic data but may be known at least in part, to the individual by time of adulthood) and e_h, (unknown to both individual and econometrician) includes measurement error.

We specify our estimable reduced form equation

$$S = \beta_0 + \beta_1 A + \beta_2 X_0 + \beta_3 D + \varepsilon_0 \quad \ldots\ldots (2a)$$

Where:

S is log of value of a firm's annual sales per capita

A is individual characteristics, including household level labour endowments

X_0 is log of medical expenditure per worker

D is firm characteristics

β's are coefficients to be estimated

ε_0 is the error term

We specify an additional equation, i.e., the mental health production function and express it as:

$$X_2 = f(X_0, X_1) \quad \text{(2b)}$$

Where, X_2 is the mental health variable

with X_0 being the exclusion restriction

X_1 is a vector of the individual and firm characteristics.

The estimable form of the model is:

$$X_2 = a + bX_0 + cX_1 + \varepsilon_1 \quad \text{(3)}$$

Where X_0 is the exclusion restriction and X_1 individual and firm specific exogenous characteristics, ε_1 is the error term; and a is a constant while b, c are coefficients to be estimated.

Because we cannot relate mental health capital directly to productivity, medical expenditure per capita is used as an instrumental variable in breaking the link between mental health capital and the error term in the firm's revenue function, which is also the structural equation in the measurement framework used. The produced mental health from equation (3) feeds into equation (4) below as follows:

$$S = \gamma_0 + \gamma_1 A + \gamma_2 X_2 + \gamma_3 D + \gamma_4 X_4 + \varepsilon_2 \quad \text{(4)}$$

Where:

S is log value of a firm's annual sales per capita

A is the individual characteristics of the worker

X_2 is the mental health variable

D is firm characteristics

X_4 are the control function regressors

ε_2 is the error term

γ_0 is a constant and $\gamma_1, \gamma_2, \gamma_3$ are coefficients to be estimated.

In order to measure separately the sales revenue effect of mental health capital and the productivity effect of the mental health capital, we have also to re-estimate equation (3) using the individual workers' wage rate as the dependent variable.

2.2.2 The wage equation

Our structural equation helps us to measure the productivity effects of mental health capital. We use wage to proxy for productivity. We assume that markets are efficient and that workers in manufacturing firms are paid according to their productivity (Dearden *et al.*, 2006, Serneels, 2005).

The first step in our estimation of the structural wage equation, is to illustrate a reduced form equation in which labour productivity function, $h^*(.)$, which depends on a set of observable exogenous individual and firm characteristics X_1, identifying instrument X_0 and a productivity-related individual-specific unobservable ε.

The estimable form of the reduced form equation is:

$$LnW = \alpha + \beta \ln X_0 + \gamma X_1 + \varepsilon \quad \text{..... (5a)}$$

Where W is wage per hour per worker, X_0 is the instrument for mental health, X_1 is a vector of individual and firm exogenous characteristics such as gender and years of experience in the firm and ε is the error term.

β and γ are coefficients to be estimated, α is a constant.

In the structural equation, we measure the effects on the productivity of mental health capital of the workers. We use the standard ln(wage) function, conditional on mental health capital, X_2. We include all the variables in the reduced form equation 4, except the

identifying instrument, X_0.

$$LnW = \omega(X_1, X_2, \mu) \quad \text{(5b)}$$

Where $X_2 = f(X_0, X_1)$, with X_0 being the exclusion restriction. The estimable form is derived in equation 3.

This wage equation is similar to that used in the general literature, see e.g. Thomas and Strauss (1997).

The estimable form of the structural wage equation is:

$$LnW = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \alpha_5 X_5 + \mu \quad \text{(6)}$$

Where LnW is the log of hourly wage of the individual, X_1 is a vector of individual and firm exogenous characteristics (such as gender and years of experience in the firm); X_2 = the endogenous regressor (mental health capital), X_3 = a vector of location dummies, X_5 is a vector for control function regressors and μ is the econometric unobservable.

$\alpha_0, \alpha_1, \alpha_2$ are coefficients to be estimated α_3 .and α_5 are vector coefficients to be estimated.

2.3 Estimation issues

In order to draw inferences about the effect of health on the economic outcomes, at least two key issues need to be addressed. The first is the issue of measurement of health status. Health is multi-dimensional and difficult to capture in survey data. The inherent healthiness of the individual, is generally not observed in socioeconomic data, but may be known, at least in part, to an adult individual. Second, there is a part of health which is unknown to both the individual and the researcher, which includes measurement error (Strauss and Thomas, 1998).

In the same manner, we argue that those workers who reported the extent to which HIV/AIDS was an important concern to them, may fall into several categories. Some of those concerned may well know their status or they may not know it. Those who know their status and are concerned may experience worse mental health compared to those who know their status and are not concerned. Similarly, those who do not know their status and are concerned may experience worse mental health than those who do not know their status and are not concerned. We apply the self-reporting concept to measure mental health capital since its clinical measurements are complicated. Since HIV status is likely to be unknown to both the individual worker and the researcher, we anticipate that our measure of mental health may suffer from problems of measurement errors.

The other issue is the direction of causality between mental health capital and labour productivity. In this context, the productivity of workers with poor mental health may be affected if these workers spend less hours of work in producing a firm's outputs or as a result of reduced efficiency with which they employ all factors of production. Furthermore, low labour productivity may affect mental health of workers if workers are not able to meet the expenditures associated with poor mental health, such as drug related expenditures for themselves or family members. Thus, the OLS estimates of the effect of poor mental health on labour productivity of industrial workers are likely to be contaminated by both simultaneity and unobserved heterogeneity. In this case we use econometric approaches for which we control for these factors.

2.3.1 Hypotheses

We test the null hypothesis that poor mental health has no effect on the revenue of the firm. This hypothesis is tested by first estimating a mental health production function for workers and then conditioning the revenue of firms on predicted mental health, controlling for other determinants of revenue. The second null hypothesis is that poor mental health has no effect on wages of Kenyan manufacturing workers. This hypothesis is tested by estimating a wage function, while controlling, as in the first hypothesis, for biases due to

endogeneity and heterogeneity.

2.3.2 Definition and measurement of variables

The dependent variable in the firm performance equation (equation 2a) is the log of sales revenue per worker. Sales revenue is defined as the amount of the total sales that accrue to a firm in a particular year. Information on the sales revenue is provided by each firm in the data set. Sales revenue per worker is measured using the variable total firm sales revenue divided by the total number of workers in that year (Dearden *et al.*, 2006).

The dependent variable in the labour productivity equation is log of wage per hour per worker (equation 5a). Wage is defined as the monthly earnings excluding current benefits received by an individual. This information is reported by each worker. Wage per hour per worker is measured by dividing the wage paid to the worker by the number of hours worked. Wage as a proxy measure of productivity has been used/implied in various studies (Dearden *et al.*, 2006, Serneels, 2005). We assume that markets are efficient and workers are paid according to their productivity. The use of hours worked is more appropriate for analysis of labour productivity, since it represents a more precise measure of labour input than days or weeks worked (Sharpe *et al.*, 2008).

Explanatory variables

Our main explanatory factor (the treatment variable) in the structural revenue equation and labour productivity is the individual measure of mental health, i.e., workers' concerns about HIV/AIDS. The variable "concerns" is synonymous to "worry" and is measured as a dummy variable which takes the value "1" when a worker is concerned about HIV/AIDS and "0" when the worker is not concerned.

Similarly, in the reduced-form revenue equation and wage equation, the main explanatory variable is the log of per capita firm expenditures on the health care of workers. This refers to the per capita medical expenditures incurred by the firms. The variable on

medical expenditures is provided for, in the dataset by each firm. The variable is measured by dividing the total firm medical expenditures by the total number of workers in the firm. It should be noted that the firm's health care expenditure is the instrumental variable for the mental health capital in both the sales revenue and wage equations.

The control variables (exogenous determinants of revenue or labour productivity) include demographic characteristics such as gender and years of work experience in the firm. Gender is measured as a female dummy which takes the value "1" if worker is female and "0" if worker is male. Job experience in the firm is measured by the number of years of experience an individual has worked in the firm, its square is also used (Brown and Medoff, 1978, Dijk, 2002, Fox *et al.*, 2004, Jones, 2001).

2.4 Data description and sample statistics

2.4.1 Data

We use firm-level data from the 2002/3 Regional Program on Enterprise Development (RPED) Survey to analyse the effects of mental health (employee concerns about HIV/AIDS) on performance of firms and on wages of the industrial workers in Kenya.
The Kenyan manufacturing sector is classified under three main sub-sectors, namely, agro-based, engineering and chemical and mineral clusters. The agro-based sub-sector has developed on the basis of domestic resource activities and contributes 68 percent of the manufacturing sector value added. The engineering sub-sector relies heavily on imported raw materials and contributes about 12 percent of the manufacturing sector value-added.
The chemical and mineral sub-sector is Research and Development oriented and contributes 20 percent of the manufacturing sector value-added.

While firm-level data sets are well established for most of the Organisation for Economic Co-operation and Development countries, corresponding data of good quality are hardly available for most developing countries, Kenya included. Considerable advances have been made by the World Bank with the 'Regional Program on Enterprise Development

(RPED) Surveys in making firm level data available in developing countries. The RPED offers harmonized cross-sectional data on the investment climate, i.e., the conditions affecting firm production and investment behaviour, in developing countries.

Firm level panel data would be better suited for this study since problems of endogeneity resulting from explanatory variables that are firm-specific and possibly correlated with mental health capital, could be tackled by using appropriate time lag structures. Unfortunately, the existing RPED panel data sets (1993-1995) available for most sub-Saharan African countries including Kenya do not have health data, key information for this analysis.

The Kenyan 2002/2003 RPED dataset is therefore an interesting alternative source of health data for this study, despite its limitations in other dimensions. The Kenyan RPED was organized and coordinated by the World Bank. It was executed in 2003 by Kenya Institute for Public Policy Analysis (KIPPRA) in collaboration with the Kenya National Bureau of Statistics (KNBS). The RPED 2002/03 survey of 282 formal manufacturing firms and workers covered seven sub-sectors in five urban areas, namely, Nairobi, Mombasa, Eldoret, Kisumu and Nakuru.

The information on individuals was obtained through interviews, with at most ten employees randomly chosen from a list of workers of each firm. A study by Mairesse and Greenan (1999) shows that, econometric studies of the firm can be effectively and substantially enriched by using information collected from employees, even if only a few of them (at least two) are surveyed per firm. Though variables measured on the basis of the answers of very few employees per firm are subject to very important sampling errors, they can be usefully included in a measurement model implemented with firm level data (Addison and Belfield, 2004, Bigsten *et al.*, 2000, Corvers, 1997, Soderbom and Teal, 2001).

The information on the firms was elicited from representatives of each firm. The data set

on which this research is based does not contain information on individual HIV status or on deaths due to AIDS. None the less, the respondents are well aware of the epidemic. Majority are familiar with the symptoms of AIDS, are aware of how HIV/AIDS is transmitted, know where to go for HIV tests, know their own behaviour and may be their spouse behaviour to understand whether they are at risk of HIV infection or not.

Some of the information collected include: ownership structure, total sales revenue, value of exports, total number of employees, absenteeism, proportion of employees believed to be HIV positive, and proportion of employees believed to have died of HIV/AIDS. The employees interviewed provided a range of information including education level, previous experience, experience in the current firm, age, sex, hours of work, degree of concern about HIV/AIDS, willingness to test for HIV/AIDS, job tenure length, own-financed training, firm supported on–the–job training, previous training before joining the firm, health status, days missed work due to own illness, days missed work due to family or friend's illness, wages received, benefits received, and numerous other personal characteristics.

2.4.2 Summary statistics, essay one

Table 2-3 shows descriptive statistics for the sample used in this essay. On the average, the age of manufacturing workers is 36 years. The manufacturing sector is dominated by secondary school leavers who have also attained about 9 years of experience in the firm. About 18.6 percent of the work-force is female. Majority of the firms are dominated by workers who are worried about the risks associated with HIV/AIDS. On average 93 percent of the workers expressed some form of *concern* about HIV/AIDS at varying degrees of fear. About 51 percent said that HIV/AIDS 'was a 'very big concern' to them; 33 percent said it was a 'big concern'; 6.5 percent said it was of 'moderate concern'; 2.0 percent said it was of a 'small concern'; while only 7.5 percent were not concerned about HIV/AIDS at all. Nearly 59.0 percent of the firms interviewed are located in Nairobi, 15.0 percent in Mombasa, 13.0 percent in Nakuru, 8.0 percent in Eldoret and 5.0 percent in Kisumu.

Table 2-3: Summary statistics, essay one

Variable	Observations	Mean	Standard deviation
Age of workers (in years)	1556	36.25	9.53
Years of education	1556	11.14	4.24
Firm size (total number of employees)	1556	214.62	330.43
Age of the firm (in years)	1551	26.17	18.94
Years of experience in this firm	1556	9.09	8.11
Years of experience in this firm squared	1556	1498.47	276.60
Female (=1 if female, 0 otherwise)	1556	0.18	0.38
Is worker concerned about HIV/AIDS (=1 if concerned, 0 otherwise)	1556	0.93	0.26
Log of total firm expenditures on medical per worker	1556	0.14	0.19
Workers concerned about HIV/AIDS (=1 if small concerned, 0 otherwise)	1556	0.03	0.16
Workers concerned about HIV/AIDS (=1 if moderate concerned, 0 otherwise)	1556	0.06	0.24
Workers concerned about HIV/AIDS (=1 if big concern, 0 otherwise)	1556	0.33	0.47
Workers concerned about HIV/AIDS (=1 if very big concern, 0 otherwise)	1556	0.51	0.50
Log of value of sales per worker	1556	0.30	0.48
Nairobi=1, if firm located in Nairobi, 0 otherwise	1556	0.59	0.49
Mombasa=1, if firm located in Mombasa, 0 otherwise	1556	0.15	0.36
Nakuru=1, if firm located in Nakuru, 0 otherwise	1556	0.13	0.33
Eldoret=1, if firm located in Eldoret, 0 otherwise	1556	0.08	0.28
Kisumu=1, if firm located in Kisumu, 0 otherwise	1556	0.05	0.23

Source: RPED survey 2002/2003.

Table 2-4: Pair wise correlations between mental health capital and value of sales per worker with other firm and worker characteristics (p-values in parentheses)

Variables	**Mental health (=1 if HIV/AIDS concerned)**	**Log of value of firm sales per worker**
Years of experience in this firm	0.0112 (0.6595)	0.0452 (0.0747)
Years of experience in this firm squared	-0.0090 (0.7222)	0.0380 (0.1344)
Female (=1 if female, 0 otherwise)	0.0334 (0.1884)	-0.0225 (0.3753)
Mental health	1.000 (.0000)	-0.0590(0.0199)
Log of per capita medical care expenditure	-0.0494 (0.0513)	0.3803 (0.0000)
Nairobi	-0.0967 (0.0001)	0.0002 (0.9952)
Mombasa	0.0332 (0.1899)	-0.0600 (0.0179)
Nakuru	0.0378 (0.1359)	0.0403 (0.1120)
Eldoret	0.0386 (0.1276)	0.0818 (0.0012)
Kisumu	0.0555 (0.0285)	-0.0644 (0.0111)

Source: RPED survey 2002/2003.

From Table 2-4 , the correlation between medical care expenditure and mental health (=1 if workers are concerned about HIV/AIDS) is negative and statistically significant at 5 percent level. Similarly, the correlation between medical care expenditure and value of firm sales per worker is positive and highly statistically significant at 1 percent level. A further correlation between mental health and location dummies shows that Nairobi has a negative correlation with ill mental health at 1 percent level of significance, while the rest of the locations are positively correlated with ill mental health. The p-values are very high except for Kisumu (statistically significant at 5 percent level).

Correlation results show that poor mental health and the log of value of sales per worker is negative and statistically significant at 1 percent level. Specifically, a 10 percent deterioration in mental health (i.e., a 10 percent increase in proportion of workers concerned about HIV/AIDS) is associated with a 6.724 percent decrease in the log of

value of sales. Similarly, a 10 percent increase in the log of value of sales is associated with a 0.59 percent improvement in mental health (i.e., a 0.59 percent decrease in proportion of employees expressing concerns about HIV/AIDS at the workplace). It should be stressed that these are correlations, implying that no causal relationships are claimed among the variables displayed in Table 2-4. Nairobi, Mombasa, Nakuru and Kisumu are negatively correlated with log value of sales per worker while Nairobi, Nakuru, Eldoret are positively correlated.

2.5 Estimation strategies

Problems of endogeneity and heterogeneity are well documented in the economic literature and the methods for handling them are well known (see Wooldridge, 2002). Endogeneity arises owing to problems such as omitted confounder variables, simultaneity between a predictor and the outcome, and errors in regression covariates. The problem of endogeneity is mainly addressed using instrumental variables (IV). The theoretical and methodological literature guiding the use of IVs in linear regression models is large (Bound *et al.*, 1995).

In this essay, the IV-based approaches are applied to correct for endogeneity bias. The first is an econometric method used to correct for biases that result from problems of endogeneity and sample selection (control function approach). In particular, the two-stage residual inclusion (2SRI), a special case of the control function approach, (in a linear model 2SLS=2SRI) and two-stage predictor substitution (2SPS) are used to correct for the biases. We show the consistency of the 2SRI estimator and re-emphasise the inconsistency of the OLS estimator (base estimates). In the first stage of 2SPS, reduced form regressions are estimated and results used to predict new values for the endogenous variables. In the second stage regression, the structural equation is estimated after replacing the endogenous variable with predicted values. In the case of 2SRI, the first stage is similar to 2SPS, while in the second regression (structural equation) the endogenous variable is not replaced. Instead, the first stage residuals are included as additional regressors in the second stage estimation (see Terza *et al.*, 2008 for details).

In addition to the methodologies in Terza *et al.*,(2008) we follow the approaches by Nevo and Rosen (2008, , 2010) which show that the imperfect instrumental variable (IIV) can still be valid for identification. This will be true for as long as the correlation between the endogenous variables and the instruments is negative. The validity condition also requires that the correlation between the endogenous covariates and the econometric unobservables and the correlation between the IIV and the econometric unobservales are of the same sign, with more preference given to the negative correlation (the sign allows the parameter of interest to be bound both from above and below).

An additional assumption is that the correlation coefficient between the IIV and the error term is less than the correlation coefficient between the endogenous variable and the error term. Similarly, we follow the approach by Staiger and Stock, (1997) that instruments can be weak but relevant as determined by the exogeneity test and over identification test (to determine the strengths and relevance) of these IVs. Also work by Godfrey, (1999) informed the interpretation of the diagnostic statistics.

In order to determine the existence of the problem of heterogeneity in the regressions, we introduce another variable that is generated by interacting the predicted residuals of the endogenous variable with the endogenous variable itself. This is part of the control function approach.

The contributions of the econometric analyses undertaken are the economic benefits that can be realised from improving the mental health of industrial workforce in the country.

2.6 Results and discussions

2.6.1 The reduced-form analysis

We estimate two reduced form equations. The first is the reduced form equation 2a and the second is the reduced form equation 5a. The reduced form estimates show both the direct

and indirect effects of medical care expenditure on the value of firm sales per worker, our measure of firm performance and on wages- our measure of productivity respectively. The log of medical care expenditure has a statistically significant impact on both the log of value of sales and the log of wages as shown in Table 2-5. However, it is important to point out that the coefficients on log of medical care expenditures are not causal effects. The estimated coefficients could incorporate the effect on sales revenue of another factor, in the sales revenue equation, such as the mental health capital of workers. Similarly, the estimated coefficients in the wage equation could incorporate the effect on the wage, of another factor. This would be particularly the case if medical care expenditure of firms is strongly correlated with the mental health of workers.

Thus, the coefficient on medical care expenditure shows the impact of this expenditure on sales and also on wages respectively, *lumped* together with the effects of all the factors with which the medical expenditure is correlated. In column (1), the coefficient shows that a 1 percent increase in medical care expenditure per worker is associated with 0.9409 percent increase in the value of firm sales per worker. Similarly, the coefficients in column (2) indicate that a 1 percent increase in medical care expenditure per worker is associated with 0.079 percent increase in the productivity per worker. Both revenue of firms and labour productivity are inelastic with respect to medical care expenditures of firms.

There are two assumptions on the coefficient of medical care expenditure in Table 2-5. The first is that the medical care effect is being driven by the health of workers, specifically, the workers' mental health that is correlated with medical care expenditure of firms. The second assumption is that medical care expenditure has no direct, independent effect on sales and on wages respectively. That is, it affects sales only through its effect on the mental health of workers and similarly, it affects wages only through its effects on the mental health of workers. Thus, medical care expenditure is theoretically a valid instrument for mental health in a regression framework in which the effects of mental health on sales and on wages are being measured. That is, medical expenditure incurred by firms can be used as an instrument for mental health in an equation in which mental health

is endogenous to a firm's revenue and wages respectively.

Table 2-5 Effect of medical care expenditure on value of sales and on wages

Variable	**Reduced-form OLS Estimates (dependent variable is log of value of sales per worker) (1)**	**Reduced-form OLS Estimates (dependent variable is log of wage per hour per worker) (2)**
Log of medical care expenditure per worker	.9409 (16.41)	.0787 (11.15)
Years of worker experience in the firm	-.0015 (0.44)	.0047 (0.78)
Years of worker experience in the firm squared	.00005 (0.50)	.0001 (1.04)
Female	.0061 (0.21)	-.0278 (0.94)
Constant	0.1738 (7.41)	3.4479 (58.37)
Adjusted R-squared	.1480	.0833
F-Statistic [p-value]	68.68 [.0000]	35.54 [.0000]
No. of observations	1560	1522

Source: RPED survey 2002/2003.

Note: Absolute *t* statistics in parentheses. Critical t-values: 1%=2.58, 5%=1.96 and 10%=1.65.

Thus, the first step in estimating the *causal effect* of mental health on the revenue of the firm and productivity of the firm, is to make mental health vary according to a factor (or in accordance with a set of factors) that has no direct impact on both variables (revenue and wages). In that case, the effect of a variation in mental health on the revenue of a firm or on the labour productivity of the firm would not be contaminated by effects originating from elsewhere.

In the ensuing section, the results from the first stage regression (so called because it is performed in the first step in the estimation of the causal effect of mental health on sales and on wages) are presented. Medical care expenditure is the exclusion restriction in both the regressions (i.e., it is the instrumental variable that is excluded from the second stage regressions, where the effect of mental health capital on sales is estimated and where the

effect of mental health on wages is determined). All the other instruments in the first stage regression, the so-called control variables are included in the second stage regression as well (see Mwabu, 2009).

2.6.2 Determinants of mental health

Table 2-6 presents the basic results for individual worker regression for both OLS and probit specifications of the mental health production function (refer equation 3). Both regressions have the mental health capital as the dependent variable. The OLS regression results are included as baseline estimates to show how the specification change as the model specification improves. Column 2 shows results from the linear probability model (LPM) regression with the exclusion restrictions included.

Table 2-6: Determinants of mental health (dependent variable =mental health)

Variables	**Estimation Methods**		
	Ordinary Least Squares	**Probit**	
	OLS (LPM)-without controls for endogeneity and heterogeneity (1)	**Probit estimates (marginal effects) (2)**	**Probit Marginal Effects-elasticities (3)**
Years of experience in this firm	.0041(2.09)	.0037 (2.09)	.0339(2.09)
Years of experience squared	-.0001(1.95)	-.0001(1.99)	-.0141(1.99)
Female	.0218(1.27)	.0213 (1.38)	.0042(1.27)
Log of medical expenditures per worker	-.0674(2.03)	-.0608 (2.03)	-.0088(2.03)
Constant	.9131(67.40)	-	-
Pseudo R-squared	-	0.0114	
F statistic [p-value]	2.40 [.0483]	-	-
Adjusted R-squared	0.0036	-	-
No. of observations	1556		

Source: RPED survey 2002/2003.

Note: Absolute *t* statistics in parentheses. Critical t-values: 1%=2.58, 5%=1.96 and 10%=1.65.

A percentage increase in medical care expenditure is associated with a 0.0674 improvement in the probability of being in good mental health on a 0-1 scale. A similar regression using probit model is shown in columns 2 and 3. Column 3 shows marginal effects for the probit model of all the covariates in the regression. A percentage increase in medical care expenditure of firms would reduce the workers' probability of suffering mental health disability by 0.0088 percent. Since the method of OLS suffers from heteroscedasticity and problem of boundary restrictions on the predicted probability, the results from the probit model are preferred.

2.6.3 The effects of mental health on sales revenue

Is mental health of workers correlated with their productivity? Equation 4 is used to estimate this relation. Table 2-7 presents two possible approaches to answering this question. Column 1 depicts OLS estimates of endogenous mental health on a firm's performance, expressed as log of sales per worker. Columns 2 and 3 show estimates from a similar regression as column 1 but with controls for endogeneity and heterogeneity, respectively. Two new regressors are included via the control function approach to account for correlations of mental health with the econometric unobservables. The assumption is that the econometric unobservables are uncorrelated with the excluded instruments.

The results in Table 2-7 show that mental health capital has a statistically significant and economically important effect on the performance of firms. As argued in an earlier section of this chapter, mental health capital is complementary to human capital. The absolute value of magnitude of the coefficient increases as we move to a specification which controls for both endogeneity and heterogeneity biases. The estimates imply that for a 1 percent reduction in the proportion of workers suffering from poor mental health, the revenue of firms increases by 0.928 percent.

Table 2-7: The effects of mental health on firm's revenue (dependent variable = log value of sales per worker)

Variables	Estimation Methods				
	OLS	2SPS	Control Function Approach		
	Controls for endogeneity and heterogeneity? (No)	Controls for endogeneity? (Yes)	2SR1 Controls for endogeneity? (Yes)	Controls for heterogeneity? (Yes)	Elasticities
	(1)	(2)	(3)	(4)	(5)
Are Workers concerned about HIV/AIDS? (1=yes)	-.1100 (2.12)	-	-.1376 (11.93)	-.1141 (3.75)	-.9279 (3.75)
Predicted probability that a worker is concerned about HIV/AIDS	-	-.1376 (11.90)	-	-	-
Predicted residual for workers' concerns about HIV/AIDS	-	-	.1368 (11.80)	.1112 (3.37)	-.1059 (3.75)
Predicted residuals for workers' concerns about HIV/AIDS *Concerns about HIV/AIDS	-	-	-	2.766 (0.86)	.1837 (0.86)
Years of experience in this firm	.0039 (1.08)	.0549 (10.35)	.0549 (10.35)	.0549 (10.30)	.4997 (10.30)
Years of experience squared	-.00004 (0.44)	-.0015 (10.86)	-.0015 (10.86)	-.0015 (10.77)	-.2207 (-10.77)
Female	-.0212 (0.68)	.3059 (7.68)	.3059 (7.68)	.3066 (7.70)	.0552 (7.70)
Constant	.3810 (7.46)	.1273 (12.19)	.1273 (12.21)	.1038 (3.44)	-
R-squared	.0060	0.1447	0.1463	0.1473	-
F statistic [p-value]	2.00 [0.0922]	37.03 [0.000]	30.90 [0.000]	25.28 [0.000]	-
Number of observations	1556				

Source: RPED survey 2002/2003.

Note: Absolute *t* statistics in parentheses. Critical t-values: 1%=2.58, 5%=1.96 and 10%=1.65.

The coefficient on the predicted value of the residual of the mental health variable is statistically significant indicating that mental health is potentially endogenous to the revenue of firms. Therefore, the inclusion of predicted value of mental health (predicted probability that a worker is concerned about HIV/AIDS) using expenditure on medical care per worker as the instrumental variable is needed.

This is important for consistent estimation of structural parameters of the sales revenue equation. The coefficient on the predicted residual for workers concerned about HIV/AIDS interacted with the endogenous mental health capital in the structural sales equation is statistically insignificant. This result provides evidence of no heterogeneous effects of mental health capital on sales revenue across firms. This finding suggests that the control function approach is the appropriate estimation method.

2.6.4 Does mental health capital affect labour productivity?

Table 2-8 presents coefficient estimates of OLS and the control function approach. The earnings function is estimated for all the workers using equation 6. We use log of wages per hour, for each employee as our proxy variable for labour productivity. Column 1 report coefficient estimates derived from OLS without controlling for endogeneity. The results suggest that women in manufacturing firms earn significantly less than men. This could be linked to the fact that they worry more than men and this worry has negative implications on their productivity.

The firm location coefficients show that firms located in Nairobi pay significantly more than Kisumu, while those located in Nakuru and Eldoret pay significantly less than those located in Kisumu. Column 2 reports similar estimates using the control function approach to control for endogeneity. The coefficient of the predicted residual term for mental health capital is highly significant. This result suggests that endogeneity of mental health is a problem in the estimation.

Table 2-8: Effects of mental health on the workers' wages (dependent variable = log of wage per hour, per worker)

Explanatory variables	Estimation method		
	OLS	Control Function Approach	
	Baseline estimates (1)	Controls for heterogeneity?(No) (2)	Controls for heterogeneity? Yes) (3)
Mental health capital of workers (concerned about HIV/AIDS=1)	.0007 (0.80)	.0275 (4.36)	-.1088 (5.95)
Predicted residuals for mental health capital of workers	-	-.0283 (4.39)	.2439 (6.50)
Predicted residuals for mental health capital of workers*mental health capital of workers	-	-	-.3374 (7.18)
Square of predicted residuals for mental health capital of Workers	-	-	.1269 (4.89)
Years of experience in this firm	0.0105 (1.81)	.0090 (1.55)	.0005 (0.10)
Years of experience squared	-.00005 (0.38)	.0001 (0.94)	.0003 (2.51)
Female	-.1238 (1.87)	.0175 (0.27)	-.7746 (7.05)
Nairobi	.00004 (0.03)	.0020 (1.48)	.0069 (4.54)
Mombasa	-.0021 (1.56)	-.0012 (0.85)	.0020 (1.39)
Nakuru	-.0049 (3.68)	-.0042 (3.02)	-.0013 (0.93)
Eldoret	-.0064 (4.96)	-.0058 (4.41)	-.0035 (2.55)
Constant	3.856 (24.69)	1.3029 (2.07)	15.094 (8.17)
F-statistics [p-value]	18.05 (0.0000)	18.17 (0.0000)	20.65 (0.0000)
R-squared	0.0574	0.0785	0.1247
Number of observations	1521		

Source: RPED survey 2002/2003.

Note:absolute *t*-statistics in parentheses.Critical t-values:1%=2.56, 5%=1.96 & 10%=1.65.

We include two other variables obtained by interacting the predicted residuals for mental health capital and mental health capital itself and square of predicted residuals for mental health capital. These variables control for unobserved heterogeneity among workers. These results are shown in column 3. As observed, all the variables now have expected signs. The coefficient of the interaction term between the predicted residual for mental health and mental health capital is also highly significant. This provides empirical evidence of heterogeneity of workers. Specifically, the results show that poor mental health capital can be detrimental to the productivity of a worker and the firm in general.

2.6.5 Relevance, strength and exogeneity of instruments

For an instrument to be valid, there are three properties that need to hold. First, an instrument is considered relevant if its effect on a potentially endogenous variable is statistically significant. Second, an instrument is strong, if the size of its effect is large (F>10) and third, an instrument is exogenous if it is uncorrelated with the error term of the structural equation. However, it may be difficult for an instrument to meet all the three requirements (Bound *et al.*, 1995) and still be valid (Nevo and Rosen, 2010).

Diagnostic tests on the instrumental variables used in the estimations provide further information on the instruments. The partial R^2 tests the strength of each of the instruments while the F statistic tells about the statistical significance of the Shea R^2 (Shea, 1997). The first stage F statistic on excluded instruments varies from 4.1 ($p-$ value = 0.0430) to 6.4 ($p-$ value = 0.017) this is less than the recommended value of at least 10. According to the $p-$value and the magnitude of the first stage F statistic on the excluded instruments, we conclude that the instruments are imperfect but valid for identification. Further evidence shows that, the Durbin-Wu-Hausman χ^2 tests is 219.73 and 189.96 respectively with a ($p-$ value = 0.0000) in both cases. Similarly, the t tests of the residual term are statistically significant. This means that the OLS estimates are not reliable for inference.

2.7 Summary and conclusions

In this chapter, we have examined the impact of mental health capital of workers on sales revenue of manufacturing firms and also the effect of mental health capital on labour productivity of workers. We used a dataset that was collected for both the individual workers and manufacturing firms in 2002/3 to conduct the analysis. We implemented an empirical approach for evaluating the disabling burden of poor mental health capital as it reduces the productivity of labour and erodes the capacity of workers to labour for longer hours.

Two measurement issues have been addressed. The first is that poor mental health capital may affect productivity of the workers, but productivity provides the resources to invest in better nutrition and health care, and hence to produce better health (Strauss and Thomas, 1998). We controlled for unobserved heterogeneity of the workers and endogeneity of mental health capital using the control function approach. In this essay, concerns about HIV/AIDS as a result of being infected or affected have been used as a proxy for poor mental health. It is often argued that mental health strongly correlates with indicators of social and economic prosperity.

We find that when a firm spends on medical care needs of its workers, the value of its sales per worker increase significantly. Similarly, the productivity of the workers increases significantly. This means that both the revenue of firms and labour productivity are responsive to firm expenditure on medical care. These results are similar to a study on tea workers in Kenya (Larson *et al.*, 2009)

A gender perspective shows that female workers earn significantly less than men. Our results show that, an additional expenditure on the medical care needs of the workers would reduce the probability of suffering mental health disability by 0.0674 percent. This means that mental health capital strongly affects the revenue of the firm. As argued in an earlier section of this chapter, mental health capital is complementary to human capital and hence, poor mental health capital can be detrimental to the productivity of a worker

and the firm in general.

The results show that productivity per worker is negatively associated with poor mental health capital. On the other hand, expenditure on medical care can improve mental capital. These results are consistent with the theoretical conceptual work on the economic importance of mental health capital (Chatterji *et al.*, 2007, Ettner *et al.*, 1997, Frank and Gertler, 1991, Reichman *et al.*, 2009, Weehuizen, 2008). This means that mental health matters for firm revenue and productivity.

CHAPTER THREE

3 TOTAL FACTOR PRODUCTIVITY, EXPORT PROPENSITY AND EXPORT INTENSITY

3.0 Introduction

Exports play an important role in the development and growth of an economy. Besides foreign direct investment, exporting is one of the most important channels through which developing countries can link with the world economy (Benard and Jensen, 1999, Graner and Isaksson, 2002). Previous studies on the role of exports address several issues: quantifying the contribution of exports to economic growth (Fosu, 1992, Rangasamy, 2009), designing of appropriate trade and industrial policies (Neary and Leahy, 1999) , and identifying macroeconomic factors that affect trade performance among others. The issue of what determines export performance of firms remains an active area of research, particularly in emerging economies.

For a long time, the comparative advantage theory of export structure has been central in explaining exporting behaviour across countries. The theory of comparative advantage asserts that countries specialize in the production and export of products in which they have a comparative cost advantage caused by relative abundance of a certain factor of production. In contrast to the comparative advantage theory of export structure is the view that firm-level factors are important determinants of the ability to export (Soderborm and Teal, 2000). This view implies that increasing efficiency is the key to a firm's ability to enter the export market. Such efficiency may be linked to the observable skills that the firms possess; and the amount of education and tenure of workforce. Efficiency may, on the other hand be linked to unobservable factors, such as managerial ability, effort and workers' entrepreneurial capacities (Soderbom and Teal, 2000). It is clear that understanding trade performance is now beyond parameters of comparative advantage and role played by technology (Duenas-Caparas, 2007).

A critical observation made in previous investigations is that all firms face the same macroeconomic conditions yet these firms respond and perform differently in their export activities. There are good reasons to suggest that health is also an important determinant of export performance of firms. Lvovsky (2001) in Cole and Neumayer (2006), for instance, provides evidence on the burden of disease in Less Developed Countries, (expressed in disability-adjusted live years lost per million people) which is approximately twice, the burden in developed countries. While a higher disease burden might be a function of poverty, a high disease burden is also likely to adversely affect a nation's development prospects.

Depending on the fatality levels of a disease, an individual's labour supply could be affected. The very common diseases and disabilities in the developing world include under-nourishment, malaria and waterborne disease and relatively recently, HIV/AIDS. The former diseases mainly have non-fatal consequences while the later have both fatal and non-fatal consequences, particularly on adults who participate in the labour force. The affected individuals remain in the labour force, but their productivity is severely impaired (Thirumurthy *et al.*, 2006).

Despite the important role played by exports in development and growth, there is a dearth of empirical evidence on the linkages between health, total factor productivity, and exporting activity in developing countries. Our study contributes to this literature and goes further to analyse mental health mediated impact of factor productivity on export propensity and export intensity of manufacturing firms. First, we proxy the HIV/AIDS related worries expressed by workers for state of mental health capital of the worker and use it as a determinant of TFP, we instrument mental health capital with training of workers in the TFP equation. We assume that mental capital is a complement to human capital just as human capital is a complement to physical capital in some forms of production processes.

Second, we apply recent econometric techniques, such as the control function approach, to

deal with estimation problems of endogeneity, unobserved heterogeneity, and sample selectivity bias. To the best of our knowledge no previous study has examined the impact of poor mental health on TFP and related effects on exports in a developing country context. We begin by deriving the TFP from a manufacturing firm production function. We then examine the determinants of TFP paying particular attention to the key role played by mental health.

3.1 Literature review

3.1.1 Introduction

The section examines both theoretical and empirical literature on the exporting behaviour of firms. On theoretical literature, a brief review of literature on Hecksher-Ohlin model and neo-technology/technology-gap trade theories is first explored. These theories emphasize the role of technology in determining international trade patterns, as a way of showing the limitations of the existing models of exports determinants, especially in low-income countries, where health of the majority of workers is far from the ideal situation. Second, theories of self–selection versus learning by exporting are discussed. Third, we review literature that relates TFP to exporting. The discussion here is mainly on the drivers of TFP. Lastly we review the empirical literature that provides evidence on the exporting behaviour.

3.1.2 Theoretical literature

A brief review of trade theories

Early trade theorist David Ricardo (1772-1823) emphasised relative labour productivity differentials as the basis of trade and showed that each country has a comparative advantage, i.e., ability to find some good it can produce at a lower relative cost, and thereby trade with other countries. This notion was extended in the Hecksher-Ohlin model. For a long time the neoclassical Heckser-Ohlin model has been the dominant paradigm. The model predicts that for countries with abundant unskilled labour, investment for skilled labour would be costly and will have a negative effect on exports. Empirical testing

of the model using data from Brazilian and Indonesian firms shows that human capital variable yielded statistically negative relation with export performance (Dijk, 2002, Duenas-Caparas, 2007).

In both models, technology is taken as either a costless activity or irrelevant in the production and trading process. The recognition of human capital as an important factor of production became the significant contribution of the neo-factor trade theory but still maintained the static view of the Hecksher-Ohlin model. In the eighties, so-called new or strategic trade theory loosened some of these stringent assumptions to allow for other sources of comparative advantage. Various models were constructed in which imperfect competition and economies of scale determined international trade patterns (Helleiner, 1992).

In addition, neo-technology or technology-gap trade theories emphasize the role of technology in determining international trade patterns (Dosi *et al.*, 1990). Innovation, specialisation and learning are the main determinants of comparative advantage in this literature. However, the limitation of this neo-technology model lies in the failure to account for a catch-up process between the rich and poor countries. Learning models are not incorporated, resulting to an insufficient treatment of technology.

The negligence of industry-level approach on the different market conditions and the capabilities of firms within the same industry became the starting point for the proponents of the capability framework as influenced by Austrian economist J. Schumpeter. The capability literature highlights the importance of the firm as the core player in the acquisition and assimilation of new technology. Technological change is regarded as an activity that can be generated by firms involving a continuous search and learning process that could have varying results ranging from the adaptation and improvement of chosen technology to the generation of an entire new technology.

Although the theories outlined above are very broad and mainly used to explain trade

patterns between countries, they also provide useful guidance in explaining export at a lower level of aggregation. Previous empirical research showed that comparative advantage in costs, scale economies, perfect competition and technology are also important determinants of export at the firm and sectoral level.

Firm productivity and exporting

There are two competing hypotheses in the literature with regard to the relation between exporting and productivity i.e., the roles played by self-selection into export markets and learning-by-exporting. The self-selection hypothesis asserts that firms which became exporters were more productive than non-exporters to start with, so that they were more able to enter the export market. According to this view, the process of exporting did not make these firms more productive relative to non-exporters. The efficiency of these firms, and their trade competitiveness thus came from another source other than the exporting activity.

Firms that export incur additional costs, perhaps to modify domestic products for foreign consumption, for transportation, distribution, or marketing, or for skilled personnel to manage foreign networks. These costs are entry barriers that more productive firms were more likely to cope with (Benard and Jensen, 1999, Roberts and Tybout, 1997). Export markets are also likely to be more competitive than domestic markets, making it harder for less productive firms to overcome these barriers. Firms might even be forward-looking with the desire to export leading them to improve productivity so as to become competitive in foreign markets. Thus, there might be prior productivity differences between exporters and non-exporters (Wagner, 2007), the sources of which are of research interest.

Learning-by-exporting hypothesis, on the other hand, asserts that even if there is self-selection, exporters also improve productivity because of entering foreign markets, which increases the competitive pressures on them, while also enabling them to exploit economies of scale. Firms which enter the international market are also more likely to

acquire new technology and to continue exporting. The two hypotheses are by no means mutually exclusive: high-productivity firms, that can afford the extra cost of entry into export markets, may still improve their productivity as a result of exporting (Fernandes and Isgut, 2005).

A number of studies (Benard and Jensen, 1999, Graner and Isaksson, 2002, 2009) have shown that exporters and non-exporters are quite different firm entities. Exporters are larger, more capital-intensive, pay higher wages, and are more productive than non-exporters. These characteristics of exporters could be either a cause or a consequence of their participation in the export market.

3.1.3 Empirical literature

A lot of empirical work shows that there exist inter-firm differences in export performance for both developed and developing countries. This variation seems to be related to technological advantages and other characteristics of the firm, such as employment, labour cost, capital intensity and the sector where the firm belongs.

Following the work of Bernard and Jensen (1999) and Clerides *et al.*, (1998) there has been growing interest in testing the causal relationship between exporting and productivity. Most studies have found evidence supporting self-selection but not learning-by-exporting. For instance, Benard and Jensen (1999) , using data for United States for the period 1984-1992 found evidence that good (efficient) firms become exporters; both growth rates and levels of success measures are higher ex-ante for exporters. However, the benefits of exporting are less clear. Clerides *et al.*, (1998) analyse plant-level data for Colombia, Mexico and Morocco. They examine the causal links between exporting and productivity. They find evidence for self-selection of more efficient firms moving into export market. They also find evidence of positive regional externalities among exporting firms.

Using data for 1992-2000, Arnold and Hussinger (2005) examine the causal relationship

between TFP and exporting in German manufacturing firms. They apply matching techniques in their analysis to account for endogeneity of TFP in the export equation. They find a causal link from high productivity to the presence of firms in foreign markets. They conclude that high-productivity firms self-select themselves into export markets, while exporting itself does not play a significant role in enhancing productivity of German firms.

Delgado *et al.* (2002) use a novel non-parametric analysis of productivity distributions for a five-year period 1991-1996, using firm level data from Spain. They examine the market selection and learning hypothesis, and find higher levels of productivity for exporting firms than non-exporting firms. They conclude that more productive firms self select into the export market. Evidence for learning by exporting is rather weak and limited to younger exporters.

However, some studies have found evidence of both self-selection and learning-by-exporting (Hahn, 2004) for Korea, (Fernandes and Isgut, 2005) for Columbia and (Kraay, 1999), for China; and (Girma *et al.*, 2003), for the United Kingdom; and Bigsten *et al.*, (2004), Bigsten and Gebreeyesus (2008) as well as Van Biesebroeck, (2005), for sub-Saharan Africa countries). Hence the evidence on learning on exports is mixed, which might indicate that the effects vary by economic environments of firms. For example, exporting may have less effect on productivity in a highly industrialized country, where differences between exporting and non-exporting firms may be small.

The relation between exports and efficiency in developing countries has been investigated several times before; (Krueger and Tuncer, 1982, Miller and Upadhyay, 2000) however, this literature is mainly limited to Latin American and Asian countries. Moreover, compared with the great volume of empirical studies based on macro data, there are relatively few studies using micro-data. In sub-Saharan Africa, there are few studies linking efficiency and exports using micro-data (Bigsten et al., 2000, Van Biesebroeck, 2005). To the best of my knowledge, there are only nine previous studies that investigate

the relationship between efficiency and exports that use firm level data from sub-Saharan African countries (Bigsten *et al.*, 2004, Graner and Isaksson, 2002, 2009, Muluvi, 2008, Niringiye *et al.*, 2010, Rankin *et al.*, 2006, Sarpong and Wolf, 2004, Soderborm and Teal, 2000, Van Biesebroeck, 2005). The lack of firm level data has hindered the developments in this research area.

Empirical evidence shows that exporting firms in developing countries are more efficient than their domestically oriented counter-parts. Graner and Isaksson, (2002) used plant level data to analyse causality between efficiency and exports in Kenya. They found plants that will enter the export market in the future are significantly more productive than plants that remain out of the export market. This suggests that relatively efficient firms self-select into the export market. These results are consistent with the theoretical model in Roberts and Tybout (1997), which predicts that in the presence of sunk costs, current market participation is affected by prior export-market experience.

Bigsten *et al.,* (2000) examined the links between exporting and firm efficiency for manufacturing firms in a set of African countries using panel data. They find that firms which export have higher efficiency and there is evidence that the causation runs both ways. More efficient firms are more likely to enter the export market and, once in the export market, the efficiency of such firms rises.

Benhabib and Spiegel (1994) incorporate human capital, measured as the growth rate of human capital, into the production function. They find insignificant and negative coefficients for the human capital variable. This finding leads them to consider more complex paths, i.e., through interaction terms whereby human capital affects growth. They conclude that human capital does not enter the production function as an input, but rather influences growth through its effect on total factor productivity.

Miller and Upadhyay (2000) using pooled data for a sample of developed and developing countries 1960-1989, study the effects of openness, trade orientation and human capital on

total factor productivity. They find that higher openness benefits total factor productivity. Outward–oriented countries experience higher TFP, over and above the positive effect of openness. Human capital generally contributes positively to TFP. However, in poor countries, human capital interacts with openness to exert a positive effect on TFP.

Abala (2009) using panel data from manufacturing firms in Kenya analysed the determinants of manufactured exports with a focus on the effects of TFP on export propensity and export intensity. He maintains that TFP is driven by education. He found that export propensity and export intensity are highly responsive to TFP. A 1 percentage increase in total factor productivity increases the export propensity by 5.4 percent and export intensity by 1.8 percent. He concludes that policy measures to increase export orientation of Kenyan firms should focus on improving TFP, encouraging foreign capital investment, and stimulating modernization of capital equipment employed by firms.

Studies on health and TFP are at best scanty. Only a handful of studies exist. For example, Alemu *et al.*(2005) investigates the impact of HIV prevalence rates on TFP growth using data for over 100 countries for a period of 9 years (1994- 2002). They find that HIV can have a large negative impact on factor productivity growth in southern African countries. Similarly, Cole and Neumaye (2006) examine the relationship between poor health (malaria, water borne diseases and malnutrition) on TFP levels for a list of countries outside Africa and within Africa. They argue that poor health affects economic development through its effects on TFP and not as an additional factor of production or by affecting the productivity of one other factor of production only and find that each malady has a negative impact on TFP levels.

3.1.4 Overview of literature

The above literature provides a summary of existing studies on productivity and exporting. What is clear from the review is that there is a general understanding that firms that export are different from those that sale domestically. They are different in terms of performance indicators, firm size etc (Abala, 2009, Benard and Jensen, 1999, Bigsten *et al.*, 2004,

Bigsten and Gebreeyesus, 2008, Clerides *et al.*, 1998, Graner and Isaksson, 2009, Roberts and Tybout, 1997, Sarpong and Wolf, 2004).

The literature review also suggests that fewer studies exist for developing countries as opposed to developed countries. As reviewed in Abala (2009), most sub-Saharan countries , Kenya included, remain focused on domestic market and only export a small proportion of their total output. The studies also emphasise that TFP is driven by technological factors and other factors like educational attainment of the workforce. The question is, what limits their entry into foreign markets and what can be done to increase their access to foreign markets? A handful of studies have attempted to answer this question. However, the evidence in this research area remains inconclusive.

This essay hypothesises that firms that participate in health production of their workers are likely to experience higher productivity, and therefore more likely to become exporters. In particular this study argues that mental health capital does not enter the export equation directly but it enters via TFP i.e., TFP is driven by mental health capital rather than technological factors and education. Our study differs from all the reviewed studies in that it takes into account mental health capital of the worker as an additional variable in the human capital specification. It also uses a two step control function approach to perform estimations. The approach has been used recently by Abala (2009) and Mwabu (2009). The approach is useful in controlling for endogeneity and unobserved heterogeneity in the estimations.

3.2 Analytical framework

The analysis begins with an understanding of effect of poor mental health capital on the TFP. TFP is derived as residual, i.e., productivity net of contribution of factor inputs (physical and human inputs) using a production function. This measure of TFP has been applied in earlier key productivity studies (Benard and Jones, 1996, Cole and Neumayer, 2006, Corvers, 1997, Miller and Upadhyay, 2000) .

$$TFP = f(X_1, X_2) \quad \text{(1a)}$$

Where, X_1 is a vector of the individual and firm characteristics and X_2 is the mental health variable. However, in the TFP equation 1a, mental health is potentially endogenous. We therefore specify a mental health equation 1b.

$$X_2 = f(X_0, X_1) \quad \text{(1b)}$$

Where, X_2 is the mental health variable and X_0 being the exclusion restriction

X_1 is a vector of the individual and firm characteristics.

The estimable form of equation (1b) is:

$$X_2 = a + bX_0 + cX_1 + \varepsilon_1 \quad \text{(1c)}$$

Where X_0 and X_1 are defined as before and ε_1 is the error term. a, b and c are coefficients to be estimated.

Since mental health variable is potentially endogenous in the TFP function, we estimate a linear probability model (LPM) to identify the determinants of mental health capital before conditioning TFP on it. As in essay two, Table 2-6, equation (1c) forms the first stage in the estimation of effects of TFP on export propensity and export intensity.

TFP is hypothesized to depend on mental health capital and a number of other factors, the most important of which is the experience attained within the firm. A dummy variable for female workers is included to capture the gender effect on total factor productivity. Firm expenditure on medical care per worker is used as the exclusive restriction in the mental health capital function as shown equation (1c).

TFP is assumed to be endogenous to export propensity and export intensity. This is to say that it is correlated with the error term in the respective export equations. We first identify a variable that we would use to instrument in the TFP equation (1d).

We introduce training in the reduced form TFP equation: We use this instrument to control for endogeneity of TFP by estimating a reduced form TFP equation (1d).

Suppose in the reduced form, TFP (with control variables suppressed) is given by

$TFP = \psi t + \varepsilon_1$ ..... (1d)

Where t is the instrumental variable that is independent of ε_1 and uncorrelated with u_1 in structural equation i.e., the probit equation that models the probability of a firm exporting (equation 4a).

In order to determine the relevance of the instrumental variable for TFP, it is important to estimate equation (1e) to establish the association between training and mental health capital. We specify the following equation (with control variables suppressed):

$t = \beta X_2 + \varepsilon_2$ ..... (1e)

Where t is worker's training acquired before joining the firm and X_2 is mental health capital, β is the coefficient to be estimated and ε_2 is error term.

Based on regression equation (1d); we predict our new variable for TFP. We also derive the residual for TFP and another new variable where the observed TFP is interacted with the predicted TFP residual. The two variables are also called control function regressors. The former (residual for TFP) and the later (interaction factor) are included in the probit equation that models the probability of a firm exporting (equation 4a) and the export propensity equation (4b) to control for endogeneity and unobserved heterogeneity, respectively.

The procedure described in the preceding paragraph is the control function approach. It is an econometric method used to correct for biases that arise as a consequence of selection and / or endogeneity. It is an approach for dealing with selection bias (Wooldridge, 2002). Similar methods have been used to address problems of endogeneity in several

econometric studies (see Mwabu, 2009, Soderbom *et al.*, 2006, Terza *et al.*, 2008).

What characterizes an exporting firm?

The approach used in this study to distinguish between firms that sell only domestically and those that export to foreign markets, follows that used by Bernard and Jensen (1999) and Arnold and Hussinger (2005). Export decisions are modelled using a probit model to determine the relationship between the export status and characteristics of the firm (see Greene, 2002 pp 666-671).

We specify the export decision as an unobserved variable z^* such that,

$$z^* = X'\beta + \varepsilon \quad \text{..... (2a)}$$

But we observe,

$z = 1$ if $z^* > 0$,

$z = 0$ if $z^* \leq 0$.

It can be shown that the conditional probability of an event, such as exporting can be written as the cumulative distribution function, equation (2b):

$\Pr ob(Y = 1 \mid X) = F(X'\beta)$ and

$\Pr ob(Y = 0 \mid X) = 1 - F(X'\beta)$

The choice of a particular form for F_i leads to the empirical model to be estimated . The CDF for the standard normal distribution results in the probit model, equation (2b)

$$\Pr ob(Y = 1 \mid X) = \int_{-\infty}^{X'\beta} \phi(\tau) dt = \Phi(X'\beta), \quad \text{..... (2b)}$$

Where: $\tau = (Y - X'\beta)$, so that

The conditional expectation of Y is equivalent to the conditional probability,

$E[Y \mid X] = 0[1 - F(X'\beta)] + 1[F(X'\beta)] = F(X'\beta) = \Pr ob(Y = 1 \mid X)$

The unknown parameters of the probit model are estimated by the method of maximum

likelihood. The model with success probability $\Phi(X'\beta)$ and independently drawn observations leads to the joint probability or likelihood function of the form

$$\Pr ob(Y_1 = y_1, Y_2 = y_2, \ldots\ldots\ldots, Y_n = y_n \mid X) = \prod_{y_i=0}[1 - \Phi(X_i'\beta)]\prod_{y_i=1}\Phi(X_i'\beta), \quad i = 1, \ldots\ldots, n.$$

The likelihood function for a sample of n observations can be written as:

$$L(\beta \mid data) = \prod_{i=1}^{n}[\Phi(X'\beta_i)]^{y_i}[1 - \Phi(X_i'\beta)]^{1-y_i}$$

Taking logs, we obtain the log likelihood equation:

$$\ln L = \sum_{i=1}^{n}\{y_i \ln \Phi(X_i'\beta) + (1 - y_i)\ln[1 - \Phi(X_i'\beta)]\} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(2c)}$$

Where, subscript *i* identify the firm and the β_s (i.e., coefficients that maximises the log likelihood equation) are the ones that are being sought.

The interpretation of the estimated coefficients is specified below.
In general, the marginal effect of X is given by

$$\frac{\partial E[Y \mid X]}{\partial X} = \left\{\frac{d\Phi(X'\beta)}{d(X'\beta)}\right\}\beta = \phi(X'\beta)\beta,$$

Export Intensity

Intensity of exports among manufacturing firms was analysed using the Heckman sample selection model. The main idea of the Heckman selection model is that the outcome variable (export intensity) is only observed if some criterion, defined in terms of a variable (export propensity), is met.

According to Correa *et al.* (2007), the Heckman selection model of export intensity has two stages. The first stage equation, export propensity is of the form:

$$z_i^* = w_i\alpha + \varepsilon_i \quad \text{(3a)}$$

$z_i = 0$ if $z_i^* \leq 0$

$z_i = 1$ if $z_i^* > 0$

The second stage equation (the export intensity model) is specified as:

$$y_i^* = x_i\beta + u_i \quad \text{(3b)}$$

$y_i = y_i^*$ if $z_i = 1$

y_i is not observed if $z_i = 0$

Where z_i is the observable dichotomous variable, w_i is a vector of independent variables (including exclusion restrictions) with coefficients vector α, y_i is the export intensity variable, x_i is a vector of independent variables with coefficients vector β, and ε_i and u_i are error terms (normally distributed with zero-mean).

In the first stage, a dichotomous variable z (export propensity) determines whether or not y (export intensity) is observed, y being observed if firm exports (z=1). In the second stage, the expected value of y is modelled conditional to it being observed. The dummy variable z is a realization of a latent continuous variable (z*) that has a normally distributed and independent error term (ε_i) with a zero mean and variance σ^2. If z=1, y is observed, being the realization of a second latent variable (y*), which has a normally distributed and independent error term (u_i) with a zero mean and variance of unity.

The two errors (ε_i and u_i) are assumed to have a correlation ρ and a normal and bi-variate joint distribution. This procedure not only gives insights about exporting decisions, but it also provides analysis of factors that influence the volume of exports or the export

intensity. The correlation (ρ) between the error terms ε_i and u_i in the Heckman selection model, is of high interest to the model. When $\rho = 0$ the likelihood function allows the sample selection model to be split into two independent parts: The first is, a probit regression for the probability of exporting i.e., prob (z=1) and second an OLS regression for the expected value of exporting intensity in the exporting firms [E(y>0|z=1)].

Following Heckman (1979) procedure, we estimate a probit model in the first step to determine the probability of a firm exporting. We regress the firm's export dummy on TFP and other exogenous variables including the control function regressors. This is the sample selection equation (4a). It is used to model the probability of the firm being included in the estimation sample of the outcome equation (export intensity equation 4b).

The selection equation and outcome equation estimated are 4a and 4b respectively.

$$Y_1 = \beta_1 X_1 + \beta_2 X_2 + \beta_3 TFP + u_1 \quad \text{(4a)}$$

$$Y_2 = \alpha_1 X_1 + \alpha_2 X_3 + \alpha_3 TFP + \alpha_4 Z + \alpha_5 \lambda + u_2 \quad \text{(4b)}$$

Where: Y_1 is the propensity to export and Y_2 is export intensity. X_1 include exogenous control function regressors, X_2 and X_3 includes all exogenous variables that determine export propensity and export intensity, Z is predicted TFP, β_1, β_2 and α_2 are vector coefficients and; $\beta_3, \alpha_1, \alpha_3, \alpha_4, \alpha_5$ are coefficients to be estimated, *lambda* (λ) is the inverse of Mills ratio and u_1 and u_2 are stochastic disturbance terms.

The inverse of Mills ration in the second step is calculated for each observation following the generalized Heckman approach as developed by Amemiya (1984). The inclusion of *lambda* in equation (4b) helps correct biases in the estimated parameters resulting from any non-randomness of the selected sample (Heckman, 1979).

3.3 Estimation issues, definitions and measurement of variables

3.3.1 Estimation issues

When estimating the equation for propensity of a firm entering the export market and the intensity of the firm's export after it has entered the foreign market, several factors come into play. There is the possibility of encountering problem of identification and also the potential problem of sample selection bias. The problem of identification arises when variables that determine export propensity also determine export intensity. Technically, the model is identified on the basis of distributional assumptions of error terms (Heckman, 1979, Olsen, 1980).

However, having the same independent variables in the two equations leads to imprecise estimates of outcome equation. Hence, the need to have identifying variables in the export propensity and export intensity equations. It is difficult to find good identifying variables that determine export propensity but without any theoretical influence on export intensity. Also, it is possible to have feed back effects between export intensity and export propensity. The standard procedure applied is a two or three stage estimation method, which requires appropriate instrumentation for proper identification.

The problem of sample selection may be a consequence of the fact that exporting decisions are not randomly distributed but are subject to firm's characteristics and their initial performance. Hence, the exporting and non-exporting firms cannot be treated as homogenous units of observation due to possibility of endogeneity of exporting decisions. In order to correct for the two problems we use the generalised Heckman two-step procedure (Heckman, 1979).

In using the inverse of the Mills ratio to adjust the parameters of the export intensity equation (4b), two tasks have to be accomplished. The first is the construction of this ratio from the probit estimates of the equation (4a). The second task is estimation of equation (4b) with the inverse of the Mills ratio included as one of the exogenous regressors. These

tasks can be accomplished using a one step command (application of maximum likelihood procedures on equation (4a) and (4b)) or in two steps, that is first, probit estimation of the selection equation to obtain the inverse of the Mills ratio, and second, least squares estimation of the export intensity equation, with the inverse of the Mills ratio being treated as one of the regressors. We use both, the maximum likelihood approach and the two-step procedure in order to compare the results.

In both equations 4a and 4b, TFP is our main variable of interest. This variable is potentially endogenous to export propensity and export intensity therefore we need to obtain good instruments in order to get valid results. For this reason, using OLS would give biased estimates of the effects of TFP on export propensity and export intensity. In the section on results, we report additional results that should be more robust to these potential problems than OLS estimates. We assume that mental health affects TFP via the training of the workers. Workers are assumed to have obtained their training before joining the firm. Training is therefore exogenous to the productivity in firm.

We use previous training of workers to instrument for TFP. Our choice of training of workers as instrument is based on the fact that after workers attain training within a given firm, they are likely to move out in search for better jobs which pay them higher wages (Dearden *et al.*, 2006) . In this case previous training would be exogenous to productivity in the firm. Training of workers is also highly correlated with productivity per worker. This relation is positive and very significant at 1 percent level (see Table 3-4). In addition to the endogeneity test, diagnostic tests are also performed on the instrumental variables used in the analysis.

In order to estimate the two equations (4a and 4b), there are two possible approaches that have been previously used in the literature. These are the two-step control function approach and the instrumental variable probit method. In our study we use the control function approach to estimate the export propensity and export intensity equations. As shown in Soderbom *et al.*, (2006), the control function approach is more robust than two-

stage least squares (2SLS) when slope parameters co-vary with the unobserved factors of the model. Even if all slope parameters are constant, 2SLS is likely to result in relatively imprecise parameter estimates if non linear in the endogenous variable. The null hypotheses tested in this essay are (i) TFP has no effect on export propensity and (ii) TFP has no effect on export intensity.

3.3.2 Definition and measurements of variables

Dependent variables

In order to examine exporting behaviour of manufacturing firms in Kenya, we analyse two measures of exporting performance, export propensity (probability of exporting) and export intensity (the proportion of total output value exported). The dependent variable in equation (4a), export propensity, is the probability that a firm enters a foreign market. Export propensity is measured as a dummy variable which takes the value "1" if a firm is engaged in exporting and value "0" if the firm does not export (only sells in the domestic market).

The dependent variable in equation (4b), export intensity, is the proportion of the total output value of the firm that is exported. These measures have been used in several studies (Abala, 2009, Correa *et al.*, 2007, Estrada and Heijs, 2006, Recai, 2003). Both dependent variables are bounded between 0 and 1.

Explanatory variables

The key explanatory variable in the exporting behaviour equations (probability of exporting, and proportion of value of output exported) is TFP. In order to examine the impact of TFP on exporting, a measure of TFP is required. We adopt the most commonly used and widely accepted method for calculating TFP (Benard and Jensen, 1999, Miller and Upadhyay, 2000) with some modification. We estimate productivity per worker (value added per worker) function, and then we predict the residual. We use the predicted residual as our measure of TFP. The control variables include location dummies i.e., Nairobi, Mombasa, Eldoret and Nakuru (Kisumu is the left out dummy).

The control variables for the export intensity equation include: Education of a worker i.e., the number of complete years of education of the worker. Age of worker is measured in years. Training is measured as a dummy. It takes the value "1" if worker has attained previous training before joining the firm and "0" if worker has no prior training.

3.4 Data and sample statistics

The data used in this study are drawn from a survey of manufacturing firms in Kenya (RPED 2002/3). This data is described in detail in chapter two. Refer to chapter two for detailed description. However, the descriptive statistics are discussed below.

Summary statistics, essay two

Table 3-1 presents summary statistics for the variables used in the estimation equations in this essay. Female workers account for about 21 percent of workforce while male workers account for the remaining 79 percent. Majority of these workers have attained about eight years of education, with about 33 percent having received formal training before joining the firms. In addition they have also attained about 9 years of work experience. The average distance between where the workers live and where they work is about 9 km.

In the manufacturing sector, 54 percent of the firms export their products. Nearly the same percentage was exporting in the previous year. The percent of exports to total sales is about 17 percent. The firms are generally medium sized and each firm employs about 213 workers on average. The firms have been in existence for about 27 years. About 13 percent are owned by foreigners. In terms of regional distribution, Nairobi accounts for the highest concentration of firms (62.5 percent) followed by Mombasa with about 15.2 percent while Nakuru, Eldoret and Kisumu account for 9.6, 8.1 and 4.6 percent respectively.

Table 3-2: Linking training to mental health capital (dependent variable = training)

Variables	Estimation methods			
	CFA -LPM with controls for endogeneity and heterogeneity	**CFA-Probit marginal effects with controls for endogeneity and heterogeneity**	**CFA-LPM with controls for endogeneity and heterogeneity**	**CFA-Probit marginal effects with controls for endogeneity and heterogeneity**
	(1)	**(2)**	**(3)**	**(4)**
Years of experience in the firm	-.0009 (0.35)	-.0034 (0.79)	-.0010 (0.41)	-.0018 (0.54)
Years of experience squared	.0001 (2.45)	.0002 (1.71)	.0001 (2.00)	.0001 (1.41)
Female	-.1223 (2.96)	-.1161 (3.10)	-.0034 (0.09)	-.0031 (0.08)
Mental health capital (concerned about HIV/AIDS =1)	-.0271 (0.48)	-.0249 (0.38)	-.1104 (1.96)	-.0912 (1.49)
Predicted mental health capital residual	.1281 (1.07)	.1351 (0.96)	.2760 (2.26)	.2425 (1.85)
Predicted residual for mental health interacted with mental health	-.0019 (1.49)	-.0019 (1.32)	-.0032 (2.43)	-.0028 (2.01)
Squared residual for mental health capital	.1008 (1.57)	.1105 (1.46)	.0165 (2.49)	.1514 (2.15)
Location dummies	Yes	Yes	No	No
Constant	3.225 (0.57)	-	11.59 (2.05)	-
F[statistic]	16.21 (0.000)	-	11.60 [.0000]	-
R-squared	0.093	-	.0464	-
Number of observations	1238			

Source: RPED survey 2002/03.

Note: The residual for mental health capital is generated from equation (1c). Absolute *t* statistics in parentheses. Critical t-values: 1%=2.58, 5%=1.96 and 10%=1.65.

interact the predicted residual for mental health with the mental health itself and include it in the regression, to control for unobserved heterogeneity. Column (1) and column (2) also include location dummies but in column (3) and (4), the location dummies are omitted. The difference between column (1) and (2) is in the estimation methods used, i.e., CFA-LPM (control function approach and linear probability model) and the CFA-probit (control function approach and MLE probit), respectively.

The results indicate that mental health capital has a weak explanatory power for training, a necessary condition for identification, in all the results except for results in column (3) where we estimate CFA-LPM without location dummies. The location controls make a big difference in the magnitude of the estimated coefficients. While inclusion of location dummies in columns (1) and (2) shows no signs of endogeneity and heterogeneity, (i.e., the coefficient of the residual and the interacted factor are not statistically significant) their exclusion in columns (3) and (4) shows presence of endogeneity and heterogeneity. This means that the location variables are important factors in determining whether a worker attained previous training before joining a firm or otherwise. Furthermore column (3) reveals negative and significant effects of mental health capital on the training of workers.

Further analysis based on Norton *et al.* (2004) computes the true probit marginal mean effect of the interaction term, i.e., the mean coefficient of the predicted residual for mental health interacted with mental health variable. In Table 3-3 columns 1 and 3 give the marginal effects of a change in both interacted variables, i.e., the cross partial derivative with respect to training while columns 2 and 4 give the marginal effects of changing just the interaction term. The coefficient of the interaction term in columns 2 and 4 is the same as the coefficient of the interaction term in Table 3-2.

As can be observed in Table 3-3 the magnitudes of the interaction effect is much higher (0.0060 and 0.0029) when the true interaction effects are computed as in Norton *et al.* (2004) compared to their values when the non-linearity assumption is relaxed (-0.0028 and -0.0019). Moreover, the signs change from negative to positive when the non-linearities are taken into account. However the interaction term is no longer statistically significant. This means that there is indeed no unobserved heterogeneity as had been shown earlier in Table 3-2. An in-depth explanation to this approach can also be found in Friedrich (1982).

Table 3-3: Estimated coefficients for interaction terms (probit model of training)

	Probit model without location dummies		**Probit model with location dummies**	
Variable	**Non-linear mean effect**	**Mean effect under linearity assumption**	**Non-linear mean effect**	**Mean effect under linearity assumption**
Predicted residual for mental health interacted with mental health	0.0060	-0.0028	0.0029	-0.0019
Standard error of estimated coefficient	0.0077	0.0014	0.0085	0.0015
z-statistic/ *t*-statistic	0.3472	-2.01	-0.0219	-1.32
Location dummies	No	No	Yes	Yes
Number of observations	1238			

Source: RPED survey 2002/3.

To assess the effect of training on TFP, TFP is regressed on training acquired in previous employment as shown in equation 1d. The results are in Table 3-4. The coefficient on

training is positive and highly significant at 1 percent. That is, training has a positive impact on total factor productivity per worker. We perform various diagnostic tests in order to determine the strength and relevance of training as an instrument for TFP. The first-stage *F* statistic on the excluded instrument (training) provides important information on the validity and relevance of instrument (Shea, 1997). The *F* statistic is 27.32, which is greater than 10. We conclude that, it is valid to use training as the instrument for TFP. The relevance of this instrument is also supported by the Durbin –Wu-Hausman F-test (8.53 *p*[0.0035].

Table 3-4: Determinants of total factor productivity (dependent variable=TFP)

Variables	**Ordinary Least Squares**
Training	.5864 (5.23)
Nairobi	.8603 (4.02)
Mombasa	-.0694 (0.29)
Nakuru	.5711 (2.18)
Eldoret	-1.8701 (5.60)
Constant	-.8054 (3.88)
F [statistics] (p-value)	33.05 (0.0000)
R-squared	0.1262
Adjusted R-squared	0.1224
No. of observations	1150

Source: RPED survey 2002/3.
Note: Absolute *t* statistics in parentheses. Critical t-values: 1%=2.58, 5%=1.96 and 10%=1.65.

The results on the effect of training on TFP are similar to earlier study by Dearden, *et al.*, (2006) who found that training has a positive and significant impact on productivity. The magnitude of the coefficient on training in Dearden, *et al.*,(2006) was 0.60 which is very comparable to the coefficient of 0.586 in our case.

Having established the validity of training as an instrument for TFP, the effect of TFP on export propensity is examined using various regression methods. The analysis performed

controls for common econometric problems of endogeneity and heterogeneity. Most importantly for our purposes, TFP has a statistically significant and economically important effect on export propensity. The size of this effect increases as we move away from less rigorous methods to precise techniques (see Table 3-5).

In column 1, we report ordinary least squares (OLS) estimates without controls for endogeneity and heterogeneity. The results show that productivity, as measured by TFP, has a positive and statistically significant effect on export propensity. This finding conforms with findings from earlier studies (Abala, 2009).

3.5.2 Impact of TFP on export propensity

Table 3-5: The impact of total factor productivity on export propensity (dependent variable =export propensity)

Variables	Estimation Methods				
	OLS	Control Function Approach			
	LPM-without controls for endogeneity and heterogeneity with location dummies (1)	LPM (with controls for endogeneity) (2)	LPM (with controls for heterogeneity (3)	Probit marginal effects (with controls for heteroscedasticity and unobservables) (4)	Probit parameter estimates (not mfx) (5)
Total Factor Productivity	.0261 (3.42)	.1436 (2.80)	.1829 (3.64)	.2015 (3.56)	.5086 (3.56)
Nairobi	.3037 (6.14)	.2224 (3.34)	.2101 (3.19)	.2214 (2.90)	.5629 (2.90)
Mombasa	.3350 (5.96)	.3814 (6.49)	.3939 (6.66)	.3697 (6.03)	1.0739 (6.03)
Nakuru	.0258 (0.44)	-.0394 (0.56)	-0609 (0.88)	-.0558 (0.67)	-.403 (0.67)
Eldoret	.3443 (4.77)	.4874 (3.69)	.6224 (4.75)	.4347 (4.36)	1.657 (4.36)
Predicted TFP Residual	-	-.1124 (2.20)	-.1509 (2.96)	-.1662(2.92)	-.4197 (2.92)
Interaction between predicted residuals for TFP with TFP	-	-	-.0100 (11.19)	-.0119(7.92)	-.0303 (7.92)
Constant	.2663 (5.71)	.3467 (6.16)	.3847 (6.88)	-	-
Wald chi2(5)	-	-	-	145.65 (0.0000)	145.65(0.0000)
Pseudo R-squared	-	-	-	.0854	.0854
F statistics (p-value)	21.09 (.0000)	17.42 (0.0000)	34.06 (0.0000)	-	-
R-squared	0.0568	0.080	0.1119	-	-
Number of observations	1581	1150			

Source: RPED survey 2002/3. *Notes*: Productivity= value added per worker; TFP as residual is derived from equation 1d, pg 67.

Note: Absolute *t* statistics in parentheses. Critical t-values: 1%=2.58, 5%=1.96 and 10%=1.65.

These results are consistent with our prior expectations that firms export because of high TFP. However, the same firms might also export because they have other factors which non-exporting firms do not have. For instance, special contacts with people outside, large capital stock and high proportion of non-production workers (Abala, 2009, Alvarez, 2002, Benard and Jensen, 1999, Dijk, 2002, Duenas-Caparas, 2007).

Despite the positive results from OLS regression analysis in the column 1, TFP is endogenous in the export propensity equation. There are three reasons that could explain the endogeneity of TFP in the export equation. First, is possibility of measurement error in TFP, second is possibility of simultaneity between exports and TFP and third, there could be unobserved factors such as managerial ability which are not controlled for in our OLS regression. These variables may also be highly correlated with export propensity. Moreover, they could make firms to behave differently even where they are exposed to the same environment. This means our results could suffer from problems of endogeneity of TFP and heterogeneity of firms. Such problems would bias our results leading to unreliable and inconsistent estimates.

In column 2 we estimate the same LPM model but control for endogeneity by including the predicted residual for TFP. The results indicate a substantial improvement in the size of coefficient on TFP. The value of the coefficient increases from 0.0261 to 0.1436. Similarly in column 3, we control for unobserved heterogeneity and these increases the magnitude of the coefficient further to 0.1829. This means that the OLS regression underestimates the magnitude of the coefficient of TFP as a result of endogeneity and unobserved heterogeneity in the export propensity model.

Further, in column 4, marginal effects from a probit model that includes controls for endogeneity and heterogeneity are reported. The marginal effect for TFP is 0.2015. This means that a one unit increase in the TFP would result in an increase in the probability of exporting of about 0.20 percent.

Table 3-6 is an extension of the analysis for probit estimates for the interaction term between the predicted residual for TFP and TFP itself. This analysis invokes the work of (Friedrich, 1982, Norton *et al.*, 2004) as discussed earlier in this chapter. Again the results show that the full interaction effect is best estimated when the entire cross derivative is taken into account as shown in column 1. The magnitude of the interaction effect is now positive (0.001) but the coefficient of the interaction term is statistically insignificant. The non-significance means that indeed there is no heterogeneity, contrary to what the simple effect in column 2 shows.

Table 3-6: Probit estimates for non-linear and linear effects of interaction term

Variable	**Estimated non-linear mean effect** (1)	**Estimated mean effect under linearity assumption** (2)
Predicted residual for TFP interacted with TFP	0.001	-0.0119
Standard error of estimated coefficient	0.019	0.002
z-statistic/ *t*-statistic	0.144	-7.92
Number of observations	1150	1150

Source: RPED survey 2002/3.

3.5.3 Does TFP affect export intensity?

We use different estimation methods to assess the impact of TFP on export intensity. The results are in Table 3-7. Column 1 shows results from OLS estimation. We use the two-stage predictor substitution (2SPS) approach (see Terza *et al.*, 2008) in order to address the problem of endogeneity. Using predicted TFP and without controls for sample selection bias, we find that TFP has the expected positive sign with statistically significant coefficient. This means that TFP increases export intensity. This finding is similar to results from other studies (see e.g., Abala, 2009). Further, the results support earlier strands of literature which argue that firms with higher productivity self select into export market and once there, they export a larger proportion of their total output (Arnold and Hussinger, 2005, Benard and Jensen, 1999, Bigsten *et al.*, 2004, Clerides *et al.*, 1998, Fernandes and Isgut, 2005, Girma *et al.*, 2003, Hahn, 2004, Roberts and Tybout, 1997,

Van Biesebroeck, 2005).

In column 2 estimation results based on the Heckman model are reported. We control for sample selection bias by including the inverse of Mills ratio in the export intensity equation 4b. The 2SPS approach is used to address the problem of endogeneity. Again the results show that the coefficient for TFP is positive and significant. However, the magnitude of the coefficient is now much larger, having changed from 0.0789 for OLS to 0.4146. The coefficient for *lambda* is also positive and significant at 10 percent level. This has two implications. First, sample selection is a problem. Second, inclusion of inverse of Mills ratio corrects for it. The coefficient for years of education remains positive and significant while age and gender dummy are insignificant. This estimation includes location dummies.

Columns 3 up to 5 present findings derived from using the Heckit method that corrects for sample selection bias. Identification is through functional form. The control function approach corrects for endogeneity and heterogeneity. The regression in this column is different from regressions in column 1 and 2 in various ways. First, in the regression in column 3, we control for all the biases as mentioned earlier. In order to correct for endogeneity, we use two-stage residual inclusion (2SRI) approach which is a more theoretically consistent approach compared to 2SPS (see Terza *et al.*, 2008 for a comprehensive explanation).

The regression results in column 3 also include the control function regressors, i.e., the residual for TFP and the interaction out come variable between TFP residual and TFP itself. The results show that TFP still has positive effect on export intensity;

Table 3-7: The impact of total factor productivity on export intensity (dependent variable =export intensity)

Explanatory Variables	Estimation Methods				
		2SPS	Control Function Approach		Heckit
	OLS - (without controls for sample selection bias) - 2SPS	Two Stage Predictor Substitution (with controls for sample selection bias)	Two Stage Residual Inclusion - 2SRI (with controls for sample selection bias, endogeneity and heterogeneity)	Two Stage Residual Inclusion - 2SRI (with controls for sample selection bias, endogeneity and heterogeneity)	Maximum likelihood - Heckman-one step estimates
	(1)	(2)	(3)	(4)	(5)
Predicted TFP	.0789(2.96)	.4146 (2.03)	-	-	.0808 (2.09)
TFP	-	-	.3577 (1.38)	-.0814 (4.76)	-
Age of worker	-.0001 (0.90)	-.0001 (0.16)	.0001 (0.10)	.0008 (0.89)	-
years of education	.0269 (2.09)	.0267 (2.08)	.0273 (2.02)	.0401 (2.94)	-
Female	.0114 (0.60)	.0109 (0.58)	.0156 (0.74)	.0292 (1.34)	-
Inverse of Mills ratio	-	1.9107 (1.66)	1.528 (1.04)	-.1479 (3.14))	-.0468 (1.11)
TFP residual	-	-	-.3505(1.35)	.0890(5.02)	
TFP * TFP residual	-	-	.0007 (0.80)	-.0005 (0.56)	
Constant	.0767 (1.32)	-1.8189 (1.59)	-1.471 (1.00)	.1560(2.75)	.3887 (5.49)
Location dummies	Yes	Yes	Yes	No	Yes
F statistic	17.99 (0.0000)	1632 (0.0000)	10.99 (0.0000)	5.13 (0.0000)	
Adjusted R-squared	0.0865	.0876	.0876	.0246	
Wald chi2(5)	-	-	-	-	148.93 (0.00)
No. of observations	1437	1437	1146	1146	1347

Source: RPED survey 2002/3.

Note: Absolute *t* statistics in parentheses. Critical t-values: 1%=2.58, 5%=1.96 and 10%=1.65.

However, the coefficient on TFP is no longer statistically significant. The coefficient of inverse of Mills ratio is also not significant. This is interpreted to mean that sample selection is not a problem of concern. Similarly, endogeneity and heterogeneity is not a problem given that the coefficient of the residual for TFP and the interaction of TFP with its residual are not significant.

In column 4, we repeat similar regression but we exclude location dummies. We find that the magnitude of the coefficient for TFP becomes very small and negative (from .3577 to-.0814) at 1 percent level of significance. It is not surprising to obtain the negative correlation since it is possible that when export sales increase as a result of high efficiency (due to TFP), then it follows that export intensity would decline. The coefficient of the inverse of Mills ratio becomes statistically significant and negative. As indicated earlier, only about 52 percent of firms in the sample export. This sample selection problem is therefore controlled for when we include the inverse of Mills ratio. Endogeneity of TFP is also a problem. It is captured through the coefficient of the residual for TFP. It is very significant in this estimation equation. However, heterogeneity may not be a problem.

In column (5), we use the Heckman maximum likelihood estimation to account for sample selection bias. Here the inverse of Mills ratio (the variable we derive from the export propensity equation to control for unobservables that are correlated with the selection of exporting firms into the estimation sample) is equal to the probability density of the probit index divided by the cumulative distribution of the probit index. The results show that TFP is positively associated with export intensity. OLS and the Heckman maximum likelihood estimates are similar and statistically significant at 5 percent level.

The preferred results are from column (2). The coefficient of IMR corrects for sample selection bias. The parameters in column (3), (4), and (5), are less precisely estimated than the 2SPS estimates.

3.6 Summary and conclusions

The study was motivated by the growing realisation that manufactured exports are key to industrialization as evidenced by export-driven growth in the newly industrialised countries. The Kenya Vision 2030, which is a key policy document for the country, aims to make Kenya a newly industrialised middle income country by the year 2030. This study therefore comes in handy in providing policy prescriptions, not only for Kenya but also for similar developing countries in sub-Saharan Africa.

The data source for this study is the 2002/03 RPED survey for the manufacturing firms in Kenya. This essay has examined the factors that determine export propensity and export intensity while giving special attention to the effect of mental health capital of the worker on TFP. The variable "concerns regarding HIV/AIDS" has been used as a proxy for the state of mental health capital of workers. We hypothesis that TFP is driven by mental health in addition to technical and other factors. Using appropriate econometric techniques, we controlled for endogeneity, unobserved heterogeneity and sample selection biases when estimating effects of mental health on firm performance, worker productivity and competitiveness of Kenyan manufacturing firms in export markets. In particular, we used the control function approach to remove endogeneity of mental health and unobserved heterogeneity among firms. The Heckman sample selection procedure was used to correct for biases arising from non-randomness of the estimation samples.

We find that mental health affects the training received by workers. Moreover, training has a positive impact on productivity per worker and productivity, as measured by TFP, has a positive and statistically significant effect on export propensity and export intensity of the firm. The findings of this essay, strengthen the results obtained in earlier work by Abala (2009), who explored education capital as the only form of human capital determining propensity to export. Our study goes further to examine the effects health capital on export propensity and export intensity.

Comparison of results from various functional forms estimated in this study show that

OLS coefficients for TFP are biased downwards as stressed in the literature (Abala, 2009). The bias is highly likely due to correlation of TFP with the unobserved factors in the error term. These econometric unobservables are the sources of endogeneity of TFP in the export equation. Using the probit with controls for endogeneity and unobserved heterogeneity of firms in the export propensity equation, we find that the coefficient for TFP is 0.2015, which is ten times larger (0.0216 versus 0.2015) than the OLS estimate. These results are consistent with earlier literature on self selection, which show that TFP is a major determinant of export propensity when controls for endogeneity and firm heterogeneity are taken into account (Abala, 2009, Alvarez, 2002, Clerides *et al.*, 1998).

In our export intensity equation, we correct for sample selection bias using the Heckman procedure. In doing this, we include an additional regressor, the inverse of Mills ratio. We also address the problem of endogeneity of TFP by using the 2SPS approach. We compare results from OLS with other methods and we find that the coefficient for TFP is positive and significant in both specifications. However, OLS underestimates the magnitude of the coefficient (OLS estimate is 0.0789 versus the estimate of 0.4146 for 2SPS).

In the Heckit method that corrects for sample selection bias, identification is through functional form. The control function approach corrects for endogeneity of TFP and unobserved heterogeneity of firms. Using two-stage residual inclusion (2SRI) approach which is a more theoretically consistent approach compared to the 2SPS (see Terza *et al.*, 2008 for a comprehensive explanation) to correct for endogeneity of TFP, we find that TFP still has positive effect on export intensity (0.4146 for 2SPS versus 0.3577 for 2SRI).

Based on our findings, we conclude that mental health is an important factor in the determination of TFP. This is found to be effective via the training acquired by the workers in the firm. Similarly we find that TFP matters for export propensity and export intensity.

CHAPTER FOUR

4 EXPORT COMPETITIVENESS AND POVERTY STATUS

4.0 Introduction

Developing countries particularly those found in sub-Saharan Africa suffer from pervasive poverty that is driven in many ways by deep seated structural factors. Nearly one in two people in sub-Saharan Africa live on less than a dollar a day (Handley *et al.*, 2009). The level and persistence of poverty remains a major concern for most developing countries in the sub-Saharan region despite efforts by governments and donor agencies. The Millennium Development Goals targets set for 2015 articulates halving of extreme poverty and hunger as the number one goal (Republic of Kenya, 2007).

In Kenya, poverty is pervasive and widespread among all socio-economic groups, a situation that threatens the very foundation of the Kenyan society (Kenya National Bureau of Statistics, 2007, Mwabu *et al.*, 2003, Mwabu *et al.*, 2000). At independence the government of Kenya recognised poverty, disease and ignorance as major constraints to human development that needed to be addressed. This was marked by the preparation of Sessional Paper No. 10 of 1965. Major initiatives were later articulated in various Sessional Papers and 5-year development plans. These included: land settlement schemes in the 1960s; promotion of rapid growth and creation of employment opportunities in the 1960s and 1970s: District Focus for Rural Development in the 1983 (to open up rural areas to markets); and promotion of the informal economy in the late 1980s (Manda *et al.*, 2001). The assumption here was that benefits of growth from high performing sectors and regions could "trickle down" to benefit everybody. However, this assumption was not realised and this gave rise to the "redistribution with growth" slogan. Nearly five decades later, poverty remains elusive. Nevertheless, poverty reduction still remains a priority in virtually all economic policy documents

The Economic Recovery Strategy for Wealth and Employment Creation and the Kenya

Vision 2030 policy documents identifies various causes of poverty including worsening economic performance and upsurge in the HIV/AIDS pandemic. In addition, it identifies increased employment as the main vehicle for halting rising poverty and reviving the economy. However, the strategy does not identify specific actions to be taken to achieve the greatest impact on poverty reduction. Also it is not clear which sectors will contribute most to reduction in poverty and how this can be done. While promotion of trade-induced export-led economic growth strategy has received due attention in Kenya, its implications for employment, earnings and poverty reduction are often ignored. The high unemployment especially in urban areas, insecure jobs and declining earnings for less skilled labour remain a major challenge to development and poverty reduction initiatives (Were, 2006).

This chapter analyses poverty status among the workers in the manufacturing firms to provide insights into the extent of wage poverty and how export intensification could be used as a strategy for poverty reduction. This analysis is important because there are no widely accepted strategies for reducing poverty in Kenya. Cash transfers are doubtful poverty reduction strategies in the African context, and little is known as to whether cash transfers can successfully reduce poverty. Section 4.1 reviews issue of poverty and inequality in Kenya. Section 4.2 reviews theoretical and empirical issues on poverty. Variable definitions, data and summary statistics are in sections 4.3 and 4.4. Section 4.5 evaluates poverty and inequality profiles in the manufacturing sector. Empirical results are presented in section 4.6 while the summary and conclusions are outlined in section 4.7.

4.1 Poverty and inequality

Poverty refers to lack of basic necessities of life and opportunities for human development. It is multi-dimensional and manifests itself in various forms, making its definition using one criterion impossible. It is pervasive and widespread among all socio-economic groups (Geda *et al.*, 2005, Oyugi, 2000) and is a threat to the very foundation of the society. Poverty includes deprivation, isolation, alienation, insecurity and despondency (Mwabu *et al.*, 2000). Low-income poverty manifests itself in the form of malnutrition,

high mortality rate, illiteracy, lack of access to basic education, drinking water, health facilities and shelter.

On the other hand income inequality refers to the unequal distribution of income among a given population. The most important goal for development efforts is to reduce poverty, which can be accomplished by economic growth and /or by income redistribution. However, a pro-poor growth strategy does not have to only focus on economic growth, but could also be combined with an active policy of income redistribution.

In Kenya, the poverty situation has worsened over time despite government efforts to contain it. In 2000, it was estimated that about 56 percent of the Kenyan population was poor. However, the most recent estimates based on Kenya Integrated Household and Budget Survey (KIHBS) for 2005/2006 shows that the incidence of poverty has come down to about 46 percent with rural poverty being 49 percent and urban poverty being 34 percent (Kenya National Bureau of Statistics, 2007). Despite the decline in the indicator, the total number of the poor people increased considerably between 1997 and 2006.

The social composition of the poor people is well documented. Based on previous studies (see e.g. Collier and Lal, 1980, Greer and Thorbecke, 1986, Mwabu *et al.*, 2000, Republic of Kenya, 1998, 1999), the poor in Kenya are clustered into a number of social categories including the landless, the handicapped, female-headed households, households headed by people without formal education, subsistence farmers, pastoralists in drought prone districts, unskilled and semiskilled casual labourers, AIDS orphans, street children and beggars. A recent government report (Kenya National Bureau of Statistics, 2007) shows that poverty in Kenya is severe in certain regions than in others. This shows that although poverty is widespread and multi-dimensional, its victims can be identified by region of residence and by certain social characteristics.

Table 4-1 shows national and regional absolute poverty measures in Kenya. Substantial regional differences in the incidence of poverty exist in Kenya. About a half the rural

population was poor in the 1990s and 2000s while, between 29 percent and 50 percent of the urban population were poor during the same period. Rural poverty is marked by its common connection to agriculture and land, whereas urban poverty is more heterogeneous in how incomes are generated. The rural poor depend very much on agriculture than the non-poor (see e.g. Quibria and Srinivasan, 1991, Reardon *et al.*, 1992). Also, the few non-farm activities in the rural areas derive their prosperity on forward and backward production linkages with agriculture. Poverty in the rural areas tends to be explained more by low access to physical assets (particularly land), low agricultural productivity, inadequate non-farm employment opportunities and, low access to health care and schooling while labour market distortions tend to explain poverty in the urban areas.

Table 4-1: Overall poverty estimates in Kenya 1981-2005/06

Region	**1981/82**	**1992**	**1994a**	**1994b**	**1997**	**2000 (est.)**	**2005/06**
Central	25.7	35.9	31.9	31.79	31.4	32.3*	30.4
Coast	54.6	43.5	55.6	41.36	62.1	69.9*	69.7
Eastern	47.7	42.2	57.8	44.96	58.6	65.9*	50.9
Rift Valley	51.1	51.5	42.9	38.31	50.1	73.1*	49.0
N/ Eastern	Na	Na	58.0	51.33	-	-	73.9
Nyanza	57.9	47.4	42.2	38.31	63.1	71.0*	47.6
Western	53.8	54.2	53.8	40.58	58.8	56.4*	52.2
Nairobi	Na	26.5	25.9	22.30	50.2	52.6*	21.3
Rural	48.8	46.3	46.8	39.70	52.9	59.6	49.1
Urban	Na	29.3	28.9	28.63	49.2	51.5	33.7
National	46.8	46.3	43.8	38.80	52.3	56.8	45.9

Source: Economic survey 1994, 1997; Mwabu, *et al.*,(2000); and KNBS 2007 .

Notes:* Rural poverty estimate for provinces (see Mwabu *et al.*, 2002), Na = not available.

Large disparities in rural poverty incidence have also been documented for a number of countries including Kenya (for Kenya see e.g Kenya National Bureau of Statistics, 2007, Republic of Kenya, 1998). The regional disparities in the incidence of rural poverty are strongly associated with rainfall and dependence on rain-fed agriculture. In Kenya, for example, poverty incidence is high in arid and semi-arid areas of the country (Kenya National Bureau of Statistics, 2007, Republic of Kenya, 1998, 2003)).

According to previous studies (Ravallion, 1996, Van de Walle, 1995) there are two sets of determinants of why poverty tends to be concentrated in certain areas. The first set is based on individualistic model in which poverty arises from low household-level endowment of privately held productive resources including human capital. According to this model poor areas exist because people with poor endowments tend to live together.

The second set of determinants is based on a geographical model in which individual poverty depends heavily on geographic capacity and where mobility is limited. In this case the marginal returns to a given level of schooling depend substantially on where one lives and limited factor mobility entails that these differences persist. The relevant geographic factors include local agro-climatic conditions, local physical infrastructure, access to social services and the stock of shared local knowledge about agro-climatic conditions and about the technologies appropriate to those conditions. If the model is right, then the policies called for entail either public investment in geographical capital or (under certain conditions) pro-active efforts to encourage migration. However, the individualist model begs the questions of why individual endowments differ persistently and why residential differentiation occurs and the geographic model begs the questions of why common endowments differ, and why mobility is restricted. Nevertheless, knowing which model dominates is very important for anti-poverty policy formulation.

The success of economic growth in alleviating poverty depends on a number of factors, such as the sector composition of growth, the translation of growth into increases in personal income, and progressive changes in the distribution of personal income. Moreover, the interaction of macroeconomic policies and the circumstances of each country vitally affect the efficacy of these factors in reducing poverty. Growth must be translated into increases in personal income in sectors of the economy where the poor are concentrated for it to be effective in poverty reduction. It is also important to note that macroeconomic policies can have an important effect on reducing inequality, but it is unwise to rely on them alone to carry out redistributive measures. Much of the impact of

policies depends, for instance, on social institutions such as the system of land holdings or corporate ownership. Interrelated sets of policies such as redistributing assets to the poor, such as land and human capital, and using macroeconomic policies to help raise the returns to these assets are vital for poverty reduction (United Nations Development Programme, 2001).

A high degree of unequal income distribution can have negative effect on growth and thereby poverty. For instance, a study by Person and Tabellini (1989) and Ali and Thorbecke (2000) find a strong negative relationship between income inequality and growth and poverty for both developing and developed countries. Kenya has one of the highest indicators of unequal income distribution of any low-income country in the world and the fourth highest in the world (World Bank, 1997). The most widely used measure of inequality is the gini coefficient which ranges from zero (i.e., perfect equality) to one (perfect inequality). For most developing countries, the gini coefficient ranges between 0.3 and 0.6 (Kenya National Bureau of Statistics, 2007).

During the early 1990s, the estimated gini coefficient for Kenya was 0.57, which was the highest among the 22 poorest countries in the world and only lower than those of Guatemala, South Africa and Brazil. For rural Kenya, the gini coefficient declined from 0.417 in 1997 to 0.380 in 2005/06, while the urban gini coefficient increased from 0.426 in 1997 to 0.447 in 2005/06 (Kenya National Bureau of Statistics, 2007). Policies to effectively tackle the problem of unequal income are inadequate meaning that the high unequal income distribution in Kenya remains to be an obstacle to the achievement of high rates of growth in future and reduction in poverty. Reducing income inequality is important because it can benefit the poor both immediately and in the long-term through higher growth.

4.2 Theoretical and empirical issues

There is essentially only one way that industrial policy could impact on poverty and this is through the creation of more and higher wage jobs. The process of creating more jobs

depends on rapid growth in the economy. The poverty reduction aspects of industrial policy operate through workers getting access to more better paying jobs. Why poverty reduction through manufacturing? Manufacturing is one of the few sectors which is export focused and can be labour intensive, and thus economic activities in this sector have the potential to reduce poverty.

If a firm is efficient it is likely that it will produce for the export market. Exporting increases the income of a firm. With high incomes firms can pay higher wages. According to efficiency wage theory, firms pay workers higher wages in order to increase their productivity. If firms pay workers a higher wage, then workers will afford the minimum calorific requirements necessary to keep them above the poverty line.

4.2.1 Poverty: identification, aggregation and measurement

The literature on measuring poverty has evolved rapidly over the last four decades. Sen's (1976) seminal work laid the ground for an axiomatic approach to the measurement of poverty, which led to a large literature that provided a basis for welfare-theoretic measures of poverty. The earliest and perhaps the most popular measure of poverty is the headcount ratio that simply takes the ratio of the poor however defined to the total population in a community. The most common way of defining the poor is as those people who lack income sufficient for a minimum standard of living, called the poverty line, which may be relative or absolute in magnitude. Later on, the poverty-gap or the total income shortfall relative to what would be required to eradicate poverty was suggested (Foster *et al.*, 1984). These poverty measures can be formally stated by considering an income distribution structure given by the vector $Y = (y_1, y_2 ..... y_n)$ so that $y_1 < y_2 , ... < y_n$. y_i represents the income of individual i in the community. If z represents the poverty line then, the H can be written as:

$$H = \frac{q}{n} \quad \text{..... (1)}$$

Where, q is the number of people with income less or equal to the poverty line z and n

represents the total number of individuals in the community. We express poverty gap as:

$IG = \sum_{i=1}^{q}(z - y_i)$,..... (2)

Sen (1976) argued that H and IG lack desirable properties stated in his monotonicity and transfer axioms. The headcount ratio (H) is completely insensitive to the extent of the poverty shortfall per person; the income-gap ratio (IG) is completely insensitive to the numbers involved. These deficiencies of H and IG motivated Sen to suggest what he called the "basic equation to measure poverty" defined as:

$S(z,y) = A(z,y)\sum_{i=1}^{q}(z - y_i)v_i(z,y)$,..... (3)

Where $S(z,y)$ is the aggregate income-gap of people whose income is no more that z, $v_i(z,y)$ is a non-negative weight given to the individual i, and $A(z,y)$ is a normalising factor.

Sen then considered the general poverty index defined as:

$P(z,y) = MaxS(z,y)$,..... (4)

That is, the maximum aggregate income-gap of the poor in the community. Invoking a rank preserving welfare-criterion and the desirable properties of monotonicity, transfer and normalization, Sen then suggested a specific poverty index defined as:

$S(z,y) = H[I + (1 - I)G_p]$,..... (5)

Where $I = \sum_{i=1}^{q} {}^{(z - y_i)}/_{z}$ is the average income gap and G_p is the gini index among the poor. Equation 5 applies in the case of large numbers of the poor. Sen thus tried to capture who the poor are (H), their average deprivation (I) and their relative deprivation to one another (G_p). This poverty index led to a large body of literature in the measurement of poverty.

Subsequent developments in the measurement of poverty followed two approaches. Thon (1979, , 1981), Takayama (1979), extended Sen's axiomatic approach to derive a poverty measure that satisfied certain desirable properties. Blackorby and Donaldson (1980), Clark *et al.* (1981) and Chakravarty (1983) applied the notion of social welfare function and the underlying concept of "equally distributed income" to obtain an index of poverty along Atkinson's (1970) inequality index.

In our study, we use the most common and current measure of poverty index suggested by Foster *et al.* (1984), which meets most of the desirable properties mentioned above.

4.2.2 Foster Greer and Thorbecke (FGT) poverty measures

One poverty measure that has been found manageable in presenting information on the poor in an operationally convenient manner is the FGT measure developed by Foster *et al.*, (1984). The FGT measure helps quantify three well known elements of poverty, namely; incidence, depth and severity of poverty. The index is defined as:

$$P_{\alpha} = \frac{1}{N}\sum_{i=1}^{q}\left(1-\frac{y_i}{z}\right)^{\alpha} \quad \ldots\ldots (6)$$

Where

P_{α} is a measure of absolute poverty

y_i is the total expenditure or income of individual i $(i = 1 \ldots N)$

z is the poverty line

N is the total number of individuals/population

q is the total number of poor individuals

α is the FGT parameter, which may be interpreted as a measure of poverty aversion, $\alpha \geq 0$, or poverty elasticity.

The first measure of poverty according to the FGT is the headcount ratio $(P_{\alpha=0})$, which indicates the proportion of individuals below the poverty line i.e., the poor expressed as a

proportion of the population. The incidence of poverty, however, does not indicate how far below the poverty line the poor are. The second measure is the poverty gap or average income shortfall ($P_{\alpha=1}$), which gives the proportional shortfall of the average poor person from the poverty line. It can give an estimate of the resources that would be required to bring the expenditure of every poor person up to the poverty line, thereby eradicating poverty. The poverty gap is, however, insensitive to the effect of income redistribution among the poor on poverty. The third measure that overcomes this problem is known as the severity of poverty ($P_{\alpha=2}$). This measure reflects the degree of inequality among the poor (see e.g. Foster *et al.*, 1984 for further comments on the FGT measure, Mwabu *et al.*, 2000).

Once an aggregate measure of welfare, in this case wage income is computed, the next step is to generate a poverty line to identify the poor. Poverty line can be defined in two ways i.e., absolute and relative. People often tend to view their standard of living in comparison to others in their vicinity. Thus they define poverty in relative terms making it difficult to identify the poor. To avoid this, one can construct a poverty line that can be used as an instrument of comparison among households and sub-groups.

The most frequently used methods of constructing an absolute poverty-line is the cost-of-basic-needs approach popularized by Ravallion and Bidani (1994) frequently used by the poor are first picked to be included in the poverty line 'basket'. The calorie content of these items is evaluated and their quantities scaled to give 2250 kilo calories per day. This is the minimum level recommended for an adult to subsist in Kenya. The cost of purchasing such a bundle is then computed using market prices and constitutes the food poverty line. Adjustment for non-food items can be done in various ways, either using Engel's function to generate the food share or compute the average-food share at the poverty line (see Ravallion and Bidani, 1994 for further discussions) .

In our study we use poverty line that was determined using Kenya Integrated Household and Budget Survey (KIHBS) data for 2005/06 (Earlier household surveys include: Welfare

Monitoring Surveys 1992, 1994 and 1997). The reason for choosing the poverty line for 2005/06 is that, two years down the line we do not expect much change in food prices and also composition of food basket. The methodology used to compute the poverty line can be found in poverty report for 2005/06 (Kenya National Bureau of Statistics, 2007). Also the overall underlying inflation between the two years (2002/3 and 2005/6) remained relatively low at about 5 percent (Central Bank of Kenya, 2003, 2006).

4.2.3 Empirical review

Empirical studies that link poverty and exports are rare. However, most of the available studies on poverty are descriptive and focus mainly on measurement issues (Geda *et al.*, 2005, Handley *et al.*, 2009, Kenya National Bureau of Statistics, 2007, Mwabu *et al.*, 2003, Mwabu *et al.*, 2000, Republic of Kenya, 1998). Most of the analytical studies have used household survey data. The studies show that poverty is multi-dimensional and there is no one single policy that can be used to alleviate poverty in Kenya.

Mwabu *et al.*,(2000) using household survey data for Kenya, identified the following as important determinants of poverty: unobserved region-specific factors, mean age, size of household, place of residence, level of schooling, livestock holding and sanitary conditions.

Porto (2004) investigates the poverty impacts of informal export barriers using household survey data for Moldova for 1997, 1999 and 2002. The results show that improving export practices would benefit the average Moldovan household across the whole income distribution.

McCaig (2009) used data for 2002 and 2004 from Vietnam household living standards survey. He used simple regression methods to analyse the data. He foud that an increase in exposure to the Bilateral Trade Agreement of one standard deviation is estimated to lead to approximately a 10 percent decrease in the incidence of poverty within a province.
Balat *et al.*,(2009) in their study investigate the relationship between poverty and export

marketing costs. They use household survey data for Uganda for 1999/2000 combined with village level measures of local agricultural export markets. Instrumental variables, Ordinary least squares and maximum likelihood estimation methods are used in determining results. They find that presence of export markets leads to lower poverty in rural Uganda. Further results show that export markets act as a facilitator of export agriculture cropping and that poverty among producers of export crops is lower than poverty among subsistence farmers (major export crops have higher returns than food crops).They conclude that lower export marketing costs induce export crop participation, which raises household income and decreases the likelihood of poverty.

McCulloch and Ota (2002) using household data for Kenya analysed the contribution of export horticulture to poverty reduction. The data were collected from 263 households in 2001. They use OLS and maximum likelihood estimation methods in their analysis. They find evidence that households involved in export horticulture are better off than those which are not, particularly in rural areas. Simulation results show that enabling more households to participate in the sector could reduce poverty substantially in both rural and urban areas.

4.3 Modelling poverty status

In order to determine the relation between poverty and exporting, we first estimate equation (6) to derive estimates for the three indicators of poverty, namely; poverty incidence, poverty depth and poverty severity. Poverty incidence is determined when α takes the value 0, while poverty depth and poverty severity are determined when α takes values 1 and 2 respectively.

Second, we specify two structural equations. The first equation includes export propensity as the variable of interest (equation 7a) while the second specification has export intensity as the variable of interest (equation 7b).

Using the poverty indices, one at a time, we regress poverty index in structural equation

(7a), i.e., on the probability of exporting (export propensity) and other control variables

$$P_\alpha = \beta + \delta_1 Y_1 + \delta_2 S_1 + \delta_3 S_2 + \delta_4 K + \mu_1 \quad \ldots\ldots(7a)$$

where:

P_α = measure of poverty index

Y_1 = export status of a firm

S_1 =vector of worker demographic characteristics

S_2 = vector of firm characteristics

K =control function regressors

β and δ_1 are coefficients and δ_2, δ_3 and δ_4 are vector coefficients to be estimated

$\alpha \geq 0$, or poverty aversion parameter.

We regress the poverty index in the structural equation (7b) on the proportion of exports to total value of sales (export intensity) and other control variables. The equation is

$$P_\alpha = \gamma_0 + \gamma_1 Y_2 + \gamma_2 S_1 + \gamma_3 S_2 + \gamma_4 K + \mu_2 \quad \ldots\ldots(7b)$$

where:

P_α = measure of poverty

Y_2 = export intensity

S_1 = vector of worker demographic characteristics

S_2 =vector of firm characteristics

K =control function regressors

γ_0 and γ_1 are coefficients and γ_2, γ_3 and γ_4 are vector coefficients to be estimated

$\alpha \geq 0$ = poverty aversion parameter.

But we know that exports are potentially endogenous in the poverty equations (7a) and (7b). We therefore specify export equations (8a) and (8b) respectively.

Suppose in the reduced form equation for export propensity, we have:

$Y_1 = \alpha_1 Z + \varepsilon_1$ ..... (8a)

Y_1 is export propensity

Z is a set of exogenous variables including exclusion restrictions

ε_1 is error term

We specify a similar functional form with export intensity see equation (7b).

The reduced form equation for export intensity is given by:

$Y_2 = \alpha_2 R + \varepsilon_2$ ..... (8b)

Where:

Y_2 is export intensity

R is a set of exogenous variables including exclusion restrictions

ε_2 is error term

4.4 Definition of variables

4.4.1 Dependent variables

We define the dependent variables using the indices derived by Foster, *et al.*, (1984), namely, the poverty incidence, poverty gap and poverty severity.

Poverty incidence (also prevalence of poverty or the poverty headcount ratio) is measured as the proportion of individual workers below the poverty line, i.e., the poor expressed as a proportion of the population (number of workers). Poverty incidence is measured as a dummy variable, which takes the value "1"if the individual is poor and a value of "0" if the individual is non-poor.

Poverty gap (also average income shortfall/poverty depth) is measured as the proportional shortfall of the average poor person from the poverty line. Poverty gap is a proportion. Poverty gap squared (poverty severity) is measured by squaring the poverty gap see Foster, *et al.*, (1984) and Mwabu, *et al.*, (2003) for further details on FGT poverty

measures. The poverty gap and poverty gap squared only apply if an individual is poor. This means we have to control for selection bias when estimating these two poverty equations.

4.4.2 Explanatory variables

The key independent variables are measures of probability of exporting and proportion of exports in the total output. The first independent variable, export propensity, is defined as the probability that a firm enters a foreign market. Export propensity is measured as a dummy variable which takes the value "1" if a firm is engaged in exporting and a value of "0" if the firm does not export (only sells in the domestic market). The second independent variable, export intensity, is defined as the proportion of the total sales value of the firm that is exported. This is measured by dividing the total value from exports by the total value of the firm's output.

Other explanatory variables consist of a number of worker demographic characteristics that could affect poverty such as age, years of schooling, and also a vector of firm level characteristics that impact on poverty, such as size (number of employees), and location dummies.

4.5 Data and summary statistics

The data set used in this analysis is described in chapter two. Descriptive statistics are shown in Table 4-2. This section will only discuss summary statistics not discussed in chapter 2.

The data shows that very few workers have no formal education, those with primary education are about 19.5 percent. Majority of the workers have secondary education (43 percent) while technical education and university account for 26.2 percent and 10.4 percent respectively.

Table 4-2: Summary statistics: essay three

Variable	Observations	Mean	Standard deviation
Age of workers (in years)	1863	36.03	9.62
No schooling	1825	0.01	0.11
Primary	1825	0.19	0.40
Secondary	1825	0.43	0.49
Technical and vocational	1825	0.26	0.44
University	1825	0.10	0.31
Years of education of workers	1821	11.34	3.89
Monthly wage per worker	1863	17243	29715.39
Dummy for export (export propensity) (1=yes)	1918	0.54	0.50
Poverty headcount ratio (P_0) (1=yes)	1863	0.037	0.19
Poverty depth (P_1)	1863	0.01	0.09
Poverty Severity (P_2)	1863	0.01	0.07
Firm size (total number of employees)	1863	201.44	324.85
Predicted probability of exporting	1821	0.54	0.16
Log of investment last year	1863	8.32	7.65
Inverse of Mills ratio	1821	2.29	0.33

Source: RPED survey 2002/3.

On average, workers earn Ksh. 17,243 and about 54 percent of firms are involved in exporting. The high mean wage may suggest that there is no wage poverty in manufacturing firms. However, this is not true, poverty statistics show that about 4 percent of workers earn a monthly wage below the poverty line. This may imply high income inequalities among the workers. Most firms are medium sized with about 201 workers.

A further analysis of correlation shows that all the poverty indicators are negatively correlated with age, years of worker education, firm-size and last year investment, while exports are positively correlated with the same variables. Worker years of education and log of previous investment by the firm are both significant at 1 percent. While firm size correlated with exports is significant at 1 percent, firm-size correlated with the three poverty indicators is significant at 10 percent. Age is not significant across all the cases.

Table 4-3: Pair-wise correlations between exports, poverty and selected characteristics of workers and firms (p-values in parentheses)

Variables	Exports	P_0	P_1	P_2
Age of the worker (in years)	0.0208 (0.3698)	-0.0307 (0.1859)	-0.0292 (0.2072)	-0.0292 (0.2072)
Worker years of education	0.1183 (0.0000)	-0.1158 (0.0000)	-0.1157 (0.0000)	-0.1157 (0.0000)
Log of Firm size (total number of employees)	0.3179 (0.0000)	-0.0388 (0.0943)	-0.0387 (0.0952)	-0.0387 (0.0952)
Log of investment last year	0.2190 (0.0000)	-0.0809 (0.0005)	-0.0813 (0.0004)	-0.0813 (0.0004)

Source: RPED survey 2002/3.

The correlations in Table 4-3 show that the association between years of education and poverty indicators and export propensity is highly significant at 1 percent level. For instance, a 10 percent increase in the years of education is associated with a 1.2 percent increase in exports. Similarly, a 10 percent increase in the log of lagged investments is associated with 2.2 percent increase in exports. These correlations are symmetric.

4.6 Poverty and inequality profiles

Poverty and inequality is determined to a large extent by characteristics that define the endowments and potentials of individuals, households or communities/firms. Differences in the human and physical capital of workers affect the pattern of wage income in the firm. In a firm environment, these characteristics include export status of the firm, location of firm, gender of worker and highest education level attained. Table 4-4 shows the poverty profile of manufacturing workers. Even without sharing their incomes with the other members of household, some workers are still trapped in poverty.

Table 4-4: Poverty profile of manufacturing workers

Indicator	Poverty headcount ratio	Poverty depth	Poverty severity
Export status			
Does not export	0.05164	0.01393	0.00639
Exports	0.02468	0.01250	0.00889
Gender			
Male	0.03303	0.01239	0.00756
Female	0.05507	0.01671	0.00872
Educational attainment			
No formal education	0.09524	0.05241	0.03773
Primary	0.08239	0.02397	0.01285
Secondary	0.03020	0.01166	0.00704
Technical and vocational	0.01957	0.00897	0.00576
University	0.00559	0.00398	0.00283
Location dummy			
Nairobi	0.02741	0.01105	0.00655
Mombasa	0.03559	0.01807	0.01368
Nakuru	0.07944	0.02127	0.00954
Eldoret	0.03448	0.00418	0.00067
Kisumu	0.06383	0.01905	0.01121
All	0.03700	0.01315	0.00775

Source: RPED survey 2002/3.

About 4 percent of workers in manufacturing firms earn incomes below the poverty line. Firms which export are likely to be efficient and therefore pay their workers a wage that is high above the poverty line as compared to those which do not export. About 5.2 percent of workers in non-exporting firms are poor, while only 2.5 percent of workers in exporting firms are poor. Firms that are located in Nakuru and Kisumu pay their workers a lower wage as compared to those in Nairobi, Mombasa and Eldoret. About 8.0 percent and 6.4 percent of workers in Nakuru and Kisumu are poor while only 2.7 percent, 3.6 percent and 3.4 percent of workers in Nairobi, Mombasa and Eldoret are poor. In terms of individual characteristics, the prevalence of poverty is higher among the female workers (6.0 percent) as compared to male workers (3.3 percent).

Similarly, poverty declines with education. Those workers without formal education account for the highest prevalence (10 percent) while those with primary, secondary and

university education account for 8.2 percent, 3.0 percent and 0.6 percent respectively. This result corroborates earlier poverty studies which have found that education is an important determinant of poverty status (Geda *et al.*, 2005, Oyugi, 2000).

Similarly, the poverty incidence and poverty severity index follow a similar pattern as the poverty headcount ratio. The poverty depth is much lower in exporting firms than non-exporting firms. The proportion of income shortfall from the poverty line declines the higher the educational attainment level of a worker. It is lowest for firms located in Eldoret and Nairobi but highest in firms located in Nakuru, Kisumu and Mombasa.

Table 4-5 shows inequality index as measured by the gini coefficient. It represents perfect inequality when equals one and perfect equality when equals zero. Wage inequality is very high in manufacturing firms; it accounts for about 58.3 percent of the workers. Non-exporting firms even have much worse income inequality (60 percent) as compared to exporting firms (56.3 percent). It is highest in firms located in Mombasa (62.2 percent), Kisumu (57.6 percent), Nairobi (57.2 percent) and Nakuru (52.2 percent) and lowest among workers in firms located in Eldoret (37.7 percent).

Table 4-5: Wage inequality profile

Indicator	**Gini Coefficient**
Export status	
Doe not export	0.59511
Exports	0.56264
Gender	
Male	0.58571
Female	0.55188
Educational attainment	
No education	0.52590
Primary	0.36540
Secondary	0.52318
Technical & vocational	0.49766
University	0.49406

Location dummy	
Nairobi	0.57225
Mombasa	0.62215
Nakuru	0.52211
Eldoret	0.37684
Kisumu	0.57575
All	0.58328

Source: RPED survey 2002/3.

In terms of individual characteristics, wage inequality is highest among male workers (58.6 percent) compared to female workers (55.1 percent). Wage is highly unequal among workers without education (52.6 percent) and those with secondary education (52.3 percent) while it is less unequal among those with primary (36.5 percent) and university education (49.4 percent).

4.7 Empirical results

In this section, we discuss the impact of exporting and impact of export intensity on the poverty status of workers in the manufacturing firms. To begin with, we analyse the reduced form equations for each structural equation. In the reduced form equations we are interested in determining the correlation between the instrument and the dependent variable while in the structural form, we estimate the actual effect of exporting on the poverty indices.

4.7.1 Determinants of exporting

In the earlier essay on TFP and exporting (chapter 3), we analysed a similar equation on the determinants of exporting. However, in this section we do the same but the main difference is that our variable of main interest is the log of previous firm investment which we shall also use as our instrument for the exports in the later analyses.

As is expected from economic theory, exports are endogenous to the poverty measures. We therefore require good instruments in order to properly estimate our structural equations. Table 4-6 shows results from estimating OLS (LPM) in column 1 and probit

equations in column 2. The results show that OLS (LPM) under states the effect of all the variables on probability of exporting.

Our main variable of interest, which is also our instrument, is the log of investment last year. The magnitude of the coefficient on this variable is .0093 and .0098 for OLS (LPM) and the probit model, respectively. The coefficient is positive as expected and the *t*-statistic is significant at 1 percent. According to the LPM estimates, a percentage increase in the previous investment would increase the probability of exporting by 0.0093.

Table 4-6: Determinants of exporting (dependent variable =export propensity)

Explanatory Variables	Estimation Methods	
	OLS (LPM) (1)	Probit Marginal Effects (2)
Log of investment last year	.0093 (5.94)	.0098 (5.85)
Age of the worker	.0006 (0.54)	.0006 (0.50)
Log of Worker years of education	.0066 (2.12)	.0070 (2.08)
Log of Firm size (total number of employees)	.0865 (8.60)	.0902 (8.04)
Constant	-.0201 (0.29)	-
F statistics [p-value]	43.79 (0.0000)	
Adjusted R-squared	.0988	
Wald chi2(4)		135.79 (0.0000)
Pseudo R-squared		.0736
No. of observations	1751	1751

Source: RPED survey 2002/03.
Note: Absolute *t* statistics in parentheses. Critical t-values: 1%=2.58, 5%=1.96 and 10%=1.65.

The results show that previous investment is a relevant instrument for exports. The diagnostic tests show a very high magnitude for first stage *F*-statistic (35.84 [0.0000]) on the instrument. The *F*-statistic is greater than ten. This suggests that the instrument is strong and valid for identification (Godfrey, 1999, Nevo and Rosen, 2010, Shea, 1997, Staiger and Stock, 1997).

4.7.2 The impact of exporting on poverty status

Table 4-7 compares the OLS (LPM) without controls for endogeneity and heterogeneity with results obtained from the control function approach accounting for endogeneity and heterogeneity. We use the control function approach to control for endogeneity and unobserved heterogeneity as shown in columns 3, 4 and 5. We checked the endogeneity of exports using Durbin-Wu-Hausman's test of endogeneity.

A comparison of the two results from columns 1, 2 and 3 shows that controlling for unobservables in the estimation of parameters of the export function, makes a difference. The estimated results follow *a prior* expectation regarding the bias caused by endogeneity

problem. When this bias is not controlled for, the coefficients associated with export variables are expected to be biased upward. Thus, controlling for endogeneity biases seems to be important since differences in the magnitudes of the coefficients arise. The years of education attained by the worker is an important factor in poverty reduction. The higher the years of education the less likely it is for a worker to live in poverty. The coefficient is very significant. Firm size also gives interesting results. The results show that poverty is prevalent in large firm sizes. This may be interpreted to mean lack of trickle down effects in such firms. Results from probit function in column 4, give even more precise estimates: firms which export have poverty rates 26.2 percent lower than those which do not export, which suggests that exporting is good for poverty reduction.

Table 4-7: The impact of exporting on poverty incidence (dependent variable =poverty headcount)

Variables	Estimation Methods			
	LPM-2SPS without controls for endogeneity and heterogeneity	Control Function Approach		
		LPM (with controls for endogeneity) 2SRI	LPM (with controls for heterogeneity	Probit Marginal Effects (with controls for heterogeneity)
	(1)	(2)	(3)	(4)
Export propensity	-	-.1681 (2.70)	-.1685 (2.71)	-.2617 (2.65)
Predicted residual of probability of exporting	-	.1463 (2.31)	.1854 (2.56)	.1706 (2.58)
Predicted probability of exporting	-.1681 (2.50)	-		-
Predicted residual interacted with exporting propensity	-	-	-.0831 (1.50)	-.0534 (1.01)
Age of the worker (in years)	-.0007 (1.36)	-.0007 (1.25)	-.0007 (1.24)	-.0006 (1.30)
Worker years of education	-.0051 (3.86)	-.0051 (3.71)	-.0050 (3.64)	-.0291 (3.32)
Log of firm size (total number of employees)	.0154 (2.03)	.0154 (2.48)	.0147 (2.38)	.0147 (2.39)
Constant	.1433 (5.21)	.1433 (4.77)	.1634 (4.35)	-
F statistics [p-value]	8.85 (0.0000)	6.05 (0.0000)	5.08 (0.0000)	
Adjusted R-squared	0.0199	.0227	.0237	
Wald chi2(6)	-	-	-	43.98 (0.0000)
Pseudo R-squared	-	-	-	.0632
No. of observations	1751			

Source: RPED survey 2002/3.

Notes: Predicted probability of exporting is derived from export equation (8a). Absolute *t* statistics in parentheses. Critical t-values: 1%=2.58, 5%=1.96 and 10%=1.65.

Table 4-8 compares results from probit estimation which take into account non-linear effect of the interaction term (column1) with results from probit estimation under the linearity assumption of the interaction term (column 2) (see Friedrich, 1982, Norton *et al.*, 2004). The coefficient of the interaction term in the probit model Table 4-7 is improperly estimated. Using the *inteff* commad in stata, after running the probit model, the results are properly computed. Results from the non-linear probit show that the effect of the interaction term is quite large (coefficient = -0.488, t = -4.26) as opposed to probit mean effect under linearity assumption (coefficient = -0.053, t = -1.01). Besides, the former coefficient is highly statistically significant as opposed to the latter which is statistically insignificant. This means that while the probit estimates in Table 4-7 show no signs of heterogeneity, the re-estimation of interaction effect (assuming non-linearity) show that there is strong evidence of heterogeneity.

Table 4-8: Probit estimates of the mean coefficient of the interaction term in Table 4-7

Variables	**Estimated non-linear mean effect (1)**	**Estimated mean effect under linearity assumption (2)**
Predicted residual interacted with export propensity	-0.488	-0.053
Standard error of the estimated coefficient	0.155	0.0528
z-statistic / t-statistic	-4.258	-1.01
No. of observations	1752	1752

Source: RPED survey 2002/3.

In estimating the impact of exporting on poverty depth, we restricted the sample only to the poor workers. It was difficult to think of a variable (instrument) that will affect poverty incidence and not poverty depth. Therefore the potential problems of sample selection are not addressed due to data limitations. Without the exclusion restrictions in the probit equation, the results should be interpreted with caution.

We present results from OLS and IV estimations. This approach is similar to that used by Moll (1996) and Mwabu and Schultz (2000). The results are shown in Table 4-9. In

column (1) OLS estimates without controls for endogeneity and unobserved heterogeneity show a positive sign on the coefficient for exports, but this is insignificant while the IV regression in column 3 show that exports reduce poverty. A 10 percent increase in the proportion of exporting firms would reduce poverty gap by 8.3 percent. The coefficient is significant at 5 percent level.

Table 4-9: The impact of exporting on poverty depth (dependent variable =poverty depth)

Variables	Estimation Methods		
	OLS	**Two stage least squares (one- step command)**	
		First stage regression dependent variable = export	**Second stage regression dependent variable = poverty depth**
	(1)	**(2)**	**(3)**
Export propensity	.0009 (0.23)	-	-.0829 (2.54)
Age of the worker (in years)	.0002 (0.78)	0.0006 (0.54)	.0003 (0.91)
Worker years of education	-.0019 (3.50)	.0066 (2.14)	-.0013 (2.12)
Log of firm size (total number of employees)	-.0009 (0.81)	.0865 (9.55)	.0075 (2.29)
Log of previous investments	-	.009 (5.99)	-
Constant	.0307 (2.76)	-.0201 (0.30)	.0296 (2.41)
F statistics [p value]	4.00 (0.0031)	47.84 (0.0000)	4.03 (0.0030)
Adjusted R-squared	0.0087	0.0967	-
No. of observations	1751		

Source: RPED survey 2002/3.
Note: Absolute *t* statistics in parentheses. Critical t-values: 1%=2.58, 5%=1.96 and 10%=1.65.

Similarly, on squaring the poverty gap, the OLS estimates bear a positive coefficient while the IV estimates show a negative effect of exporting on poverty. The results presented in Table 4-10 show that a 10 percent increase in exporting reduces the severity of poverty by 6.2 percent.

Table 4-10: The impact of exporting on poverty severity (dependent variable =poverty severity)

Explanatory variables	Estimation methods		
	OLS-estimates	Two stage least squares (one step command)	
		First stage regression dependent variable = export	Second stage regression dependent variable = poverty severity
	(1)	(2)	(3)
Export propensity	.0042 (1.32)	-	-.0622 (2.44)
Age of the worker	.0003 (1.45)	.0006 (0.54)	.0004 (1.52)
Worker years of education	-.0010 (2.44)	.0066 (2.14)	-.0005 (1.13)
Log of firm size (total number of employees)	-.0008 (1.26)	.0865 (9.55)	.0058 (2.22)
Log of previous investments	-	.009 (5.99)	-
Constant	.0085 (1.10)	-.0201 (0.30)	.0076 (0.85)
F statistics [p-value]	2.53 (0.0389)	47.84 (0.0000)	2.26 (0.0604)
Adjusted R-squared/R-squared	0.0075	0.0988	-
No. of observations	1751		

Source: RPED survey 2002/3.
Note: Absolute *t* statistics in parentheses. Critical t-values: 1%=2.58, 5%=1.96 and 10%=1.65.

4.7.3 Export intensity and poverty status

In Table 4-11, we report OLS estimates of the export intensity. The estimation in Column 1 excludes the location dummies while column 2 includes the location dummies. From these results, we observe that using log of previous investments as an instrument for export intensity is valid. The quality of our instrument is assessed using tests proposed by Bound *et al.*(1995). In this case, the instruments should have a significant effect on the

export intensity. Further evidence on the strength and validity of this instrument is tested using the Shea formula (see Nevo and Rosen, 2010, Shea, 1997, Staiger and Stock, 1997). The first stage *F*- statistic (110.04) is incredibly high and statistically significant, suggesting that previous investment is a strong instrument for export intensity. When estimating the impact of export intensity on the poverty incidence we maintain log of previous year investment as the instrument for export intensity. The difficulties of getting a good instrument are well documented. For instance see Bound *et al.* (1995).

Table 4-11: Determinants of export intensity (dependent variable =export intensity)

Explanatory variables	**Estimation method**	
	OLS - without location dummies (1)	**OLS - with location dummies (2)**
Age of the worker (in years)	-.0003(0.44)	-.0004 (0.63)
Worker years of education	-.0065 (4.10)	-.0058 (3.86)
Log of firm size (total number of employees)	.0770 (13.73)	.0778(15.15)
Log of previous year's investment	.0075(9.61)	.0081(10.71)
Location dummies	No	Yes
Constant	-.1669 (5.07)	-.3107(7.74)
F statistics [p-value]	74.04(0.0000)	52.47(0.0000)
R-squared	0.2098	0.2726
No. of observations	1751	

Source: RPED survey 2002/3.
Note: Absolute *t* statistics in parentheses. Critical t-values: 1%=2.58, 5%=1.96 and 10%=1.65.

In Table 4-12 column 1 we report LPM-2SPS results. The results for LPM-2SPS indicate that the coefficient for predicted export intensity is negative and significant at 5 percent level. In column 2, 3 and 4 we estimate the poverty incidence using the control function approach. We find that the sign on the coefficient for export intensity remains negative. However, the magnitude declines as we control for endogeneity and heterogeneity in both LPM and the probit estimations.

A percentage increase in the proportion of firms exporting would result in about 19-21 percent reduction in the headcount ratio in manufacturing firms. As shown in earlier studies, firms that export pay higher wages to their workers as compared to those firms that do not export, such that other things being constant, exporting reduces poverty.

Table 4-12: The impact of export intensity on poverty incidence (dependent variable =poverty headcount)

Explanatory Variables	**Estimation Methods**			
	LPM-2SPS with location dummies	**Control Function Approach**		
		LPM-2SRI with controls for endogeneity	**LPM-2SRI with controls for heterogeneity**	**Probit Marginal Effects (with controls for heterogeneity)**
	(1)	**(2)**	**(3)**	**(4)**
Export intensity	-	-.2080 (2.70)	-.2125 (2.58)	-.1905 (2.56)
Predicted residual of export intensity	-	.2359 (2.99)	.2323 (3.01)	.2163 (3.03)
Predicted export intensity	-.2080 (2.50)	-	-	-
Predicted residual interacted with export intensity	-	-	-.0134 (0.26)	-.0022 (0.05)
Age of the worker	-.0008 (1.71)	-.0008 (1.55)	-.0008 (1.56)	-.0008 (2.09)
Worker years of education	-.0076 (5.68)	-.0076 (5.29)	-.0076 (5.30)	-.0069 (6.32)
Log of firm size (total number of employees)	.0169 (2.08)	.0169 (2.53)	.0167 (2.54)	.0148 (2.59)
Constant	.1120 (3.66)	.1120 (3.72)	.1121 (3.71)	-
F statistics [p-value]	8.85 (0.0000)	6.08 (0.0000)	5.13 (0.0000)	
Adjusted R-squared	0.0199	.0211	.0211	
Wald chi2(6)	-	-	-	42.86 (0.0000)
Pseudo R-squared	-	-	-	.0684
Number of observations	1751			

Source: RPED survey 2002/3.
Note: Absolute *t* statistics in parentheses. Critical t-values: 1%=2.58, 5%=1.96 and 10%=1.65.

The reported results for the coefficient of the interaction variable in the probit model is misleading because the marginal effect of a unit change in the interaction term is not equal to the marginal effect of changing just the interaction term (Norton *et al.*, 2004). Using the *inteff* command in stata (StataCorp, 2007), after running the probit model, the marginal effect of a unit change in the interaction term is properly computed. The *inteff* results are shown in Table 4-13. We find that the mean interaction effect is now quite large, i.e., 1.167 versus 0.0022 and the *z*-statistic is now 1.46 compared with 0.05 in Table 4-12. This result suggests the presence of heterogeneity contrary to what is shown in Table 4-12 .

Table 4-13: Estimated coefficient of the interaction term

Variable	**Estimated non-linear mean effect (1)**	**Estimated mean effect under linearity assumption (2)**
Predicted residual of export intensity interacted with export intensity	-1.167	-0.002
Standard error of estimated coefficient	0.818	0.047
z-statistic/ *t*-statistic	-1.455	-0.050
No. of Observations	1752	1752

Source: RPED survey 2002/3.

Note: critical t-values: 1%=2.576, 5%=1.960 and 10%=1.645.

Table 4-14 reports the results from the OLS, IV and the control function estimates. The results are estimated from the sample of poor workers only. As reported earlier, the potential problems related to sample selection bias of using the sub-sample of the poor, are not addressed due to data limitations. We therefore rely on functional form identification (see Moll, 1996, Mwabu and Schultz, 2000).

Column (1) shows that the OLS method underestimates the effect of export intensification on the depth of poverty among the poor. The magnitude of the estimated coefficient is about 0.0077. However, it is statistically insignificant.

Table 4-14: The impact of export intensity on poverty depth (dependent variable =poverty depth)

Variables	Estimation Methods				
		Two stage least squares (one step procedure)		Control function approach	
	OLS –(i.e., without controls for endogeneity and heterogeneity) (1)	First stage regression dependent variable=export intensity (2)	Second stage regression dependent variable=poverty depth (3)	with controls for endogeneity (4)	without controls for endogeneity and heterogeneity (5)
Log of previous investment	-	.0081(10.49)	-	-	-
Export intensity	-.0077(1.46)		-.0904(2.52)	-.0968(2.60)	-.0885(2.26)
Predicted residual of export intensity	-	-	-	.0943(2.49)	.1010(2.68)
Predicted residual interacted with export intensity	-	-	-	-	-.0248(1.13)
Age of the worker	.0002(0.64)	-.0004(0.63)	.0002(0.58)	.0002(0.61)	.0002(0.58)
Log of worker years of education	-0020 (3.61)	-.0058 (3.77)	-.0024 (3.94)	.0025 (4.11)	-.0025 (4.13)
Log of firm size (total number of employees)	-.0004 (0.35)	.0778 (17.18)	.0070 (2.27)	.0074 (2.37)	.0077 (2.45)
Location dummies	Yes	Yes	Yes	Yes	Yes
Constant	.0389(2.12)	-.3107(7.12)	.0132(0.66)	.0247(1.35)	.0247(1.34)
F statistics	2.71(0.0058)	81.61(0.0000)	2.67(0.0065)	2.69(0.0041)	2.43(0.0071)
Adjusted R^2/R^2	0.0117	0.2693	-	0.0148	0.0151
No. of observations	1751				

Source: RPED survey 2002/3.

Notes:Residual is derived from equation (8b). Absolute *t* statistics in parentheses. Critical t-values: 1%=2.58, 5%=1.96 and 10%=1.65.

A common concern in the literature is that there is simultaneity bias between poverty and exports (Balat *et al.*, 2009). This means that poverty depth affects export intensity and export intensity affects poverty depth. For this reason, we report additional results that should be more robust to these potential problems than the OLS estimates. We use the IV and the control function methods to correct for these biases (Mwabu, 2009, Soderbom *et al.*, 2006).

The results in Table 4-14 show that the IV estimates and the control function estimates are higher in magnitude compared to OLS estimates. The results also suggests that treating export intensity as endogenous increases its effect on the poverty depth. A test for endogeneity provides evidence of endogeneity as shown by significant coefficients on predicted residual for export intensity in column 4, but there is no evidence of heterogeneity because the coefficient on predicted residual for export intensity interacted with export intensity in column 5 is statistically insignificant.

An extension of similar analysis of export intensity on the severity of poverty is shown in Table 4-15. Poverty severity is the same as poverty depth except that greater weight is placed on people in extreme poverty. The pattern on export intensification on poverty severity is similar as previously observed in the estimation of the export intensity on poverty incidence and poverty depth. The coefficient on the export intensity from OLS regression has the expected sign and is statistically significant at 5 percent level. However, the coefficients on export intensity from the IV regression (column 3) and the control function approach (columns 4 and 5) are substantially larger than those obtained from OLS regression in column 1. The IV estimates, show it is evident that manufactured exports are associated with large poverty reduction gains because an increase in mean export intensity lowers the intensity of poverty by 0.0709.

Table 4-15: The impact of export intensity on poverty severity (dependent variable =poverty severity)

Variables	Estimation Methods				
	OLS -without controls for endogeneity and heterogeneity	Two stage least squares (one step command)		Control function approach	
		First stage regression dependent variable=export intensity	Second stage regression dependent variable=poverty severity	with controls for endogeneity	with controls for endogeneity and heterogeneity
	(1)	(2)	(3)	(4)	(5)
Log of previous investment	-	.0081(10.49)	-	-	-
Export intensity	-.0078 (2.33)	-	-.0709 (2.53)	-.0758 (2.59)	-.0689 (2.26)
Predicted residual of export intensity	-	-	-	.0720 (2.42)	.0775 (2.61)
Predicted residual interacted with export intensity	-	-	-	-	-.0202 (1.17)
Age of the worker	.0003 (1.41)	-.0004 (0.63)	.0003 (1.35)	.0003 (1.38)	.0003 (1.35)
Worker years of education	-.0010 (2.50)	-.0058 (3.77)	-.0013 (2.84)	-.0014 (2.98)	-.0015 (3.01)
Log of firm size (total number of employees)	.0001 (0.12)	.07778 (17.18)	.0057(2.29)	.0060 (2.38)	.0062 (2.45)
Location dummies	Yes	Yes	Yes	Yes	Yes
Constant	.0115 (0.81)	-.3107 (7.12)	-.0081 (0.52)	.0007 (0.05)	.0007 (0.05)
F statistics [p-value]	2.56 (0.0089)	81.61 (0.0000)	1.96 (0.0477)	2.26 (0.0165)	2.04 (0.0260)
Adjusted R-squared	0.0097	0.2693	-	0.0128	0.0131
No. of observations	1751				

Source: RPED survey 2002/3.
Note: Absolute *t* statistics in parentheses. Critical t-values: 1%=2.58, 5%=1.96 and 10%=1.65.

The effects of other firm specific variables on the intensity of poverty are also statistically significant. The coefficient on worker's years of education from IV regression (column 3) shows that a 1 percent increase in years of schooling is associated with a 0.00013 percent reduction in the intensity of poverty. Similarly, the control function results are not so different from the IV estimates and show different but statistically significant results when we control for endogeneity and heterogeneity biases.

The coefficient on the predicted residual is significant, suggesting that endogeneity is a problem. The test for heterogeneity is depicted by inclusion of the interaction variable (i.e., between the predicted residual of export intensity and export intensity itself). The coefficient on the interaction term is statistically insignificant, implying that unobserved heterogeneity is not a problem.

4.7.4 Policy simulations

One of the objectives of modelling export intensity and export propensity of firms is to simulate the effects of policy interventions that affect exports. The predictive power of the simulation models depends on the estimated coefficients of the export propensities and export intensities.

In this section we use results from two sets of tables i.e., Table 4-12, Table 4-14 and Table 4-15 to evaluate and compare the welfare effects of increasing the mean export intensity by 1 percent, i.e., from 0.15 to 0.16. We also use results from Table 4-7, Table 4-9 and Table 4-10 to evaluate the welfare effect of increasing the mean proportion of firms in the export sector by 1 percent, i.e., from 0.54 to 0.55. Previous experience has shown that in a span of one year, about 20 firms (approximately 1 percent) join the export market; thus the simulated policy induced changes in export propensity is feasible.

Results from this policy analysis are presented in Table 4-16 together with the resulting changes in poverty incidence, poverty depth and poverty severity. The sample proportions

are the proportions corresponding to each of the poverty indicators computed from the raw data.

Table 4-16: Policy simulations

Variables	**Poverty incidence**	**Poverty depth**	**Poverty severity**
Sample means (percent)	3.7	1.3	0.8
Policy 1: Increase mean export intensity by 1 percent, from 0.15 percent to 0.16 percent			
Change in poverty level (percent)	-1.9	-0.9	-0.7
Policy 2: Increase proportion of firms that export by 1 percent, from 0.54 percent to 0.55 percent			
Change in poverty level (percent)	-2.6	-0.8	-0.6

Source: RPED survey 2002/3.

Notes: The decision to base the simulation on 1% rests on the reasonability of the changes in the export variables between 2001 and 2002.

Besides the notable reductions in the poverty headcount ratio, increasing the proportion of exports in total sales also affects poverty depth and poverty severity. When we vary the export intensity while holding all the other factors constant, we find that poverty headcount ratio declines by about 1.9 percent. This means that the proportion of poor people in the manufacturing sector would decline by 1.9 percent. Given the low poverty levels in exporting firms, we conclude that exporting substantially reduces poverty in the manufacturing sector.

Another policy option is to increase the proportion of firms that export by 1 percent. The overall effect of this policy on poverty is more or less similar to that of increasing the proportion of exports in total sales. However, the magnitude of the effect on headcount ratio is slightly higher (2.6 percent). Again, poverty is highly elastic with respect to exporting. This suggests that poverty in manufacturing firms could be wiped out through

policies that boost exports. However, the amount of investment required to bring about reasonable reduction in poverty could be substantial and may not be easily affordable to most of the firms, which suggests the need to subsidize firms that have export potential.

In our analysis, we find that results based on proportional changes in poverty indices tend to exaggerate the effect of exporting on poverty as opposed to results based on level changes in poverty measures. The reason behind this is that proportional changes tend to suffer from base effect such that they will vary according to the value of the base figure and so this is the case in our analysis. Also the common interpretation of poverty changes is in terms of level changes and not in terms of proportional changes (Foster *et al.*, 1984). For this reason we prefer the results for poverty simulations conducted at the level changes.

We conclude that for a developing country like Kenya, the effect of exports on poverty matters for export propensity (growth in the export among countries). However, this does not exclude the poverty reduction impacts of export intensity (growth of exports conditional on being in an export relationship) only if Africa and in particular, Kenya, would afford the required amount of investments in exporting. These results are similar to those of other studies that have analysed the impacts of changes in extensive and intensive margins of exports (Evenett and Venables, 2002, Hummels and Klenow, 2005).

4.8 Summary and conclusions

There is limited empirical evidence on the effects of manufactured exports on poverty levels in Kenya. Previous literature has mainly analysed the effect of various trade policy instruments on poverty (Haiti National Strategy team, 2006, Soderbom and Teal, 2003).
The purpose of this chapter is to examine empirical evidence on whether export intensification could be used as a poverty reduction strategy. The data, drawn from a survey of Kenyan manufacturing firms, indicate that exporting is associated with low poverty. However, the effect of exporting in reducing the headcount ratio is small

compared to its role in reducing the poverty depth and poverty severity among the poor people. While this is true, the results also show that there are other factors that are important in reducing poverty, such as education.

We use the control function approach to remove endogeneity and heterogeneity biases in the parameter estimates in all the models studied. When biases are not controlled for, the coefficients on exports are biased upward in a poverty analysis model. Thus, controlling for biases from endogeneity is important since large differences in the magnitudes of the coefficients can arise.

The results show that firms which export have poverty rates 26.2 percent lower than those which do not export. Further analysis shows that a 10 percent increase in the proportion of exporting firms would reduce poverty gap by 8.3 percent. Similarly, a 10 percent increase in exporting would reduce the degree of inequality (severity of poverty) by 6.2 percent.

The results for OLS indicate that export intensity is negatively associated with poverty; the coefficient on export intensity is highly significant. We find similar results when using control function approach. However, controlling for heterogeneity lowers the size of the coefficient on export intensity. A percentage increase in the proportion of firm exports would result in about 19-21 percent reduction in the headcount ratio in the manufacturing firms.

We use the IV and the control function methods to estimate effects of export intensity on poverty. We find that IV estimates and control function estimates are larger than the OLS estimates. Further analysis shows that there is evidence of endogeneity and no evidence of heterogeneity. The effect of export intensification on poverty severity is similar to the results obtained for the effect of export intensity on poverty incidence and poverty depth.

The OLS estimates have the expected sign and are significant at 5 percent level. The IV estimates suggest that there are large poverty gains from manufactured exports: an

increase in mean export intensity lowers the intensity of poverty by .0709.
Similarly, the control function results are not so different from the IV estimates but change significantly when we control for endogeneity and unobserved heterogeneity biases.

While it is important to identify the marginal impact of each of these measures on the outcome under consideration, it is also important to compare the relative costs of various policies. The coefficients from the probit and OLS regressions were used in this section to compute the elasticities of poverty with respect to changes in the policy variables used in simulations.

Based on our regression results, we simulated effects of two policy interventions to examine their possible effects on poverty. We simulated the effects of increasing the proportion of exports in total sales by 1 percent. The impact on poverty was a reduction of about 1.9 percent for headcount index, 0.9 percent for poverty depth and 0.7 percent for poverty severity. A further simulation of poverty impact of increasing the propensity to export by 1 percent showed that the headcount ratio would decline by about 2.6 percent. Inference on the basis of our regression analysis shows that controlling for other factors, a rise in exporting significantly reduces the risk of being poor.

We also find that poverty is highly elastic with respect to exporting propensity and exporting intensity. However, these results should be interpreted with caution since the computation of elasticity may have been exaggerated due to the base effect. The outcome is highly dependent on the base value used in computations.

CHAPTER FIVE

5 SUMMARY AND POLICY IMPLICATIONS

5.0 Introduction

Mental health capital is one of the many inputs into production processes in manufacturing activities and other enterprises. In a firm, worker's health concerns such as worries, expressed or unexpressed, as a result of the risk of exposure to HIV/AIDS, or about their positive HIV-status or that of their family members or fellow workers could be a source of mental distractions and can adversely affect labour productivity (Chatterji *et al.*, 2007, Ettner *et al.*, 1997).

An individual's mental health, proxied by concerns about HIV/AIDS, is important in the formation and effective use of human capital. Mental capital complements human capital in various ways (Weehuizen, 2008). Mental health affects TFP through training of the workers. Good mental health increases the probability of being trained. A workforce that suffers from poor mental health is more likely to be unproductive and this has negative implications on the output. In a manufacturing environment, which is the case in our study, it may be difficult for such firms to remain competitive in the export market. This is because a firm would not be in a position to realise the full potential of its production and sales.

Despite the potential adverse impact of poor mental health on the quality of life, and worker productivity, little empirical analysis exists on this topic in developing countries. This study therefore presents an analysis of the effects of one indicator of mental health, i.e., workers' fears related to HIV/AIDS, on the performance of Kenyan manufacturing firms. The thesis goes further to analyse effects of health concerns on the export status of the firms through training of workers and extends the analysis to examine the effect of exporting on the poverty status of the manufacturing workers. Using an econometric

approach that overcomes problems of endogeneity and heterogeneity, the thesis has estimated several economic effects of mental health.

The remainder of this concluding chapter provides a discussion of the findings of each of the essays. Section 5.1 provides a synthesis of the findings for each of the essay. The first essay is on the effect of mental health on firm performance. An assessment of the impact of TFP on export propensity and export intensity of the firm is conducted in the second essay while the third essay analyses the link between exporting and poverty levels. The policy relevance of findings and the limitations of the study and future research agenda are presented in sections 5.2 and 5.3, respectively.

5.1 Synthesis of findings

In Chapter 2 (essay1), two issues are investigated. The first issue concerns the relationship between mental health capital of workers and sales revenue. The second issue is on the effects of mental health capital on the labour productivity. Various econometric approaches are used to investigate these issues. The results show that mental health capital has statistically significant and economically important effects on sales revenue per worker and wage per hour per worker. The results show that poor mental health can be detrimental to worker productivity.

In the case of firms that export, poor mental health could have disastrous effects on the efficiency with which all the factors of production are employed. Chapter 3 (essay 2) analyses the impact of TFP on the export propensity and export intensity of manufacturing firms. Mental health capital is found to affect TFP via training of workers. The Heckman selection model was used to overcome biases arising from unobservables driving selection into export markets, while the control function approach was applied to deal with endogeneity of TFP and heterogeneity in manufacturing firms. The results show that productivity as measured by TFP has positive and statistically significant effect on both export propensity and export intensity. Based on these results we conclude that TFP should be promoted to increase Kenya's export competitiveness in the foreign and

domestic markets.

The importance of TFP for exporting activity is demonstrated in Chapter 3; while Chapter 4 (essay 3) reports the effect of exporting on poverty status of the manufacturing workers. The poverty analysis is undertaken for each of the poverty indicators as defined by Foster, *et al.*, (1984). The results indicate that firms which export have poverty rates 26.2 percent lower than the firms which do not export. The general finding across the three indicators is that exporting reduces poverty.

5.2 Policy relevance of findings

This study makes an important empirical contribution not only to an understanding of the impact of poor health on labour productivity of the firms, but also to the design of policies for encouraging investments in the maintenance of health human capital and poverty reduction.

The results from this study are relevant to policy makers in various instances. First, the study shows that expenditure on medical care can be used as a way of improving mental health capital of workers while at the same time contributing to reducing fears associated with HIV/AIDS prevalence in the country. The target in the medium term plan for Kenya Vision 2030 is to reduce HIV/AIDS prevalence to 2 percent by 2013. This target is achievable in the manufacturing sector through treatment and prevention measures because exporting firms are in a position to afford them. If firms in this sector and other labour intensive sectors, could provide medical care that is targeted at improving the mental health of workers, the fears associated with HIV/AIDS can also be drastically reduced.

The main implication from the second essay is that there is need to increase the TFP in Kenyan manufacturing if the economy has to maintain a competitive edge in the exports market. This can be partly achieved by increasing the health capital of the workers. High health standards coupled with skilled and well trained workers is a prerequisite for high

export performance. However, our results as shown in Table 3-7 column (4) indicate that there is an optimal level of TFP beyond which it will negatively impact on the export intensity. This means there is a limit to an export promotion policy primarily aimed at increasing productivity.

The findings on the effect of exporting on poverty are critical in informing the policy makers on the ways of reducing the high poverty levels in the country. While policies on increasing export propensity and export intensity are good for poverty reduction, they may not be effective in isolation. There is need to focus on integrated policies which improve educational attainment and training of workers and that ensure that the benefits trickle down by promoting pro-poor re-distributive policies.

5.3 Study limitations and future research

This study focuses on the manufacturing firms in 5 selected cities in Kenya. The analysis conducted is limited by a number of other factors. First, we do not have a direct measure of mental health. Instead, we have its indirect measure, namely, workers' concerns about HIV/AIDS. This is the variable we use to proxy for mental health. We use it to capture the indirect effects of HIV/AIDS, which include the negative attitudes expressed by workers towards life and work, as a result of the risks of exposure to HIV/AIDS, or about their positive HIV-status or that of their family members or fellow workers.

A limitation of this variable, as a measure of health status, is that worries or concerns about HIV/AIDS may not mean the same thing to all workers and that one variable may not be adequate. Other measures of mental health have used more than one variable for instance the SF-36 and the EuroQol. The question which was asked in the survey used in this analysis is: "Is HIV/AIDS an important concern to you?" This is not a precise question. We have no idea whether respondent's answer is given relative to perceptions about national health, own health, the health of family members or that of fellow workers. However, despite the subjective nature of this health indicator, it may be less subject to systematic errors than the errors associated with self-reported HIV/AIDS status.

The second limitation of the study is that, the data we have used in this analysis is cross-sectional in nature. We are aware that panel data is best suited for this kind of analysis. However, the existing panel data sets for manufacturing firms in Kenya do not capture the health dimensions of workers. The only firm survey in Kenya with this kind of information is the RPED cross sectional survey of 2002/3. We cannot therefore deal with problems of fixed effects in our analysis. Given the above limitations, we recommend that future work should be conducted using panel data and using more precisely defined measures of workers' mental health status as defined by questionnaires that capture the quality of life.

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ANNEX

Annex Figure 1: Linkages among the three essays