DOES EXPORTING MATTER FOR POVERTY REDUCTION: THE CASE OF KENYAN MANUFACTURING

NANCY **N**ELIMA **N**AFULA **M**WANGE

Kenya Institute for Public Policy Research and Analysis, Nairobi, P.O Box 20107 00100
Kenya (e-mails: *nnafula@kippra.or.ke*, *nancy.nafula@yahoo.com*,
nancy.nafula@gmail.com

JEL Classification numbers: F14, I32, L60
Key words: Poverty, inequality, exports

April 2013

TABLE OF CONTENTS

LIST OF TABLES

ABBREVIATIONS AND ACRONYMS

2SPS	Two Stage Predictor Substitution
2SRI	Two Stage Residual Inclusion
AIDS	Acquired Immune Deficiency Syndrome
FGT	Foster Greer and Thorbecke
HIV	Human Immune-deficiency Virus
IS	Import Substitution
IV	Instrumental Variables
KIHBS	Kenya Integrated Household and Budget Survey
KNBS	Kenya National Bureau of Statistics
LPM	Linear Probability Model
OLS	Ordinary Least Squares
RPED	Regional Program for Enterprise Development

Abstract

Empirical investigations exploring the nexus between poverty and exports in manufacturing sectors of developing countries are rare. Existing analysis has mainly centered on microeconomic analysis of poverty with very limited analysis on the connection between trade and the well-being of workers. It is in this context that the current article was undertaken to examine the linkages between export competitiveness and the poverty status of the labour force in Kenyan manufacturing industry.

Using the cross-sectional data for 2002/3 from Kenyan manufacturing firms, the article empirically examines the impact of exports on the poverty status of the workers. The control function estimation technique is 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 article demonstrates that exporting is a viable strategy for poverty reduction.

1. 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 study 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 2 reviews issue of poverty and inequality in Kenya. Section 3 reviews theoretical and empirical issues on poverty while section 4 models poverty. Variable definitions, data and summary statistics are in sections 5 and 6. Section 7 evaluates poverty and inequality profiles in the manufacturing sector. Empirical results are presented in section 8 while the summary and conclusions are outlined in section 9.

2. 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 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 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.

3. 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.

1.3.1 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:

$H = \frac{q}{n}$ …… (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:

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

Where $S(z,y)$ is the aggregate income-gap of people whose income is no more that z , $w_i(z,y)$ 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 (1981, 1979), 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.

1.3.2 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:

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

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, 2006, 2003).

1.3.3 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 found 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 ordinary Least Squares (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. 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

5. Definition of variables

1.5.1 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.

1.5.2 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.

6. Data and summary statistics

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.

Descriptive statistics are shown in Table 2.

Table 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.**

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. 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 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 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.

7. 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 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 : 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 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 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).

8. 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.

1.8.1 Determinants of exporting

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 6 shows results from estimating OLS (Linear Probability Models - 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.

Table 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.

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. 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).

1.8.2 The impact of exporting on poverty status

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

Variables	Estimation Methods			
	LPM-2SPS without controls for endogeneity and heterogeneity (1)	Control Function Approach		
		LPM (with controls for endogeneity) 2SRI (2)	LPM (with controls for heterogeneity (3)	Probit Marginal Effects (with controls for heterogeneity) (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 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 **Error! Reference source not found.** 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 7 show no signs of heterogeneity, the re-estimation of interaction effect (assuming non-linearity) show that there is strong evidence of heterogeneity.

Table 8: Probit estimates of the mean coefficient of the interaction term in Error! Reference source not found.

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 Instrumental Variable (IV) estimations. This approach is similar to that used by Moll (1996) and Mwabu and Schultz (2000). The results are shown

in **Error! Reference source not found.**. 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 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 10 show that a 10 percent increase in exporting reduces the severity of poverty by 6.2 percent.

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

Explanatory variables	Estimation methods		
		Two stage least squares (one step command)	
	OLS-estimates (1)	First stage regression dependent variable = export (2)	Second stage regression dependent variable = poverty severity (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.

1.8.3 Export intensity and poverty status

In Table 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 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 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 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 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 12. This result suggests the presence of heterogeneity contrary to what is shown in Table 12 .

Table 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 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 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 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 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 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.

1.8.4 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 12, Table 14 and Table 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 7, Table 9 and Table 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 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 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).

9. 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 study 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.

REFERENCES

Addison, J. T. and Belfield, C. R. "Unions, Training, and Firm Performance: Evidence from the British Workplace Employee Relations Survey," *Discussion Paper No. 1264.* Bonn: IZA, 2004.

Ali, A. A. G. and Thorbecke, E. "The State and path of poverty in sub-Saharan Africa." *Journal of African Economies*, 2000, *9*(supplement (1)), pp. 9-40.

Atkinson, A. B. "On the Measurement of Inequality." *Journal of Economic Theory*, 1970, *2*, pp. 244-63.

Balat, J.; Brambilla, I. and Porto, G. "Realising the gains from trade: Export crops, marketing costs, and poverty." *Journal of International Economics*, 2009, *78*, pp. 21-31.

Bigsten, A.; Isaksson, A.; Soderbom, M.; Collier, P.; Zeufack, A.; Dercon, S.; Fafchamps, M.; Gunning, J. W.; Teal, F.; Gauthier, B., et al. "Rates of Return on Physical and Human Capital in Africa's Manufacturing Sector." *Economic Development and Cultural Change*, 2000, *84*(4), pp. 801-27.

Blackorby, C. and Donaldson, D. "Ethical Indices for the Measurement of Poverty." *Econometrica*, 1980, *48*(4), pp. 1053-60.

Bound, J.; Jaeger, D. A. and Baker, R. M. "Problems with Instrumental Variables Estimation When the Correlation Between the Instruments and the Endogenous Explanatory Variable is Weak." *Journal of the American Statistical Association*, 1995, *90*(430), pp. 443-50.

Central Bank of Kenya. "Annual Report." 2006.

____. "Annual Report," 2003.

Chakravarty, S. R. "Ethically Flexible Measures of Poverty." *The Canadian Journal of Economics*, 1983, *16*, pp. 74-85.

Clark, S.; Hemming, R. and Ulph, D. "On Indices for the Measurement of Poverty." *The Economic Journal*, 1981, *91*, pp. 515-26.

Collier, P. and Lal, D. "Poverty and Growth in Kenya," *World Bank Staff Working Paper No. 389.* Washington D.C.: World Bank, 1980.

Corvers, F. "The Impact of Human Capital on Labour productivity in Manufacturing Sectors of the European Union." *Applied Economics*, 1997, *29*, pp. 975-87.

Evenett, S. J. and Venables, A. J. "Export Growth in Developing Countries: Market Entry and Bilateral Trade Flows," University of Bern, 2002.

Foster, J. E.; Greer, J. and Thorbecke, E. "A Class of decomposable Poverty Measures." *Econometrica*, 1984, *52*(3), pp. 761-66.

Foster, J. E. and Shorrocks, A. F. "Subgroup Consistent Poverty Indices." *Econometrica*, 1991, *59*(3), pp. 687-709.

Friedrich, R. J. "In defense of multiplicative terms in multiple regression equations." *American Journal of Political Science*, 1982, *26*(4), pp. 797-833.

Geda, A.; Jong, N. D. and Kimenyi, M. S. "Determinants of Poverty in Kenya: A household level Analysis," *Working Paper 2005-44.* Department of Economics, University of Connecticut, 2005.

Godfrey, L. G. "Instrument relevance in multivariate linear models." *The Review of Economics and Statistics*, 1999, *81*(3), pp. 550-52.

Greer, J. and Thorbecke, E. "A Methodology for Measuring Food Poverty Applied to Kenya." *Journal of Development Economics*, 1986, *24*, pp. 59-74.

Haiti National Strategy team. "The Export Development and Poverty Reduction Nexus: The Case of Haiti," 2006.

Handley, G.; Higgins, K.; Sharma, B.; Bird, K. and Cammack, D. "Poverty and Poverty Reduction in sub-Saharan Africa: An Overview of the Issues," *Working Paper 299.* London: Overseas Development Institute, 2009.

Hummels, D. and Klenow, P. L. "The Variety and Quality of a Nation's Exports." *American Economic Review*, 2005, *95*(3), pp. 704-23.

Kenya National Bureau of Statistics. "Basic Report on Well-Being in Kenya - Based on Kenya Integrated Household and Budget Survey-2005/06," 2007.

Mairesse, J. and Greenan, N. "Using Employee-Level Data in a Firm-Level Econometric Study," *Working Paper No. 7028.* Cambridge: National Bureau of Economic Research, 1999.

Manda, D. K.; Mwabu, G. and Kimenyi, M. S. "A review of Poverty and Antipoverty Initiatives in Kenya," *Working Paper No. 3.* Nairobi: Kenya Institute for Public Policy Research and Analysis, 2001.

McCaig, B. "Exporting Out of Poverty: Provincial Poverty in Vietnam and U.S Market Access," *Working Paper No. 502.* School ofEconomics and Research School of Social Sciences, Australian National University, 2009.

McCulloch, N. and Ota, M. "Export horticulture and Poverty in Kenya," Brighton: Institute of Development Studies, University of Sussex, 2002.

Moll, P. G. "The Collapse of Primary Schooling Returns in South Africa 1960-1990." *Oxford Bulletin of Economics and Statistics*, 1996, *58*(1), pp. 0305-9049.

Mwabu, G. "The production of Child Health in Kenya: A Structural Model of Birth Weight." *Journal of African Economies*, 2009, *18*(2), pp. 212-60.

Mwabu, G.; Ainsworth, M. and Nyamete, A. "Quality of Medical Care and Choice of Treatment in Kenya: An Empirical Analysis." *The Journal of Human Resources*, 1993, *28*(4), pp. 838-62.

Mwabu, G.; Kimenyi, M. S.; Kimalu, P.; Nafula, N. and Manda, D. K. "Predicting Household Poverty: A methodological Note with a Kenyan Example." *Journal of African Development Review*, 2003, *15*(1), pp. 77-85.

Mwabu, G. and Schultz, T. P. "Wage Premiums for Education and Location of South African Workers, by Gender and Race." *Economic Development and Cultural Change*, 2000, *48*(2), pp. 307-34.

Mwabu, G.; Wafula, M.; Gesami, R.; Kirimi, J.; Ndeng'e, G.; Kiriti, T.; Munene, F.; Chemngich, M. and Mariara, J. "Poverty in Kenya: Profile and Determinants," *A Report submitted to Ministry of Finance, Kenya.* Nairobi: University of Nairobi and Ministry of Finance, 2000.

Nevo, A. and Rosen, A. M. "Identification with imperfect instruments." *Review of Economics and Statistics*, 2010.

Norton, E. C.; Wang, H. and Ai, C. "Computing interaction effects and standard errors in logit and probit models." *The Stata Journal*, 2004, *4*(2), pp. 154-67.

Oyugi, L. N. "The Determinants of Poverty in Kenya," *Department of Economics.* Nairobi: University of Nairobi, 2000.

Persson, T. and Tabellin, G. "Is Inequality Harmful for Growth?" *American Economic Review*, 1989, *84*(3), pp. 600-21.

Porto, G. G. "Informal Export Barriers and Poverty " Development Research Group, The World Bank, 2004.

Quibria, M. G. and Srinivasan, T. N. "Rural poverty in Asia: priority issues and policy options," Manila: Asian Development Bank, 1991.

Ravallion, M. "Poor Areas," Washington D.C.: World Bank, 1996.

Ravallion, M. and Bidani, B. "How Robust Is a Poverty Profile?" *The World Bank Economic Review*, 1994, *8*(1), pp. 75-102.

Reardon, T.; Delgado, C. and Matlon, P. "Determinants and effects of income diversification amongst farm households in Burkina Faso." *Journal of Development Studies*, 1992, *28*(2), pp. 264-96.

Republic of Kenya. "The First Report on Poverty in Kenya," Ministry of Finance and Planning, 1998.

____. "Kenya Demographic and Health Survey," Nairobi, 2003.

____. "Kenya Vision 2030: The Popular Version." 2007.

____. "National Poverty Eradication Programme: 1999-2015," Government Printer, 1999.

Sen, A. "Poverty: An Ordinal Approach to Measurement." *Econometrica*, 1976, *44*(2), pp. 219-31.

Shea, J. "Instrument relevance in multivariate linear models: A simple measure." *The review of Economics and Statistics*, 1997, *79*(2), pp. 348-52.

Soderbom, M. and Teal, F. "Firm Size and Human Capital as Determinants of

Productivity and Earnings," *Working Paper -2001-09.* Centre for the study of African Economies, Department of Economics, University of Oxford, 2001.

____. "How can policy towards manufacturing in Africa reduce poverty? A review of the current evidence from cross-country firm studies," Centre for the study of African Economies, Department of Economics, University of Oxford, 2003.

Soderbom, M.; Teal, F.; Wambugu, A. and Kahyarara, G. "The Dynamics of Returns to Education in Kenyan and Tanzanian Manufacturing." *Oxford Bulletin of Economics and Statistics*, 2006, *68*(3), pp. 261-88.

Staiger, D. and Stock, J. H. "Instrumental variables regression with weak instruments." *Econometrica*, 1997, *65*(3), pp. 557-86.

StataCorp. "Stata Statistical Software: Release 10," *Special Edition.* College Station, Texas: StataCorp LP, 2007.

Takayama, N. "Poverty, Income Inequality, and their Measures: Professor Sen's Axiomatic Approach Reconsidered." *Econometrica*, 1979, *47*(3), pp. 747-59.

Thon, D. "Income Inequality and Poverty: Some Problems." *The review of Income and Wealth*, 1981, *27*(2), pp. 207-10.

____. "On Measuring Poverty." *Review of income and wealth*, 1979, *25*(4), pp. 429-39.

United Nations Development Programme. "Macroeconomic Policy, Growth and Poverty Reduction," T. McKinley, United Nations Development Program, 2001.

Van de Walle, D. "Rural Poverty in an Emerging Market Economy: Is Diversification into Non-Farm Activities in Rural Vietnam the Solution? Public Economic Division, Policy Research Department," Washington D.C: World Bank, 1995.

Were, M. "Export-Orientation and employment patterns in Kenya's manufacturing sector," *CSAE conference.* 2006.

World Bank. "World Development Report, 1997: The state in a changing World," Washington D.C: World Bank, 1997.