DETERMINANTS OF RICE SUPPLY FOR EXPORT MARKETS IN TANZANIA

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ABSTRACT

Despite Tanzania being the leading rice producer in East African Community region, existence Common External Tariff trade policy, government interventions in rice sub sector and high production potential in the country rice supply to the export market in Tanzania is low. The present study was conducted to analyse the determinants of rice supply for export markets in Tanzania. Specifically, the study focused on examining the influence of price and non-price factors on rice export, assessing the competitiveness of Tanzanian rice exported and identifying factors affecting participation in export markets by rice traders. The study used mainly secondary data and occasionally supplemented with primary data. Secondary data were collected from government institutions and other sources such as FAOSTAT and WITS while primary data were collected from 150 randomly selected rice traders in Tanzania. Vector Error Correction Model was used to capture the dynamics of rice export in Tanzania. Competitiveness of rice exported was assessed using Revealed Comparative Advantage while factors affecting participation of rice traders in export markets were identified using binary logit regression. Results show that; real exchange rate, international rice price, average GDP per capita of importing countries and quantity produced lagged one period are the factors that influence rice export in Tanzania. Rice exported was found to be less competitive in international markets. Factors affecting market participation in export markets were; sex, years of experience in rice trade and access to market information. The study concludes that poor competitiveness of Tanzanian rice exported and lack of market information by the rice traders are the major limitations towards rice export in Tanzania. The study suggests that, the government should increase investment in rice production by subsidising inputs and developing means to ensure accessibility of market information by rice traders so as achieve competitiveness and to meet rice export demand to the neighbouring countries and to the world at large.

DECLARATION

I, **Win Luhwago,** do hereby declare to the Senate of Sokoine University of Agriculture that, this dissertation is my own work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

_____ _____

Win Luhwago Date

(M.Sc Candidate)

Above declaration is confirmed by;

_____ _____

Dr. Damas Philip Date

(Supervisor)

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LIST OF ABBREVIATIONS AND SYMBOLS

ADF	Argumeted Dickey Fuller
AIC	Akaike Information Criterion
ASDP	Agricultural Sector Development Programme
ASDS	Agricultural Sector Development Strategy
ATOT	Agriculture and Trade Opportunities for Tanzania
CET	Common External Tariff
COMSTAT	Compliance Status Information System
EAC	East African Community
ECM	Error Correction Model
EUCORD	European Cooperative for Rural Development
FAO	Food and Agriculture Organization
FAOSTAT	Food and Agriculture Organization of the United Nations Statistics
FPE	Final Prediction Error
GOI	Government of India
GDP	Gross Domestic Product
HQ	Hannan-Quin
IMF	International Monetary Fund
ITC	International Trade Centre
MAFAP	Monitoring African Food and Agricultural Policies
MAFSC	Ministry of Agriculture, Food Security and Cooperatives
MC	Marginal Cost
MT	Metric Ton
NBS	National Bureau of Statistics
NERICA	New Rice for Africa
NPC	Nominal Protection Coefficient
NRDS	National Rice Development Strategy
NTB	Non-Tariff Barrier
OECD	Organization for Economic Co-operation and Development
RCA	Revealed Comparative Advantage
RTA	Relative Trade Advantage
RXA	Relative Export Advantage
SC	Schwarz information criterion
TANRICE	Tanzania Rice
UPSF	University Pentecostal Student Fellowship
UNCTAD	United Nations Conference on Trade And Development
URT	United Republic of Tanzania
USA	United States of America
USAID	United States Agency for International Development
VAR	Vector Autoregressive Model
VECM	Vector Error Correction Model
WITS	World Integrated Trade Solution

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Rice is a staple food for more than half of the world's population with a vital role in the diets of billions of low-income and food insecure consumers (Zibaee, 2013). Rice provides about 20% of the calories and consumed by 31% of the population of low income countries (Irshad *et a*l., 2018). Rice export allows producers in poor countries to enlarge their markets and benefit from economies of scale. Moreover, rice export is a source of foreign currency earnings, increase employment, income and food security for a significant portion of farming households worldwide which in turn promote economic growth (Tongeren, 2014).

Rido (2016) reported that, globally, international rice market is characterized by high volatility with inelastic supply and demand. Fluctuations in production worldwide results to rice trade having instability effect on prices. Only 7% of rice production worldwide enters to the international market and concentrated by the five top exporters such as India, Thailand, United States, China and Vietnam accounting for 85% of global net trade (Wailes and Chaves, 2012). Developing countries such as Nigeria, Côte d'Ivoire, South Africa, Sierra Leone, Guinea and Benin are the main importers, this designates the existence of high rice demand to the world market (EUCORD, 2012). India is the leading exporting country worldwide with the rice export share of 32.5% followed by Thailand 19.2%, United States 8.6%, Vietnam 6.6%, Pakistan 5.6%, China 4.8%, Italy 2.9%, Mynmar 2.6% Cambodia 1.7%, Spain 0.9% while Tanzania is the least rice exporter with export share of only 0.004% to the world market (FAOSTAT, 2019). Rice export share to the world by the major exporting countries is illustrated in Figure 1.

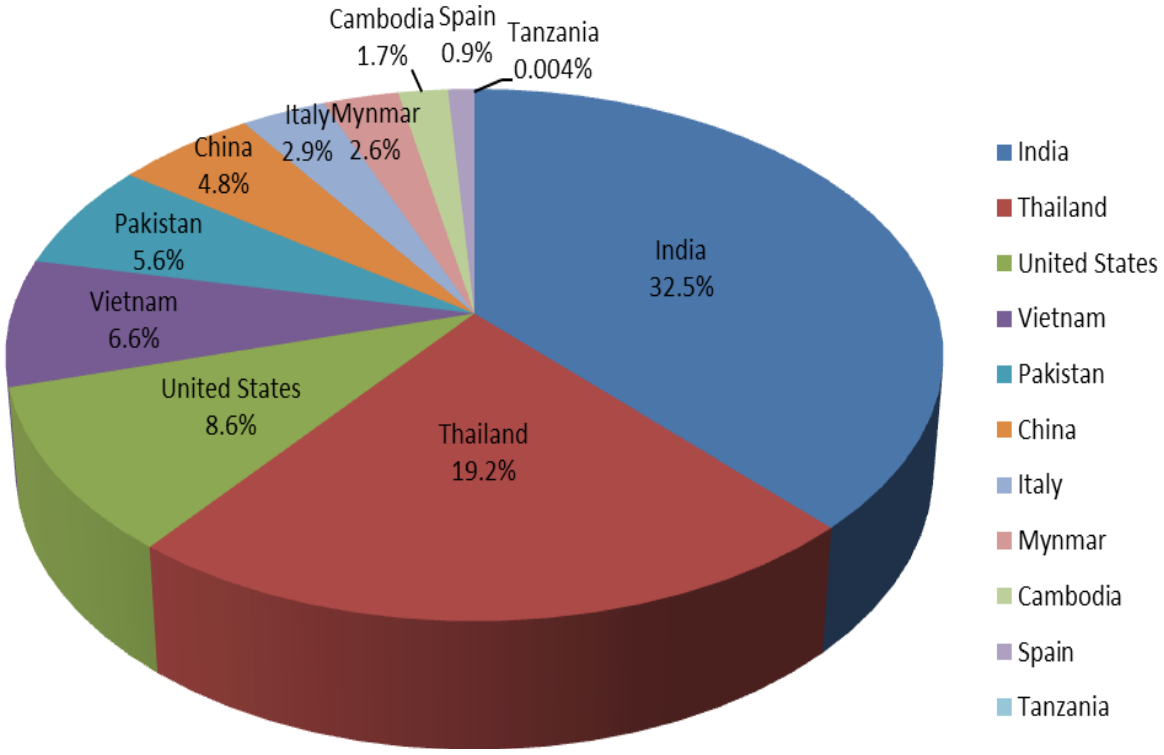

Figure 1: Export share of rice to the world market

Source: FAOSTAT, 2019

In Sub Saharan African countries, rice has become the most rapidly growing food source and it is consumed by more than 63% of African total population (FAO, 2015). The importance of rice in Sub Saharan African countries is driven mainly by changes in food preferences both in rural and urban areas and increase of population. It is also a source of livelihood for smallholder farmers (Nkuba *et a*l., 2016). In Sub Saharan African countries, rice export is instability due to the increased rice demand with inelastic rice supply triggered by insufficient and uncertainties in production (FAO, 2015). In 2016, Sub-Saharan Africa experienced rise of production by 1.1% however, still there is unsatisfactory rice export supply (Samiji, 2016).

In East Africa, Tanzania is the leading rice producer with average annual production of 1 700 000 MT milled rice (OECD, 2015). In the period 2008-2016, the EAC region

produced a total of 24 469 000 MT whereby Tanzania account for 83% of total rice produced within the EAC region, (COMSTAT, 2018). Furthermore, rice export demand within EAC region and to the neighbouring countries such as Malawi, Democratic Republic of Congo, South Sudan and Zambia is rising in faster rate compared to production (RCT, 2015). In 2013, rice production increased from 2.2 Million MT to 2.9Million MT in 2017, export demand to the neighbouring countries was approximately 51.8 Million MT however rice export supply to the neighbouring countries was only 620 000 MT equivalent to 0.012% (FAOSTAT, 2019).

Within EAC region there is favourable trade policies such as Common External Tariff of 75% charged on rice imported to EAC region from nonmember countries. Bandhu (2014) reported that, the performance of agricultural export depends not only on adequate surplus, international prices, quality of product and comparative advantage of producing the exportable commodities but also on domestic and international trade policy. CET intended to protect domestic producers within EAC thus providing a room for rice producers within EAC and in Tanzania to produce sufficient rice to meet high export demand of rice in the international market (Ayoki, 2012; RCT, 2015). Despite the favourable trade policies on rice in EAC region that were expected to trigger domestic production, rice export in Tanzania is still increasing at a low rate compared to the increase export demand. Moreover, even though, there is high rice production potential in the country enough to achieve a significant impact on rice export, still rice export is stumpy compared to export demand (Sage-el *et al*., 2018).

Similarly, within EAC region, Tanzania supplies nearly 80% of its surplus to EAC countries and the rest to other neighbouring countries such as Malawi, Zambia, South Sudan and Democratic Republic of Congo (Kilimo Trust, 2014; URT, 2016). Tanzania

export share of rice to the world is only 0.004% whereas export share to the neighbouring countries is 35% to Kenya, 29% to Rwanda, 13% Uganda, 6% South Sudan, 3.20% DRC, 9% Burundi, 2.80% Zambia and 2% of rice is exported to Malawi (Figure 2). This suggest that there is existence of high export demand to the neighbouring countries and to the world at large. However, rice export supply in Tanzania is still low with the great influence being from large scale farmers (Barreiro-Hurle, 2012 and FAO, 2015).

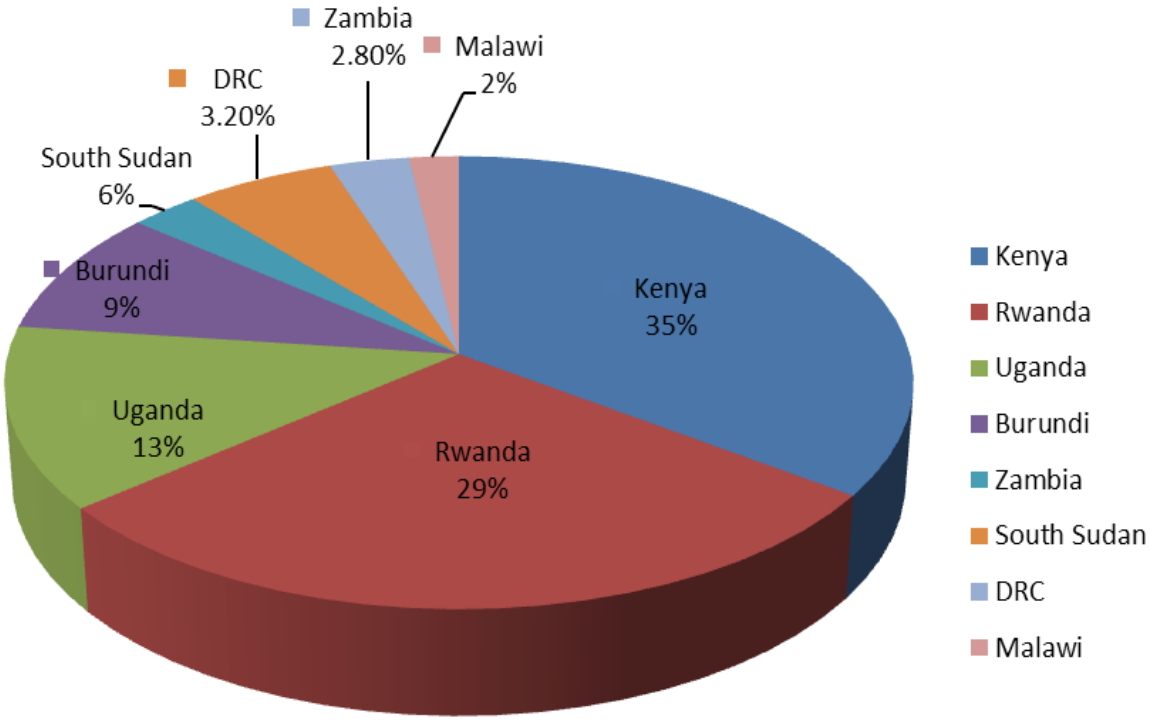

Figure 2: Tanzania export share of rice to the neighbouring countries

Source: FAOSTAT, 2019

In Tanzania, rice is the most important food crop after maize and cassava and its exports becomes a significant source of employment and foreign currency accumulation. It acts as a source of food and employment for Tanzanian farming households, as 18% of farming households grow rice (Ngailo, 2017). Also is a source of foreign income through exportation mainly done to the neighbouring countries of Kenya, Rwanda, Burundi,

Democratic Republic of Congo and Uganda (Lewis and Wilson, 2015). Economically, rice export in Tanzania contributes 2.7% of national GDP (Grant *et a*l., 2015). Tanzania rice is highly demanded and it fetches good export price in international market due to its uniqueness in terms of aroma, grain size, taste, colour and cooking attributes (Mtaki, 2017). Despite existence of strong consumer demand of Tanzania rice in international market, favourable trade policies within EAC region and high rice production potential in the country, Tanzania has not being able to meet the prevailing high export demand of rice within EAC region and to the world at large.

Competitiveness of rice exported from Tanzania is dynamic and it varies depending on the fluctuations in international and domestic price, production costs together with changes in demand and supply of rice in international market (GOI, 2012). International trade increases international competition and exposure to volatility in international prices. Tanzania has competitive advantage in rice production and exports because of favourable production environment in the country, irrigation schemes, improved rice varieties such as NERICA and SARO 5 together with diverse agro-climatic condition (Mwakasendo *et al*., 2016). An assessment of export competitiveness of Tanzanian rice is required so as to understand how far Tanzanian rice price aligned to global price of rice thus expands rice export market in Tanzania.

In Tanzania, the trend of rice production shows that there is an increase of rice production at the higher rate compared to the increase of rice export. This indicates that the quantity of rice supplied to the export market is still low compared to the rice demand need to the neighbouring countries and to the world at large (Ngailo *et a*l., 2017). This can be due to rice production constraints in Tanzania such as poor production techniques, high production and transportation costs. Other constraints to rice production in Tanzania includes; inadequate post-harvest handling techniques, limited mechanization, poor water

management strategies and poor management of labour resources (Trevor and Lewis, 2015). According to FAOSTAT (2018), rice production trend in Tanzania from 2007 up to 2010 seen to be increasing however it started to fluctuate from 2011 up to 2013 where production was 2 194 750.00 MT in 2013 while in 2010 production was 2 650 120.00 MT. Later, in 2017 the production increased up to 2 871 963.00 MT. In the period of 2008 to 2016, Tanzania exported a total of 173 242 MT to Burundi, Kenya, Uganda and Rwanda whereby Uganda and Rwanda are the largest importers of rice from Tanzania accounting for 47% and 24% respectively (URT, 2016; USAID, 2018). Despite Tanzania being the leading rice exporter and the second rice producer in Africa after Madagascar, its rice export capacity is still low. The trend of rice production and export trend in Tanzania is further illustrated in Figure 3.

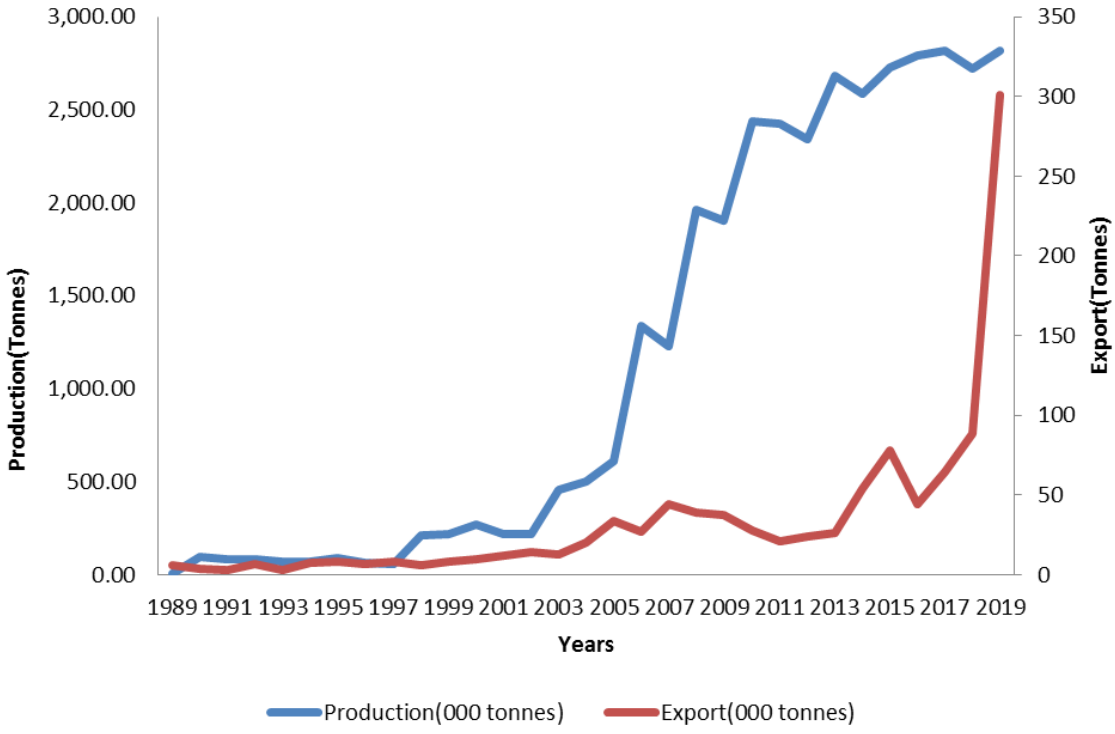

Figure 3: Trend of rice of production and exports in Tanzania (1989-2019 in tonnes)

Source: FAOSTAT (2019)

The government of Tanzania through National Rice Development Strategy (NRDS) has placed much attention on rice as a strategic commodity so as to ensure food security and

reducing poverty in the country (URT, 2013). Some strategies that have been implemented by the government include; improving irrigation facilities, provision of agricultural training, credit facilities and fertilizer distribution (EUCORD, 2012; Lewis and Wilson, 2015). Other strategies includes; improving research and development on rice as well as developing marketing infrastructure such as transport and storage facilities (Sage-el, 2018). Despite all these interventions, rice supply to the export markets in Tanzania has not responded significantly. This study was therefore conducted to investigate the determinants of rice export instabilities and insufficient rice supply despite the above mentioned interventions.

The information on rice export in the country shows that rice export over years is fluctuating primarily based on the deprived analysis on the determinants of rice supply to the export markets in Tanzania. Basically, export variability of rice can be influenced by the increase of consumer preference in both domestic and international markets. Furthermore, variability in rice export can be due to volatility of world prices, policy changes in the country and fluctuations in production volumes. Therefore, understanding the magnitude and causes of instability of rice exports in Tanzania is utmost important so as to efficiently exploit high rice production potential and sustain rice exports in the country.

Similarly, the approach used to devise measures aimed at ensuring stability of rice exports in the country may lack important information on what are the determinants that leads to the dynamics of rice supply for export market in Tanzania. Understanding the factors that cause instability of rice supply to export market in Tanzania could help in appropriate policy formulations and implementations so as to increase rice exports thus effectively utilizing the available opportunities for trade within EAC and to the world at large.

This will also expand rice export market in the country, increase foreign earnings, income of rice traders and farming households, increase rice exports in Tanzania thus alleviating poverty in Tanzania and increase of the possibility for Tanzania to become a significant exporting country worldwide.

1.2 Problem Statement and Justification

Despite existence of favourable trade policies within East African Community (EAC) region, government intervention in rice sub-sector and high production potential in the country, rice supply to the export market in Tanzania is low. According to FAOSTAT (2019), rice production in Tanzania increased from 2.2 Million MT in 2013 up to 2.9 Million MT in 2017 however rice export supply to the neighbouring countries was only 620 000 MT despite high export demand of 51.8 Million MT. Favourable trade policies within EAC such as Common External Tariff (CET) protects domestic rice producers by charging 75% import tariff on imported rice from outside EAC region. This provide a room for trade for the rice traders within EAC region (Ayoki, 2012; The government of Tanzania has placed much attention on rice as a strategic crop by increasing investment in rice sub-sector so as increase surplus rice production hence increasing rice export (EUCORD, 2012).

Kikuchi *et a*l. (2016) reported that, competitiveness of domestic rice exported is dynamic due to high production and transport cost together with instability of prices in the international markets Furthermore, Leyaro and Morrissey (2013) reported that production of rice in Tanzania has been increasing through the expansion of the land under cultivation with very limited increase in productivity. Despite high export demand of Tanzania rice to the export markets and favourable trade policies within EAC, rice competitiveness is

vastly fluctuating and most of rice traders in the country focus on domestic market as there are few traders who export rice (Thompson *et al.*, 2017).

Previous studies may not focus on the reasons for instability of rice export in Tanzania. Moreover, past studies may not focus on the influence of membership of cooperative society, access to market information and trade policies awareness towards market participation by rice traders in Tanzania. Therefore, the present study aimed at filling this knowledge gap by looking on the causes of the dynamics of rice exports and how institutional factors influence market participation in export markets. Furthermore, the country has not managed to supply sufficient rice so as to meet high rice export demand to the neighbouring countries despite government interventions to rice sub-sector and huge production potential. This study was conducted in order to investigate why rice export is not increasing to meet the growing rice demand within East Africa Community region and to the neighbouring countries such as Malawi, Zambia and Mozambique. The present study was important in order to guide policy decision which may ensure sufficient rice supply to export markets so as to meet high export demand to the neighbouring countries, increase foreign currency, developing the economy as whole and alleviate poverty in Tanzania.

1.3 Study Objectives

1.3.1 Overall objective

To analyse the performance of rice sub-sector and it’s potential to supply rice for export markets in Tanzania.

1.3.2 Specific objectives

i. To examine the influence of price and non-price factors on rice supply to the export market.
ii. To assess the competiveness of Tanzanian rice supplied to the export market.
iii. To analyse the factors affecting participation in export markets by rice traders.

1.4 Research Hypotheses

i. Price and non-price factors have no influence on the amount of rice supplied to the export markets.
ii. Rice produced in Tanzania is not competitive in the export market.
iii. Socio economic factors such as sex, experience, capital, education, membership of cooperative society and access to market information do not influence participation of rice traders in the export markets.

1.5 Organisation of the Dissertation

This dissertation is organized into five chapters. Chapter one provides the background information on rice as a commercial and staple food crop in Tanzania, in East Africa Community region and in the world at large. This chapter also explains the rice production trends in Tanzania, the problem statement and justification, objectives of the study and research hypothesis. Chapter two provides intensive literature review on the determinants of rice supply to the export markets in Tanzania. This chapter explains about the theoretical standpoint which are the theories used as the basis for this study. Furthermore, review of previous studies helps in developing a proper understanding of the research problem and identifying conceptual and methodological issues relevant to the present study. Also it helps in the understanding of the current study with the basis on what others have done regarding the similar study. The chapter also deals with review of relevant research literature that has accumulated in the present study and is consistent with the specific objectives of this study. Additional, this chapter presents a review of various

literature related to driving factors of rice supply for export markets, trends of rice supply in Tanzania, trends of rice exports and trade balance in Tanzania, review of rice sub-sector in Tanzania, competitiveness of Tanzanian rice exported as well as the factors affecting rice traders participation in export markets. Chapter three describes the research design, conceptual framework of the study, the study area, sampling and sample size, data collection methods and data sources, definitions of dependent and explanatory variables used in this study and method of data analysis. Chapter four presents the discussion of the results and lastly, chapter five presents' conclusions and recommendations of the study.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Definition of Important Terms

Export is a function of international trade whereby goods and services produced in one country are shipped or transported to another country for use, future sale or for trade (ITC, 2011). Export of goods and services is an engine for economic growth and social development due to that exports ensure increase of sales and profits (Mabrouki and Bakari, 2017). If a country exports more than what it imports, this means that a country runs trade surplus. Trade balance is the difference between exports and imports in the country. When the country exports more than it imports, it has a trade surplus. When it imports more than it exports, meaning that a country had trade deficit. Therefore a balance of trade occurs when exports equals to imports (Adhikari, 2017).

Supply is a vital economic concept that designates the amount of a specific good or service that suppliers and sellers are willing and able to sell to the market at different levels of prices. At high prices, there is more incentive to increase production of a good hence increases supply (Whelan and Msefer, 1996). As the price of goods and services to be sold increases (ceteris paribus), the amount supplied to the market will also increase. As price increases, it increases the incentive to increase production therefore supply increases while at low price there is no incentive to produce more hence this reduces amount of goods and services to be supplied to the market.

Competitiveness refers to ability of a country to sell goods and services in global markets while simultaneously maintaining and expanding the real incomes of its people over the long term (Farole, 2010). Performance of rice exports essentially is measured by its

competitiveness in international markets since countries' export performance is usually considered as an indicator of its competitive positions in the international markets. Meaning that, changes in the export share and export structure of a country in the world markets is considered as relevant and important indicators of changes in export competitiveness (Jagdambe, 2016).

2.2 Theoretical Review

2.2.1 Revealed comparative advantage theory

The theory of comparative advantage was first introduced by David Ricardo in 1917 to explain the foundations of international trade. The theory states that, comparative advantage provides impetus for international trade where by a country will specialize to produce and export the goods with lower opportunity costs than others. Ricardian further explains that, countries can benefit from international trade through specialization in production and export of goods where it has comparative advantage (Balasa, 1989). Comparative advantage stems from differences in technology across countries. A country has comparative advantage in production of certain products if it can produce those products at lower opportunity costs than others. Moreover the theory explains that, a country should produce and export the crops which they produce at lower opportunity cost than others (Ukwadu, 2015). The higher the comparative advantage, the higher the possibility of a country to become a net-exporter (Ngailo, 2014).

Revealed Comparative advantage approach is one of the approach for analysing competitive advantage or disadvantage of a country thus it is used in assessing competitiveness of a country by comparing export shares of a country relative to the export shares of other countries in the world. Approach was first introduced by Balassa (1965) and it is also known as Balassa Index. Revealed Comparative Advantage Index

(RCA) as introduced by Balasssa (1965), is the widely method used to measure relative advantage or disadvantage of a country in production of certain products as revealed by observed export structure. RCA index is also known as Balassa index. Balassa Index reveals the comparative advantage or disadvantage of a country Balassa Index is a measure of export performance of a country by comparing the export share of products in the country relative to the share of the same product traded globally. Balassa Index is equivalent to RXA as it measures the export share of a country relative to the export share of the same product by other countries.

Balassa Index as introduced by Balassa (1965) is defined as follows:

$$RCA_{ij} = RXA_{ij} \quad \text{..... (1)}$$

$$RXA_{ij} = \frac{X_{ij}}{X_t} / \frac{X_{jw}}{X_{wt}} \quad \text{..... (2)}$$

RXA_{ij}=Country's share of world export of a commodity j divided by its share of total world exports.

X_{ij}=is the country's export of commodity j

X_t=is the country's total exports

X_{jw}= is the world's export of commodity j

X_{wt}=is the total world exports

RXA_{ij}=Relative Export Advantage of a country i in exporting commodity j

A positive sign (RXA>1) indicate competitiveness of a country in exportation of a particular product while negative sign (RXA<1) indicate that a country is less competitive in exportation of a given product.

Basing on Revealed Comparative advantage theory, this study determines the competitiveness of Tanzanian rice exported relative to other competing countries such as India, Thailand, Pakistan, China, Vietnam, Bangladesh and Philippines. These are the countries which also exports rice to the EAC countries and to other neighboring countries which imports rice from Tanzania. Tanzania has a comparative advantage in producing rice due to high rice production potential in the country, favorable environment that sustain rice production, availability of improved rice varieties such as SARO 5 and NERICA thus provide a room to increase rice production and export (Ngailo *et al.,* 2016).

2.2.2 Heckscher-Ohlin factor proportions theory

Theory of international trade was taken a step further by Heckscher and Ohlin (1933). Heckscher - Ohlin theory emphasis the attributes of comparative advantage to differences in factor endowments and cost differences in factor prices across countries. This theory is also regarded as factor endowment theory because it depict that, pattern of production and trade across countries depends on domestic factor endowments. Factor endowments refer to the extent to which a country is endowed with certain resources. The theory further depict that, factor endowments determine the factor costs whereby the more the resources a country is endowed, the lower the cost of resources (Hill and Jain, 2005). Therefore, international trade takes place due to differences in the comparative costs of factors of production between nations whereby abundant or insufficient of resources within countries determines patterns of trade. Implication is that, countries should produce and export goods that they have cheap factors of production or that they are endowed with resources and import goods that they have scarce resources for production (Blaug, 1992).

H-O model continues that a country should export goods of their abundant production due to high endowments of resources in the country (Vanek, 1968). This theory further depicts that, countries must exploit those goods that make intensive use of factors that are locally abundant and import those goods that resources are locally scarce (Bernnet, 1999). This theory also addresses the importance of efficient allocation of scarce resources and specialization on production thus increasing exports. Tanzania is highly endowed with rice production resources such as labour, enough arable land, improved rice varieties such as improved seed varieties and fertilizer, therefore Tanzania has to specialize in production and exportation of rice so as to exploit the trade opportunities in export markets.

2.2.3 Production theory

This study is also guided by production theory which defines the state under which a rational producer combines minimum quantities of various inputs so as to produce maximum quantity of output under a given state of technology. Production theory is derived from production function which relates maximum amount of output that can be obtained from a given number of inputs combined such as labour and capital (Shekhar *et a*l., 2013). Production theory is used to determine how much rice producers should produce given the price of a good and what combination of inputs they should use to produce maximum output given the input prices while minimizing input costs. Production function is defined at a given state of technology. The aim of producer is to produce maximum output while minimize costs so as to maximize profit. Producers of rice can be plausibly assumed to aim maximizing profit (Debetin, 2012). Since profit is maximized at a point where P=MC, therefore it is reasonable to argue that P (price) is one of the key determinants of profit and hence rice supply.

Where P=Price, MC=Marginal Cost.

In addition, farmers increase output in response to non-price factors such as weather and rainfall. Non-price factors affect rice production and thus influence rice supply for export market. Non-price factors include; agro-climatic conditions, investment in research and development, technology, farmer's managerial ability and infrastructure availability (Yu *et al.*, 2012).

2.3 Empirical Literature Review

2.3.1 Overview of the Tanzanian rice subsector

Rice sub-sector in Tanzania is dominated by the smallholder farmers who account for 74%, medium scale farmer's account for 20% of irrigated land and large scale production is only 6% (Ngailo, 2017). Around 42% of all rice produced is marketed however this is largely because of the influence of large-scale growers (Lewis and Wilson, 2015). In Tanzania, rice is grown in southern highlands such as Mbeya (Mbarali, Kyela and Kapunga), Mwanza and Shinyanga (Bariadi and Maswa), Katavi and Iringa. Central zone such Morogoro (Kilombero and Dakawa) and Tabora (Igunga), coastal and Kilimanjaro region. Most of the smallholder rice farmers do not have access to improved and certified seeds instead they re-use the local varieties the seed for 3 to 5 years (Zaal *et al.*, 2012). Although local varieties are low yielding, they produce aromatic rice which is highly demanded in the country and to the neighbouring countries and international market whereas the most widely used improved variety is SARO 5 (Lazaro *et al*., 2017).

Challenges in rice production in Tanzania includes; little use of fertilizer, traditional planting techniques, poor yield due to predominantly use of rain fed agriculture, example; paddy average yield in Tanzania is only 1.5 t/ha while in Asia average yield is 4.4 t/ha

(FAO, 2018), rice production has high labour requirements coupled with little mechanization results to high costs, poor transport infrastructure, storage capacity in rural areas is very limited, out dated machinery, lack of credit and capital and poor implementation of government policies (Nkuba *et a*l., 2016). Moreover, other challenges of rice production in Tanzania comprises; little use of fertilizer, traditional planting techniques, poor yield due to predominantly use of rain fed agriculture, example; paddy average yield in Tanzania is only 1.5 t/ha while in Asia average yield is 4.4 t/ha (MAFSC, 2013). In Tanzania, the trend of rice production shows that there is the increase of rice production at the higher rate compared to the increase of rice export. This indicates that the quantity of rice supplied to the export market is still low compared to the rice demand need to the neighbouring countries and to the world at large (MAFAP, 2013).

2.3.2 Influence of price and non- price factors on rice supply for export markets

Adhikari (2016) studied about determinants and performance of rice export in India. Multiple linear regression and Argumented Dickey Fuller Test were employed so as achieve meaning full results. The results revealed that export price, exchange rate and low production were the major factors that affected the performance of rice export in India, however, this study didn't include some other important variables when reviewing export performance such as Gross Domestic Product (GDP) per capita of importing countries, international rice price, and non-price factors such as rainfall. This study was also included non-price factors and GDP in analyzing the determinants of rice supply for export markets in Tanzania.

Lazaro *et al.* (2017) studied about an empirical analysis of rice demand in Tanzania using the Linear Approximate Almost Ideal Demand System (LA/AIDS) (Deaton and Muellbauer, 1980). The study reported that, domestic rice in Tanzania is highly demand

than the imported one as the consumer high preference for domestic rice than the imported rice. This study reported that, despite the small amount of rice imported in Tanzania, there is high consumer preference for the domestic rice given the uniqueness features of domestic rice such as grain size, aroma and taste. This provides a room for rice production in Tanzania to be increased so as to grab trade opportunities within EAC region and to the world at large.

The study done by Rwenyagila (2016) on the determinants of export performance in Tanzania using Ordinary Least Square method in estimating the variables, testing for stationary and co-integration of the variables, reveals that export performance is directly influenced by producers productive capacity. Increase in supply is a function of farmer's ability to produce more sufficient for domestic demand and surplus for export.

Nyerere (2016) studied about the determinants of rice supply in Tanzania using Vector Error correction model to estimate the rice supply function. The results show that, non-price variables such as rainfall and fertilizer application are more sensitive to increase rice supply than the price variables. Furthermore, the results shows that, price factors on their own are inadequate to influence smallholder farmers' decision to allocate land to rice so as to increase rice production. To understand the determinants of rice export in Tanzania, the present study focused on institutional factors, competitiveness of Tanzanian rice exported and the extent of rice trader's participation in export markets.

Bilal and Rizvi (2013) on their study to analyse the determinants of Pakistan's rice exports using multivariate linear regression where by time series data from 1980 to 2010 were used and the variables were tested for stationary using Argumented Dickey-Fuller test. Variables such rice yield, domestic price and export price were used as rice export

determinants. Results reveal that production and rice yield are positively significant while export price and exchange rate are negatively significant. Results suggest that production, yield and international demand are positively significant while export price and domestic price are negatively significant.

Haleem *et al.* (2005) estimated an export supply function for citrus fruit in Pakistan. The secondary data concerning domestic production, export quantity, export and domestic prices, GDP and exchange rate was utilised in this study. Annual time series data from 1975 to 2004 was used for the analysis. Dickey Fuller test was used to check unit root. All variables were stationary at the first difference except domestic production which as stationary at both, the first difference and at the level. Results shows that export price and exchange rate were positively affecting citrus exports.

Hegde (2015) on the study with an objective to assess global rice production and export opportunity in Ethiopia using multiple regression model, discovered that rice is not only for consumption but also it has a good scope for domestic and international market, hence influencing economic development. The increase of rice supply for export in Ethiopia is of great importance as it improves economic development therefore rice has become a commodity of strategic significance for domestic consumption as well as for export.

The study conducted by Clauss *et al*. (2018) about Estimating rice production in the Mekong Delta, Vietnam, utilizing time series using Multiple regression model, the regression analysis results shows that factors affecting rice export industry includes; rice seeds used in cultivation, cultivation techniques and post-harvest handling processes. Furthermore, the study done by Mohamed *e*t *a*l. (2014) reported that non-price factors such rainfall affects rice cultivation thus minimizes rice export supply in Sierra Leone.

The study conducted by Ayinde *et al.* (2017) on the analysis of supply response and price risk in the production of rice in Nigeria using supply function model estimated by multivariate regression discovered that rice producers are more responsive not only to price and non-price factors but also to price risk and exchange rate.

The study done by Van Chu *et al.* (2016) on the assessment of the factors affecting rice export industry in Vietnam discovered that; Vietnam succeeded to export significant rice quantities in global market due to various factors that increases rice supply namely; rice development strategies that is focusing on improving quality of rice produced, rice control policy for trade missions and trade promotion on promoting rice, use of modern cultivation techniques and improved rice seeds.

The study conducted by Van and Treurnicht (2012) on a quantitative analysis of supply response in the Namibian mutton industry using Error Correction Model Approach to investigate the relationships between various price and non-price factors contributing to the supply dynamics within the mutton industry in Namibia. Results show that in the short run price of mutton has significant effect to the supply dynamics of mutton produced in Namibia. In the long run an increase in rainfall has a positive influence on the amount produce.

The present study used Vector Error Correction Model so as to estimate the rice supply function so as to determine the influence of price and-non price factors on rice supply to the export markets. Vector Error Correction Model is the appropriate model in this study as it shows both the short run and long run elasticities for better understanding of the reasons the volatilities of rice export supply in Tanzania.

2.3.3 Competitiveness of rice supply to foreign markets

Studies done by Balassa (1989), Irshad and Xin (2018) have employed Revealed Comparative Advantage (RCA) so as to estimate export competitiveness of Pakistani's rice. Another study conducted by Irshad *et al*. (2018) to estimate export competitiveness of rice exported from Pakistan from the period of 2003-2016 using RCA competitiveness index to estimate the Relative Export Advantage (RXA) of Pakistan's rice. Results revealed that Pakistan is highly competitive in exportation of rice due to that RXA obtained was greater than one (RXA>1), 4.27 therefore rice exported from Pakistan have got high potential to compete in international markets.

Patterson and Moshi (2016) studied about comparative advantage of Tanzania in exporting agricultural products to Comoros using Revealed Comparative Advantage to estimate Relative Export Advantage of agricultural crops exported to Comoros compared to other exporters. The results show that, Tanzania was competitive in exporting agricultural crops to Comoros given the calculated Relative Export Advantage of 1.118 (RXA>1). Meaning that, competitiveness of agricultural cops exported to Comoros was higher compared to other exporters of agricultural crops to Comoros such as Mauritius, United Arab Emirates, Vietnam and Pakistan. Therefore there is a room for Tanzania to increase export earnings by retaining and improving the competitiveness of the agricultural crops produced including rice. The present study assessed the competitiveness of Tanzania rice exported with EAC regional market and the neighbouring countries such as Malawi, Zambia and Mozambique using relative export advantage.

Abdullah *et a*l. (2015) studied about competitiveness of Pakistan's rice compared to other exporters at global level. Results show that, Pakistan's rice is highly competitive in international market compared with rice from its competitors such as India because rice

sold from Pakistan is of lower price than rice from India. Also in Pakistan, rice is not the staple food; this allows Pakistan to be able export significant quantities to other countries. Pakistan is also sharing the common border with trading partners such as Iran, Afghanistan and China, this reduces the transport costs as a result rice from Pakistan becomes highly competitive in international market.

The outcomes on the study done on competitiveness among Asian exporters of rice in world rice market using Revealed Comparative Advantage and Revealed Competitive Advantage revealed that, Pakistan is the most competitive country in rice trade and ranks first in both agricultural product trade and total merchandise exports (Ilyas *et a*l., 2017).

The study conducted by Sampaothon (2016) on factors affecting the performance of Thailand export market in Chinese using multiple regression and revealed comparative advantage, the results discovered that Thailand is losing its competitiveness in Chinese market compared to Vietnam due to high labor cost, high production cost, high transport cost and existing discouraging government policies towards export market.

The outcomes of the study conducted by Kikuchi *et a*l. (2016) on competitiveness of domestic rice production in East Africa using Domestic Cost ratio, a case study of Uganda, revealed that rice produced in Uganda is under rain fed cultivation which accounts for 95% of domestic produced rice; this rice is less competitive in international market compared to the rice imported from Pakistani.

The study conducted by Adhikari (2017) on the performance and determinants of rice export from India discovered that rice exported from India using Nominal Protection Coefficient (NPC), where NPC was less than unity(NPC<1) indicating that basmati rice

exported from India highly competitive in international markets due to high higher price of basmati rice exported in international market.

Bandhu (2016) studied on assessing the trade competitiveness for Indian rice and wheat using Nominal Protection Coefficient where by the results indicated that Indian rice is highly competitive in international market than wheat due to that NPC of Indian rice exported is less than unity (NPC<1) while that of wheat is greater than one (NPC>1) indicating that Indian wheat exported is less competitive in international market however the NPC of rice is approaching one indicating that the competitiveness of Indian rice now is eroded.

Jagdambe (2016) on his study on analyzing of export competitiveness of Indian agricultural products with Asean countries using Revealed Comparative Advantage discovered that, India had comparative advantage to export rice to Asean countries due to rice exports growth caused by the adjustments of the exchange rate policy that resulted to the decrease of Indian's price of rice compared to others in international markets. Additional, the study also revealed that enclosure of other improved rice varieties in production of rice in India stimulated production of quality rice hence this enlarged competitiveness of Indian's rice in the international market.

There are various methods used in estimating the export competitiveness of agricultural products in the country such as Nominal Protection Coefficient (NPC), Domestic Cost Ratio (DCR) and Relative Export Advantage (RXA). Nominal protection coefficient (NPC) is the ratio of domestic prices to international prices net of freight, transportation charges (taking produce from exporting country to importing country) and traders' margin. It is also defined as the ratio of the domestic price to the world reference price of the

commodity under consideration. Nominal Protection Coefficient is a direct measure of competitiveness of a country towards a commodity in the context of free trade however NPC measures only the deviation of domestic prices relative price to the world prices.

The major advantages of RXA is that, RXA eliminates country and product double counting also it considers all traded goods and all countries rather than sub groups and referring to global trade intensity (Havrila and Gunawardana, 2003). This study therefore employed RXA to estimate competitiveness of Tanzanian rice exported due to the fact that RXA eliminates country and product double counting and also it considers all traded goods and all countries.

2.3.4 Factors affecting participation in export markets by rice traders

According to Moono (2015) who conducted a study on factors influencing market participation by the smallholder rice farmers in western province of Zambia using Heckman two-stage econometric model, the decision for rice farmers to enter in rice market is influenced by quantity produced, access to knowledge about output prices prior to sell and membership in farmer organizations.

The study conducted by Dawana *et a*l. (2018) on the determinants of smallholder farmer's decision to participate in output market in Ethiopia using descriptive statistics and Heckman two stage econometric methods to analyze the data, the results revealed that smallholder farmer's decision to participate in output market were influenced by accessibility of credit service, access to market price information, education status of household head, transport cost, membership in farmers organization whereby being a member of farm cooperative increase the quantity of marketable output.

The study by Mkuna (2014) on the determinants of Tanzanian SMAEs engagement in EAC (East Africa Community) cross border trade using logistic regression discovered that, access to market information, Non-Tariff Barrier (NTB) and transport costs were the main hindrances of market participation by Small and Medium Agro-Enterprises participation in cross border trade. The study suggested that efforts should be done by the government and private institutions should decentralize to helps in abolishing NTB's and to assist in smoothing trade activities however this study said nothing about the influence of trade policies awareness towards market participation, therefore the present study filled this knowledge gap also by looking on how awareness of current existing trade policies to the rice traders influence participation in export markets.

The study by Rabbi *et a*l. (2017) on factors affecting rice trader's market participation in China using Heckman two-stage model discovered that age, vocational training and gender of the household head are the major determinants of market participation. The study suggested that in order to increase market participation, the government should subsidize inputs and developing new improved technology so as to increase production and achieve rice commercialization.

2.4 Review of Modeling Issues in Supply Response

2.4.1 Stationarity of the variables

Stationarity of variables is one of the basic requirements for time series analysis. A time series variable is referred to as stationary if it does not exhibit an upward or downward trend over time (Greene, 2012). This implies that the mean of such variable, as well as its variance and autocorrelation pattern must remain the same or consistent over time. Stationarity also implies constant variance of data and presence of homoscedasticity in the data. However, when given time series variable fail to meet these basic criteria, it is

referred to as non-stationary and implies that it exhibits a trend over time (Wooldridge, 2002). When this anomaly of non-stationarity is not tested for before estimating time series model, it leads to spurious regression outcome. To overcome the problem of non-stationarity of time series variables, the Augmented Dickey-Fuller test is used to diagnose the variables. The Augmented Dickey-Fuller t-statistic involves differencing time series data to make it stationary (Gujarati, 2004).

The null hypothesis of the Augmented Dickey-Fuller t-test is stated as;

H_0: $\theta = 0$ (implying that the data needs to be differenced to make it stationary)

While the alternative hypothesis is stated as;

H_0: $\theta < 0$ (implying that the data is stationary and doesn't need to be differenced)

2.4.2 Autocorrelation

Autocorrelation is a phenomenon that is also referred to as serial correlation. In the presence of autocorrelation, the observed errors follow a pattern that is correlated (Greene, 2012) and the lagged value of the dependent variable appears as a regressor in estimating the relationship. Hence, the lagged dependent variable cannot be independent of the error term because the dependent variable is in part determined by the disturbance or error term.

2.4.3 Co-integration

When the non-stationarity of the time-series is confirmed, co-integration provides an appropriate statistical techniques to further investigate if there is a statistically significant relationship between the non- stationary time-series (Gujarati, 2004). Co-integration also helps in identifying equilibrium or long run relationships between variables and can be used with non-stationary data to avoid spurious regression.

For time series to be co-integrated, two conditions have to be satisfied; (i) the series must all be integrated to the same order and (ii) there must be a linear combination of the variables and is integrated to an order lower than that of the individual series. The error term from the co-integration regression is stationary, *I* (0) only if in a regression equation the variables become stationary after first differencing (Greene, 2012).

The co-integration regression is expressed as:

$$Y_t = \alpha + \beta X_t + \mu t \qquad (3)$$

Where:

Y_t and X_t are both *I* (1) and the error term is *I* (0), meaning that the series are co-integrated of order *I* (1,0)

β Measures the equilibrium relationship between the series Y_t and X_t and μt is the deviation from the long-run equilibrium path.

An equilibrium relationship between the variables implies that even though Y_t and X_t series may have trends, the movement in one series is matched by movements in the other series (Wooldridge, 2012).

The co-integration procedure is based on the principles of unrestricted Vector Autoregressive (VAR) model specified in error-correction form (Gujarati, 2004). The two methods used in these test procedures are the trace test and the maximum eigenvalue.

It is required that before doing the co-integration tests, the optimum order of lag length of the variables should be specified. The choice of optimum lag length could be determined accurately by using the Schwartz Information Criteria (SIC) and Akaike Information Criteria (AIC) to determine the optimal lag lengths (Gutierrez *et al.*, 2009). These can also

be supplemented by using the Scharz Bayesian Criterion (SBC) and the Hannan-Quin Information Criterion (HQ), mainly to confirm the consistency of the results.

2.4.4 Vector Error Correction Model

According to Engle and Granger (1987), the process of transforming a non-stationary time series data series into a stationary time series data leads to loss of valuable long run information, however, the error correction models (ECMs) helps to resolve this problem. The error correction model is dynamic; it involves lags of the dependent and independent variables and captures both the long run and short-run adjustments (Paltasingh and Goyari, 2013). The short-run adjustment is indicated by the coefficients of lagged explanatory variables. Moreover, the Error Correction Model (ECM) helps to overcome the problem of autocorrelation because it has a well-behaved error term and allows for consistent estimation of the parameters by incorporating both short-run and long-run effects (Gujarati, 2004).

CHAPTER THREE

3.0 METHODOLOGY

3.1 Research Design

The present study employed the longitudinal design as it utilized data collected at many points in time. The study was based on both secondary data and primary data whereby the secondary time series data covering the period of 1970 up to 2018 was used for the first specific objective, for the second specific objective secondary data covering the period of 2005 up to 2018 was used while for the third specific objective, the study used cross sectional data collected from 150 rice traders in Tanzania.

3.2 Description of the Study Area

This study had national coverage but with specific focus on regions with various rice traders such as Dar es Salaam, Kahama district in Shinyanga, Kilombero district in Morogoro and Mbarali district in Mbeya. This study was conducted in Tanzania in different rice trading zones and all other regions that were found to have rice exporters such as Shinyanga, Musoma, Dar-Es Salaam, Dodoma, Morogoro region and Mbeya region (Mbabrali district), Maswa, Bariadi, Kahama district in Shinyanga region, Arusha and Kilimanjaro region.

3.3 Conceptual Framework

The conceptual framework in Figure 4 illustrates the interrelationships of variables in this study. Based on the findings of empirical review, the determinants of rice supply for export market in Tanzania is a function of socio-economic factors, institutional factors, price factors, non-price factors and production and trade policies in the country. Production and trade policies affect rice supply through different channels. Production and

trade policies of Tanzania could impact on the competitiveness of rice export by affecting positively or negatively the production costs. The production and trade policies could affect the non-price factors, institutional factors and price factors and through these channels affect the volume of rice export. Therefore, quantity of rice supplied to the export markets is a function of several factors such as price factors, non-price factors, institutional factors, socio-economic factors of market participants, production and trade policies, domestic production as well as the competitiveness of Tanzanian rice supplied to the export markets.

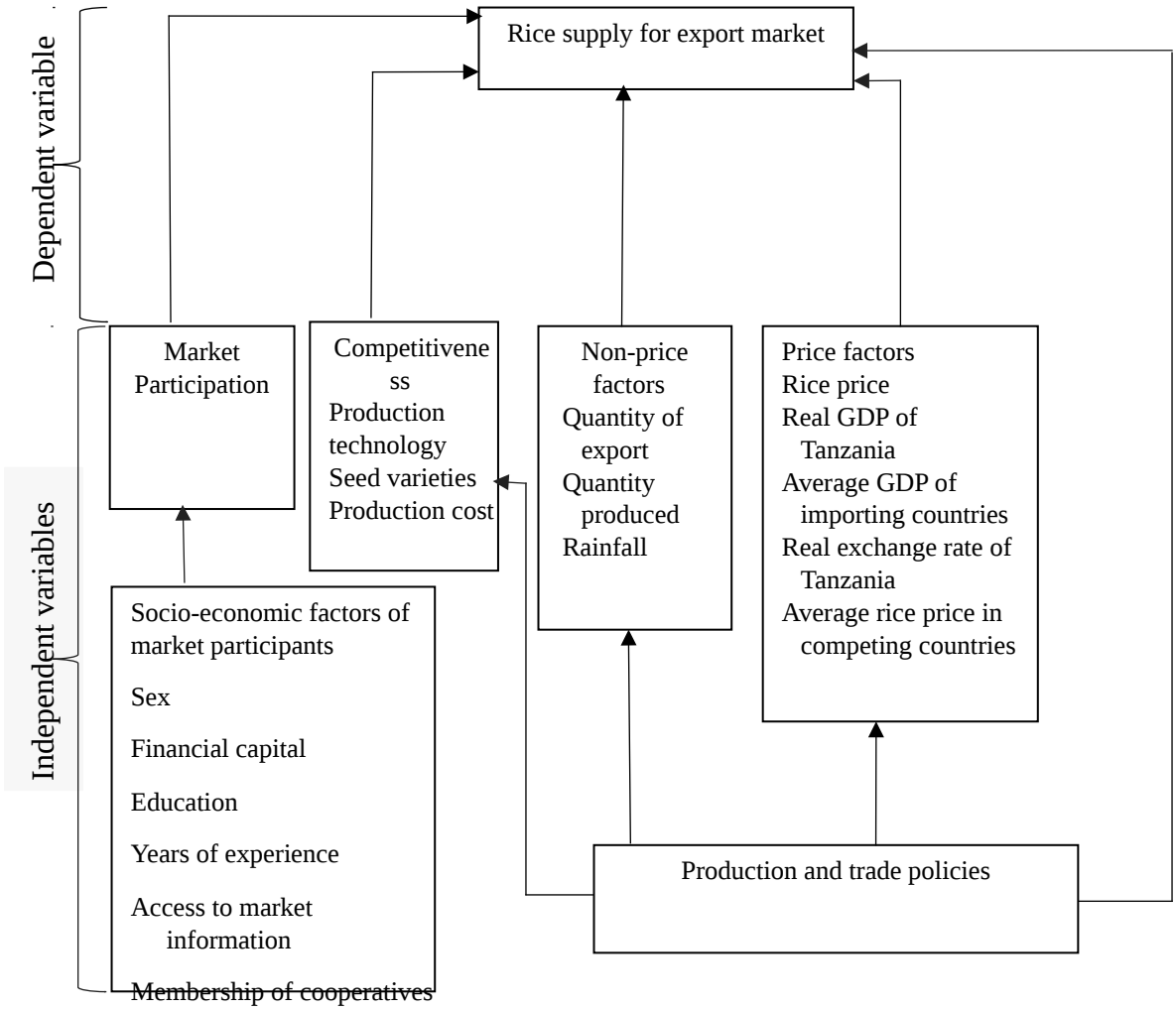

Figure 4: Conceptual framework

Source: Own conceptualization

3.4 Sampling Procedure and Sample Size

The list obtained from Ministry of Agriculture (MoA), Food security department was used as a sampling frame for the study and it contained 240 rice exporters. According to prior information given by the Ministry of Agriculture concerning the trend of rice exporters, information shows that there is fluctuations on export thus exporters were not exporting regularly. Therefore Simple Random Sampling was implemented by generating random numbers in Excel and selecting 150 rice exporters among which some are still exporting rice while others at the present are not participating in rice export thus they have been regarded as non-participant. This is further illustrated in Table 1.

Table 1*: Sample size showing participants and non-participants*

Region	District	Participant	Non participant	Total
Shinyanga	Kahama	42	22	64
Dar es Salaam	Kinondoni	13	17	30
Dodoma	Dodoma	7	12	19
Kigoma	Kibondo	3	7	10
Mara	Musoma	6	5	11
Mwanza	Magu	3	6	9
Kagera	Bukoba	3	4	7
Total		**77**	**73**	**150**

Equation 4 is the formula for sample size determination with the known population size as it has been indicated by Israel (1992). Suppose we desire a 95% confidence level and ±5% precision. The resulting sample size is verified in Equation 4.

$$n_{=}\frac{N}{1+N(e)^2} \quad \text{..... (4)}$$

Where; N =240, $e = 0.05$ n=Sample size required

$$n = \frac{240}{1 + 240(0.05)^2}$$

$n = \frac{240}{1.6}$ N=Population size, n=Sample size required, e=is the level of precision

n=150

3.5 Data Source and Data Collection

The study is based on both secondary and primary data. Time series data covering the period of 1970-2018 obtained from Government institutions such as National Bureau of Statistics (NBS) and Ministry of Agriculture, Food Security department, FAOSTAT, WITS (World Integrated Trade Solution) and International Trade Center (ITC). The primary data were collected from 150 random selected rice traders in Tanzania. A list of 240 rice traders was obtained from The Ministry of Agriculture in Tanzania, Food Security department. A semi-structured questionnaire was used to collect primary data from rice traders within a time period of two months. Five enumerators were trained and each question on the questionnaire was discussed in detail regarding its concept, reason, measurement, coverage and the reference period. More description of data and sources of data shown in Table 2.

Table 2: *Data Sources and description of the variables*

S/N	Data source	Variable/data	Description	Measurements
1.	NBS	Quantity produced	Quantity of rice produced domestically	Tonnes
		Rice price	Price of rice in Tanzania	TZS
2.	BOT	Real GDP(Gross Domestic Product)	Tanzania's GDP measured at constant factor cost of 2010	US$
3.	FAOSTAT	Rainfall	Annual rainfall	MM
		Average price in competing countries	Average international rice price in competing countries such as Thailand, Vietnam, China and India	US$
		Average GDP of importing countries	Average GDP of importing countries such as Kenya, Uganda, Burundi and Rwanda	US$
4.	ITC	Exchange rate	Real exchange rate	US$
5.	WITS	Export value(USD)	Export value of rice exported in Tanzania and rice competing countries	US$
6.	Ministry of Agriculture, Food security department	Rice exporters	List of rice exporters in Tanzania(participants and non-participants in export markets)	Number of exporters
7.	Cross sectional survey of rice traders in Tanzania	Factors influencing rice traders participation in export market	Sex (Dummy variable)	1=Male 0=Female
			Experience	Years
			Membership of cooperative society	1= Yes 0=No
			Access to market information	1= Yes 0=No
			Level of education	Years
			Overall financial capital	TZS

3.6 Analytical Models

3.6.1 Vector error correction model estimation and specification

The first specific objective which aimed to examine the influence of price and non-price factors on rice supply to the export markets was analysed using Vector Error Correction Model so as to estimate the supply function of rice. The supply function estimated by Vector Error Correction Model was used to determine how rice supply to export markets in Tanzania responds to changes in price and non-price factors. The estimation of the supply function model was done by adopting Vector Error Correction Model using

statistical software E-views. The factors affecting rice supply to the export markets were identified using log linear type of supply function as used by Boansi (2013) and Mwinuka and Mlay (2015).

The supply function to be estimated was presented is as follows:

$$lnQe_t^s = \beta_0 + \beta_1 lnAvGDP\ per\ capita_{t-1} + \beta_2 lnRRiceprice_{t-1} + \beta_3 lnRExch_{t-1} + \beta_4 lnRGDP_{t-1} + \beta_5 lnREXR_{t-1} + \beta_6 lnRain_{t-1} + \beta_7 lnACPRICE_{t-1} + U_{t-1} \ldots\ldots (5)$$

Where:

Where; lnQ_t^s = natural log of quantity of rice exported

$lnAvGDP\ per\ capita_{t-1}$= natural log of real Average GDP per capita of the importing countries of rice from Tanzania

$lnACPRICE_{t-1}$= natural log of average rice price in competing countries at time t-1 in international market

$lnPrice_{t-1}$= natural log of rice price at time t-1

$lnRGDP_{t-1}$= natural log of Real Gross Domestic Product in Tanzania at time t-1

$lnREXR_{t-1}$= natural log of Real Exchange Rate in period t-1

$lnRAINF_{t-1}$ = natural log of rainfall in periodt-1

$lnQP_{t-1}$ = natural log of quantity of rice produced in the country in periodt-1

U_t= other factors that affecting rice supply to export markets at time t-1.

3.6.2 Estimation procedure of Vector Error Correction Model (VECM)

Vector Error Correction Model is defined as a restricted Vector Auto Regression (VAR) model designed for the use of stationary data that are known to be co-integrated. Vector

Error Correction Model displays both short run and long run dynamics of the VECM is presented as follows:

$$\Delta Y_t = \theta + \sum_{i=1}^{k-1} Y_i \, \Delta Y_{t-i} + \sum_{j=1}^{k-1} n_j \, \Delta X_{t-j} + \sum_{m=1}^{k-1} \theta \varepsilon_m \, \Delta R_{t-m} + \lambda ECT_{t-1} + \mu_t .. (6)$$

Where;

ΔY_t=Is the dependent variable in the model

ECT_{t-1}=Error Correction Term which explains the previous year's deviation from long run equilibrium

k-1=Lag length

λ =Measures the speed of adjustment at which the dependent variable Y returns to the equilibrium after changes in the independent variables

For rice supply function in this study, the specified Vector Error Correction Model is as follows:

$$\Delta lnRiceQe_{t-1} = \theta_0 + \Delta lnAGPD_{t-1} + \Delta lnPrice_{t-1} + \Delta lnQp_{t-1} + \Delta lnExch_{t-1} + \Delta lnACP_{t-1} + \Delta lnRain_{t-1} + \Delta lnRGDP_{t-1} + ECT_{t-1} + \mu_t$$ .... (7)

Where:

ECT_{t-1}=Co-integrating equation in the long run model

$$ECT_{t-1} = Y_{t-1} - n_j X_{t-1} - \varepsilon_i R_{t-1} \qquad (8)$$

ECT_{t-1}Explains the previous year's deviation from the long run equilibrium in the sense that, last period deviation from the long run equilibrium influences the short run dynamics of the dependent variable(Y_t)

The coefficient of the ECT (λ) measures the speed of adjustment, it measures the speed at which the dependent variable (Y_t) returns to the equilibrium after changes in the independent variables in the model

Δ=represents the difference operator

μ_t=Is the disturbance term

3.6.3 Expectation and justification of the variables in vector error correction model

3.6.3.1 Rice price

As stipulated by demand and supply theory, the higher the price, the higher the quantity supplied (ceteris paribus). Rice price is expected to have positive relationship with rice export supply. As rice price increases in Tanzania, rice production domestically will also increase due to that rice producers will increase the amount of rice to be produced also, other farmers will shift from growing other crops and starts cultivating rice thus there will be surplus produced hence increase of rice supply to the export markets.

3.6.3.2 Gross domestic product of Tanzania

There is expected a positive relationship between quantities of rice supply to export markets and Gross Domestic Product of Tanzania. Increase of GDP of Tanzania economy shows the strength of Tanzania economy hence there will be more interventions of the Tanzanian government to the rice sub-sector as a result production will increase hence causing the increase of rice supply to the export markets.

3.6.3.3 Quantity produced

Quantity produced reveals the volumes of production that is supplied to the export markets at given international rice prices. Domestic rice production is expected to have a positive relationship with rice supply to export markets due to that as rice production increases there will be sufficient rice and surplus rice to be exported (ceteris paribus).

3.6.3.4 Exchange rate

When exchange rate of Tanzanian currency with dollar increase, then rice exports also is expected to increase (ceteris paribus). Devaluation of domestic currency makes the exports cheaper than previous. Thus a positive impact of exchange rate is expected on rice export from Tanzania due to that higher exchange rate due to depreciation of domestic currency leads to the decrease of rice prices abroad in turn leads to increase of rice exports; also devaluation increase competitiveness of Tanzanian rice exported hence higher exports.

3.6.3.5 Average GPD per capita of importing countries

Tanzania is well known to export rice to the neighbouring countries. Rice importing countries of rice from Tanzania includes; Rwanda, Burundi, Kenya, Uganda, United Republic of Congo and South Sudan. Average GDP per capita of importing countries shows the purchasing power of these countries. The higher the average GDP per capita of importing countries (ceteris paribus), the higher the purchasing power thus increases rice to be purchased from Tanzania. Average GDP per capita of importing countries of rice form Tanzania is expected to have positive influence to the increase of rice export in Tanzania.

3.6.3.6 Average international price

Average international price of rice is the price of rice in international markets especially to the countries who are the major competitors of Tanzania in export market and it is quoted in US$. These countries include the Asian countries such as Thailand, Pakistan, Vietnam, China, India and Bangladesh. The increase of rice price to competitors of Tanzania (Asian rice exporting countries (assuming rice price in Tanzania remains constant), importers will be attracted to buy Tanzanian rice because of competitive advantage. So, a positive impact of international price is expected on increase of rice exports from Tanzania.

3.6.3.7 Rainfall

The expected sign between rainfall and rice supply to the export markets is positive. Sufficient rainfall stimulates production due to availability of sufficient water for rice crops during farming activities therefore results to the production of surplus of rice to be exported hence increase rice supply to the export market.

Table 3*: Expected signs of the parameters to be estimated by VECM*

Variable	Description	Measurement	Expected sign
Average GDP per capita	Average GPD per capita of importing countries of rice from Tanzania	USD/TZS	Positive(+)
Rice price	Rice price	USD/Tsh	Positive(+)
Average international price	Average rice price in major competitors of Tanzania in international market	USD/TZS	Positive(+)
Real GDP	GPD of Tanzania	USD/TZS	Positive(+)
Quantity produced	Quantity of rice produced in Tanzania	Tonnes	Positive(+)
Exchange rate		USD/TZS	Positive(+)
Rainfall	Annual rainfall measured in mm	mm	Positive (+)

3.6.4 Revealed comparative advantage

The competitiveness of rice supplied to export markets was assessed using Revealed Comparative Advantage to estimate the Relative Trade Advantage (RTA) of Tanzania in rice export. The model is based on the economic theory of comparative advantage. The model is a theoretically- consistent measure of Ukwadu (2015). It has the advantage of being able to isolate the exporter-specific factors that drives trade flows, addresses issues of asymmetry and double counting and it takes into account the size of a country's economy in order to enable a dynamic measure rather than a static measure of comparative advantage (Balassa, 1989).

RTA=RXA-RMA…….…….. (9)

RXA=Relative Export Advantage,

RMA=Relative Import Advantage

$RXA_{ij} = \frac{X_{ij}}{X_t} / \frac{X_{jw}}{X_{wt}}$……..... (10)

RXA_{ij}=Relative Export Advantage of a country i in exporting commodity j

X_{ij}=is the country's export of commodity j

X_t=is the country's total exports

X_{jw}= is the world's export of commodity j

X_{wt}=is the total world exports

Tanzania is exporting rice to the neighbouring countries which are the countries within EAC block and other neighbouring countries such as South Sudan and Democratic

Republic of Congo. Therefore, competitiveness of Tanzanian rice exported is assessed relative to the competing countries in the world which are countries that also exports rice. These countries includes; India, Pakistan, Vietnam, Thailand, Bangladesh, Philippines and China. Therefore, RXA_T is used to assess the competitiveness of Tanzanian rice exported relative to the competing countries in the world by comparing the rice export share of Tanzania relative to the rice export share of the competing countries in the international market. The formula for assessing competitiveness is given as follows;

$$RXA_T = \left(\frac{Xr_T}{Xe_T}\right) / \left(\frac{Xr_{EAC}}{Xe_{EAC}}\right) \quad \text{..... (11)}$$

Where;

Xr_T = Tanzania rice exports to the neighbouring countries

Xe_T = Tanzania total exports to the neighbouring countries

Xr_{EAC} = Rice export of competing countries to EAC block, Congo and South Sudan

Xc_{EAC} = Total exports of the competing countries to EAC block, Congo and Sudan

If RXA is greater than one (RXA>1) meaning that Tanzanian rice exported is competitive in international markets compared to other competing countries while if RXA is less than one (RXA<1), this means that Tanzania is less competitive in exporting rice related to the competing countries.

3.6.5 Binary logit model estimation and specification

Binary Logistic regression was used in analysing factors influencing participation in export markets by rice traders. This model was adopted due to the fact that, the dependent variable was binary variable which means that the variable stands for whether or not the rice trader participated in export markets. This model was used in determining the probability on which rice traders participated on export markets. The dependent variable is binary variable as there are participants and non-participants in rice export markets. Probability lies from 0 to 1 where by 0 is for non-participants while 1 is the probability given to participants of rice trader in export markets. This model is appropriate for achieving this objective because response of rice traders is dichotomous as it takes one of only two possible values representing success and failure where by success is whether rice traders participated in export market and failure if they did not participated in rice export market.

Specification of binary logit model is as follows:

The decision of rice trader on whether to participate or not to participate in export markets is influenced by various factors (*Xi*) therefore this can be represented in the regression equation 12

$Y^*_i = X'iB_k + \varepsilon_i$; $\varepsilon_i \approx$Logistic distribution for binary logit model……. (12)

If y_i=1, then $Y^*_i > 0$ and if y_i=0, then $Y^*_i \leq 0$

Meaning that if rice trader decides to participate in export markets, Y^*_i=1 and if rice trader will not participate in export market, $Y^*_i \leq$0

The probability(P_i) that rice trader will participate in export market can be determined as follows:

$$P[y_i = 1] = P[P^* > 0] \quad \text{(13)}$$

From equation 8 above, $Y^*{}_i = X'iB_k + \varepsilon_i$, therefore by replacing y_i in equation 9, the new equation will be as follows:

$$P[y_i = 1] = P[X'iB_k + \varepsilon_i > 0] \quad \text{(14)}$$

$$\equiv P[y_i = 1] = P[\varepsilon_i > -X'iB_k] \quad \text{(15)}$$

The logistic distribution is symmetric such that

$$P[y_i = 1] = P[\varepsilon_i > -X'iB_k] \equiv P[y_i = 1] = P[\varepsilon_i \leq B_k X'] = \Lambda X'iB_k \quad \text{(16)}$$

The cumulative function is given in equation 17.

$$P[y_i = 1] = \frac{e^{X'iB_k}}{1+e^{X'iB_k}} \quad \text{(17)}$$

The probability of rice trader who decide to participate in export market is $P[y_i = 1]$ while the probability of rice trader not to participate in export market $P[y_i = 0]$ is obtained by taking the difference between 1 and the probability of rice trader to participate in export market$P[y_i = 1]$, as shown in equation 18.

$$P[y_i = 0] = 1 - P[y_i = 1] = \frac{1}{1+e^{X'iB_k}} = 1 - \Lambda(X'iB_k) \quad \text{(18)}$$

The ratio of the probability of rice trader making decision to participate in export market $P[y_i = 1]$ to the probability of rice trader not to participate in export market is known as

odds ratio and in logarithmic form is known as log of odds ratio which is represented as follows:

$$ln\left[\frac{P[y_i=1]}{P[y_i=0]}\right] = X'iB_k = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \cdots \beta_k X_{iK} + \varepsilon_i \quad \text{..... (19)}$$

By including all variables used in this study to the model, the binary logit model can simply be expressed as follows:

$$ln\left[\frac{P[y_i=1]}{P[y_i=0]}\right] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \varepsilon_i \quad \text{..... (20)}$$

Where:

X_1=Sex

X_2 =Education

X_3=Years of experience

X_4 = Access to market information

X_5 = Membership in cooperative society

X_6=Overall financial capital

3.6.5.1 Expected signs of the parameters to be estimated

Table 1 describes the expected signs of the variables to be included in the model. If the sign is positive, the explanatory variable under consideration increases the probability of the rice traders to participate in export markets while if the sign is negative; it decreases the likelihood of rice trader to export rice.

Table 4: Expected signs of the parameters to be estimated by the binary logit *model*

Code	Variable	Description	Measurement	Expected sign
X_1	Sex	Sex of rice trader	1= male 0=female	+
X_2	Education	Education level of rice traders	No of years in school	+
X_3	Years of experience	Number of years of experience in rice trade	Years	+
X_4	Access to market information	Access to market information by rice trader	1=received marketing, 0=otherwise	+
X_5	Membership	Membership of cooperative by rice trader	1=member in cooperative society, 0=otherwise	+
X_6	Financial capital	Financial capital of the respondent	TZS	+

3.6.5.2 Sex

Sex of rice trader was expected to have a positive sign due to that, male rice traders are more expected to engage in rice export markets more than female rice traders. This is because rice exportation involves many movements thus male traders can easily more thus they are more likely to participate in rice export markets than female rice traders.

3.6.5.3 Financial capital

Financial capital of a rice trader was expected to have positive sign as the higher the financial capital, the higher the possibility of rice trader to invest in rice exportation business thus increases the possibility of rice trader being able to cover all necessary costs required in export procedures such as export permits, taxes and transportation costs. Therefore it increases the probability of rice trader to participate in export markets. Also availability of capital increases the likelihood of rice trader to export more rice as higher financial capital increases the bargaining power of rice trader in export markets due to the huge volume of rice traded.

3.6.5.4 Education

Education level of rice trader measured in the number of years of schooling was expected to have positive sign since the more years spent in school, the more knowledgeable the respondent become. This makes easier for them to comply with trade regulations and requirements therefore increases the possibility of rice traders participating in export markets.

3.6.5.5 Years of experience

Experience of the rice trader in conducting rice trade is expected to increases the likelihood of rice trader to participate in export markets. Years of experience was expected to have positive sign as the more experience rice trader has in rice trade, the more aware they become on the regulations, procedures, market information and skills required in exporting rice. Also, the more years of experience of rice traders in trading rice, the more knowledge they acquire regarding trading activities thus increasing the probability of rice traders participating in export markets.

3.6.5.6 Access to market information

Access to market Information was expected to have a positive influence on rice traders participating in export markets, thus it was expected to have a positive sign. Access to market information enables rice traders to be aware of the quality and rice preferences of their customers. Availability of market information also minimizes the transport costs that could be used by rice traders since they will be assured of the customer’s availability to the countries of destination where there is high demand.

3.6.5.7 Membership in cooperative society

Membership in cooperative society by rice trader was expected to have positive sign due to that it increases the likelihood of rice trader to acquire financial capital form other members in the cooperative hence increase the likelihood of participating in export market. Membership in cooperative increases solidarity of members in exporting rice as they can be able to extend their social capital hence they transport and sell their rice in bulk, this increases the probabilities of other poor traders in the group to be able to export rice. Also, membership increases financial capital stability and the bargaining power in international markets thus increases the profit to the members henceforth increases the possibility of rice traders participating in export markets.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSIONS

4.1 Socio-economic Characteristics of Rice Traders

Sex of the respondent, education level, experience in rice trade, membership of cooperative society, financial capital and access to market information (Table 5) are the important socio-economic characteristics of rice traders interviewed. The socio-economic characteristics of rice traders are further explained as follows;

4.1.1 Sex of the rice trader

Sex of the respondent has an implication on the distribution of roles and responsibilities in the society thus influencing decision of rice trader’s participation in export markets. Results show that, 77.3% were male traders while only 22.7% were females rice traders

(Table 5). This implies that, most of the rice traders were males traders. These results might be caused by the nature of the trade itself as it requires much movements, negotiations and close follow-up with the customers to ensure that rice is timely delivered and payments are made as required. Therefore, sometimes, women may get some difficulties to deal with some unfaithful male traders in other countries where they export rice. The study referred to here, points out that among other challenges which females rice traders face in the trade include sexual harassment as well as exploitation that results from limited knowledge of trade. These are likely to affect their participation in the rice trade. Also females in Tanzania play a major role in taking care of children, the sick, the elderly and family. Since women are much required to work closely with family members to meet their needs at home, this limit their participation in rice trade (Stärken and Wandeln, 2009).

4.1.2 Education

Level of education as measured in number of years spent in formal education is very important attribute in assessing rice trader's participation in export markets in Tanzania. Education enhances skills and ability to utilize better market information which reduces marketing costs thus makes it profitable to participate in export markets (Sigei *et al.*, 2014). The results show that, 19.3% of the rice traders attended primary education, 66.7% attended secondary education, 14% attended college/university level of education and none of the rice traders was uneducated. This shows that, most of the rice traders have obtained some level of education whereby large per cent being the rice traders with secondary level of education. This enables them to read, write as well as to communicate with other customers in in other countries during rice exportation activities. 66.7% of rice traders who attended secondary level of education imply that, secondary education is

likely to be useful in understanding, analysing and making better decisions on business transactions (Table 5).

4.1.3 Years of experience

Years of experience in rice trade is very important aspect on identifying rice trader's participation in export market. Experience in rice trade enables traders to take risks as well as to bear with the challenges that may occur during rice export activities. Also experience in rice trade increases awareness on the activities and procedures involved in rice trade thus increase rice trader's decision to participate in export markets. Results show that, 17.3% of rice traders had less than five years' of experience in rice trade, 48.7% had between 5 and 10 years of experience while 34% of rice traders had more than 10 years of experience in rice trade. Whereby, out of 150 rice traders interviewed, 48.7% (73) of rice traders seen to be experienced in rice trade between 5 and 10 years. The highly experienced rice traders are more likely to participate in rice export markets compared to others who do not have high experience in rice trade. Therefore, years of experience in rice trade is vastly influence rice trader's probability of participating in rice export markets (Table 5).

4.1.4 Membership in cooperative society

Membership in cooperatives societies by rice traders increases the probability of capital availability to the rice traders, helps to reduce the transaction costs and increase the bargaining power of rice traders in rice trade. Rice traders who are members in cooperative societies are more likely to participate in export markets compared to those who are not members of cooperative society. Results shows that, among 150 rice traders interviewed, 60% were members in rice cooperative society while 40% of rice traders interviewed were not members on cooperative society. This reveals that, those who are

members in cooperative societies, they have high probability of obtaining capital from other members in the group hence increases the likely hood to participate in export markets. Furthermore, through cooperative societies, rice traders can easily obtain market information thus they become aware on what is needed in the market. Also cooperative societies increases the bargaining power of rice traders in rice trade as they can be able to sell and export rice in bulk thus results to high probability of rice traders participation in export markets (Table 5).

4.1.5 Access to market information

In this study, market information was considered to be relevant in influencing the probability of rice traders participating in export markets. Such information includes; market price, market demand and consumers preference in terms of quality required. Through market information, rice traders become aware of the existing market price, quantity of rice demanded as well as the activities required in performing business transaction activities thus increases the likelihood of rice trader's participation in export markets. The results show that, among 150 rice traders interviewed, 54.7% of rice traders have accessed to market information while 45.3% were not accessed to the market information (Table 5). These results reveals that, market information is very important when conducting rice trade due to that, those who were accessed to the market information are the one who were highly participating in rice exportation.

4.1.6 Overall financial capital

Financial capital of rice trader is important aspect in conducting rice trade thus increases the likelihood of rice trader's participation in export markets. This is because, having a big amount of overall financial capital enables rice trader to highly invest in rice trade, cover the necessary costs and undertaking bigger risks in running business activities thus

increases the likelihood of rice trader's participation in export markets. Results show that, among 150 rice traders interviewed, 43.3% of rice traders had less than TZS 5 000 000/= overall financial capital, 48% had overall financial capital between TZS 5 000 000/= to TZS 15 000 000/= and 8.7% of rice traders interviewed had overall financial capital of more than TZS 15 000 000/=. These results reveal that, large percent of rice traders had an overall capital between TZS 5 million to TZS 15 Million (Table 5).

Table 5: *Socio-economic characteristics of rice traders*

Socio-economic characteristics	Frequency (n=150)	Percentage (Total=100%)
Sex		
• Male	116	77.3
• Female	34	22.7
Education		
• Primary education	29	19.3
• Secondary education	100	66.7
• University/College	21	14
• No formal education	0	0
Years of experience		
• <5	26	17.3
• 5-10	73	48.7
• >10	51	34
Membership in cooperative society		
• Member of cooperative society	90	60
• Not member of cooperative society	60	40
Access to market information		
• Rice trader is accessed to market information	82	54.7
• Rice trader is not accessed to market information	68	45.3
Overall financial capital		
• <5000 000	65	43.3
• 5 000 000-15 000 000	72	48.0
• >15 000 000	13	8.7

4.2`Binary Logistic Regression Estimates for the Intercept

Under Variables in the Equation we see that the intercept-only model is ln (odds) = 0.014. If we exponentiate both sides of this expression we find that our predicted odds [Exp(B)] = 1.014. This means that, the predicted odds of rice traders to participate in export market is 1.014. This is expressed in Table 6.

Table 6: Binary logistic regression estimates for the intercept

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	0.014	0.166	0.007	1	0.934	1.014

4.3 Omnibus Tests of Model Coefficients

The predictor variables which are introduced includes; age, sex, education, years of experience, access to market information, membership in cooperative society and overall financial capital of rice traders. Omnibus Tests of Model Coefficients gives us a Chi-Square of 129.701 on 7 degree of freedom, significant beyond 0.000. This shows that at least one of the independent variable is statistically significant in explaining the probability under which rice traders will participate in export market. This is illustrated in Table 7.

Table 7*: Omnibus tests of model coefficients*

		Chi-square	df	Sig.
Step 1	Step	129.701	7	0.000
	Block	129.701	7	0.000
	Model	129.701	7	0.000

4.4 Unit Root Test

4.4.1 Natural log of quantity of rice export in Tanzania

Table 8 shows the ADF unit root test for natural log of quantity of rice export. The H_0 states that natural log of quantity of rice export is non-stationary whereas the H_0 states that the natural log of quantity of rice export is stationary. The results show that the ADF test statistic is -2.711which is less than the 5% of the McKinnon value of statistic (-3.516). The P-value at 5% level of significance ($p<0.05$) is 0.0002 which is insignificant at 5% level of significance. Thus we fail to reject the null hypothesis that natural log of quantity of rice export in Tanzania is non-stationary at the level hence it has to be tested at the first difference as well.

4.4.2 Natural log of real GDP of Tanzania

Table 8 shows the ADF unit root test for natural log of real GDP. The H_0 states that natural log of real GDP is non-stationary whereas the H_0 states that the natural log of real GDP of Tanzania is stationary. The results show that the ADF test statistics is -4.977 which is greater than the 5% of the McKinnon value of statistic (-3.516). Thus the null hypothesis which states that natural log of real exchange rate is non-stationary at the level has been rejected.

4.4.3 Natural log of real exchange rate

Table 8 shows the ADF unit root test for natural log of exchange rate. The H_0 states that natural log of exchange rate is non-stationary whereas the H_0: states that the natural log of real exchange rate variable is stationary. The results show that the ADF test statistics is -3.327 which is less than the 5% of the McKinnon value of statistic (-3.516). Thus we fail to reject the null hypothesis that natural log of real exchange rate is non-stationary at the level hence it has to be tested at the first difference as well.

4.4.4 Natural log of average international price

Table 8 shows the ADF unit root test for natural log of average international price of rice in competing countries. The H_0 states that natural log of average international price of rice in competing countries non-stationary whereas the H_a states that the natural log of average international price of rice in competing countries is stationary. The results show that the ADF test statistics is -3.775 which is greater than the 5% of the McKinnon value of statistic (-3.516). Thus the null hypothesis which states that the natural log of average

international price of rice in competing countries is non-stationary at the level has been rejected.

4.4.5 Natural log of quantity of rice produced domestically

Table 5 shows the ADF unit root test for natural log of production. The H_0 states that natural log of production is non-stationary whereas the H_0 states that the natural log of rice produced domestically is stationary. The results show that the ADF test statistics is -6.183 which is greater than the 5% of the McKinnon value of statistic (-3.516). Thus the null hypothesis which states that the natural log of production is non-stationary at the level was rejected.

4.4.6 Natural log of average annual rainfall

Table 5 shows the ADF unit root test for natural log of rainfall. The H_0 states that natural log of rainfall is non-stationary whereas the H_0 states that the natural log of rainfall is stationary. The results show that the ADF test statistics is -4.119 which is greater than the 5% of the McKinnon value of statistic (-3.516). Thus the null hypothesis which states that natural log of rainfall is non-stationary at the level has been rejected.

4.4.7 Natural log of rice price

Table 8 shows the ADF unit root test for natural log of rice price. The H_0 states that natural log of rice price in foreign markets is non-stationary whereas the H_0 states that the natural log of rice price is stationary. The results show that the ADF test statistics is -2.216 which is less than the 5% of the McKinnon value of statistic (-3.516). Thus we fail to reject the null hypothesis that natural log of rice price in international market is non-stationary at the level thus it has to be tested at the first difference.

4.4.8 Natural log of average GDP of importing countries

Table 8 shows the ADF unit root test for natural log of rice price. The H_0 states that natural log of rice price in foreign markets is non-stationary whereas the H_0 states that the natural log of rice price is stationary. The results show that the ADF test statistics is -5.559 which is greater than the 5% of the McKinnon value of statistic (-3.516). Thus the null hypothesis which states that natural log of average GDP of importing countries is non-stationary at the level has been rejected.

Table 8: *Summary of the unit root test results of the variables at the level*

S/NO	Variable	Variable at the level		P-values (5%)
		Test statistic	Critical value (95%)	
1.	Lnquantity export	-2.711	-3.516	0.2315
2.	LnRice price	-2.216	-3.516	0.4811
3.	LnAverage GDP of importing countries	-5.559	-4.187	0.0000
4.	LnAverageinternational price	-3.775	-3.516	0.0179
5.	LnRexchange rate	-3.327	-3.516	0.0619
6.	LnProduction	-6.183	-3.516	0.0000
7.	LnRGDP	-4.977	-3.516	0.0002
8.	LnAvAnnualRainfall	-4.119	-3.516	0.0059

Generally, results of the tests show that three variables that is rice price, real exchange rate and quantity of rice export are non-stationary at the level as the ADF values were less than the critical values. This implies that these variables need to be tested at the first difference. But when the variables were tested at the first difference, they were all found to be stationary as ADF values were greater than the critical value implying that they follow I(1) series and the p-values ($p<0.05$) were statistically significant at 5% level of significant that is therefore Vector Error Correction Model was employed for analysis. Summary of the unit root test of the variables in the time series data at the first difference is shown in Table 6. All variables were found to be stationary after the first difference implying that they follow I(1) series. Since all variables are stationary at I(1), therefore Vector Error Correction Model was employed for analysis (Table 9).

Table 9: Summary of the unit root test results of the variables at the first difference

	Variable	Variable at the first difference		P-values (5%)
		Test statistic	Critical value (95%)	
1.	D(Lnquantity export)	-7.434	-3.524	0.0000
2.	D(LnRice price)	-7.364	-3.524	0.0000
3.	D(LnAverage GDP of importing countries)	-10.627	-3.524	0.0000
4.	D(LnAverage international price)	-9.263	-3.524	0.0000
5.	D(LnRexchange rate)	-6.386	-3.524	0.0000
6.	D(LnProduction)	-10.453	-3.524	0.0000
7.	D(LnRGDP)	-9.113	-3.524	0.0000
8.	D(LnAvAnnualRainfall)	-14.201	-3.524	0.0000

4.5 Lag Length Selection Criteria

Before estimating a time series equation, it is important to decide on the maximum number of lags (Gujarati, 2004). The rule of thumb is to select the criteria with lowest lag length because the lower the number, the better the model. Therefore, the study choose the lag length for which the values of most of these lag length criteria is minimal (Gutierrez *et al*., 2009). Table 10 shows that the optimal lag length is 2 and the best selection criteria to adopt for the model is Schwarz information criterion.

Table 10: Lag length selection criteria

Lag	LL	LR	df	p	AIC	SC	HQ
0	-175.68				08.911	9.017	9.2039
1	-45.19	260.99	49	0.000	4.936	5.788	7.277
2	211.92	200.94	49	0.000	-0.435*	2.654*	8.048
3	38.338	167.06	49	0.000	3.251	4.842	7.642
4	111.45	146.23	49	0.000	2.075	4.419	8.512

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final Prediction Error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

4.6 Johansen Co-integration Test

Co-integration test is important so as to see whether the variables have long run relationship or not. The presence of co-integrating equation or equations implies there exists a long-run relationship between the variables of interest. The H_0 states that there is no co-integration between the variables while the H_a: states that there is co-integration between the variables. The Johansen approach was used to test for co-integration and it was found that the Maximum Eigen value test verifies the evidence of one co-integrating equation as presented in Table 11.

Based on the results obtained, the null hypothesis of no co-integration (H_0: $r = 0$) is rejected at $p < 0.05$ because the computed Maximum Eigenvalue test (127.06) is higher than the critical value (52.36). The Max-eigenvalue test indicates 1 co-integrating equation at 0.05 significant levels. Green (2006) points out that, before running a VECM, the variables should be co-integrated at the same level. This is the necessary condition before running the VECM. Since the Maximum Eigenvalue test indicates presence of 1 co-integrating equation at the 0.05 level, therefore it is plausible to conclude that the variables are co-integrated and possible to estimate the Vector Error Correction Model.

Table 11: Johansen co-integration test results based on Max-Eigen value

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
0	0.633906	45.21891	46.23142	0.0639
1*	0.940607	127.0610	52.36261	0.0000
2	0.567782	37.74711	40.07757	0.0895
3	0.499948	31.18694	33.87687	0.1013
4	0.335492	18.39185	27.58434	0.4628
5	0.282254	14.92378	21.13162	0.2943
6	0.115400	5.517911	14.26460	0.6755
7	0.014602	0.661933	3.841466	0.4159

* Denotes rejection of the hypothesis at the 0.05 level, CE(s) = Co-integrating equations

Furthermore, it was found that the Trace Test statistic verifies the evidence of one co-integrating equation as presented in Table 12. The results of the Johansen co-integration test shows that, the computed trace test statistic is (153.6484) are greater than the critical value (125.6154). Therefore, the null hypothesis of no co-integration is rejected at 0.05% level of significance.

Table 12*: Johansen co-integration test results based on the trace test statistic*

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
0	0.237653	159.5227	280.1697	0.7341
1 *	0.633906	153.6484	125.6154	0.0003
2	0.167782	95.7536	108.5366	0.5160
3	0.249485	67.8242	70.6889	0.0426
4	0.335492	39.49547	47.85613	0.2411
5	0.282254	21.10362	29.79707	0.3512
6	0.115400	6.179845	15.49471	0.6743
7	0.014602	0.661933	3.841466	0.4159

* Denotes rejection of the hypothesis at the 0.05 level, CE(s) = Co-integrating equations

4.7 Influence of Price and Non-Price Factors on Rice Supply to the Export Markets

Table 13 indicates the factors that influence rice export supply in the short run. Estimated coefficients in Table 13 are statistically significant with the exception of export quantity lagged in one period (Qe_{t-1}) and export quantity lagged two periods (Qe_{t-2}), quantity produced lagged two periods (Qp_{t-2}) and real GDP of Tanzania lagged one period. Elasticity of rice price lagged one period is 6.0724 and is statistically significant at 5% level of significance. That is, 1% increases of rice price results to 6.0724% increase of rice export supply (ceteris paribus). This support the supply theory that, the higher the price, the higher the quantity supplied, holding other factors that influence supply constant.

These results are contrary to the study done by Paltasingh and Goyari (2013) on supply response of rice in rain fed agriculture of Odisha, Eastern India who revealed that price elasticity of rice is 0.37 while elasticity of weather found to be very high which is 0.59 indicating that non-price factors are more important on influencing rice produce than price factors.

Elasticity estimates of international rice price lagged one period and two periods is 6.0723 and 9.583 respectively and statistically significant at 1% and 5% level of significance respectively. The results of the Vector Error Correction Model in the short run are further illustrated in Table 13.

Table 13: Results of the short run elasticity estimates of the influence of price and non-price factors on rice supply to the export markets

Variable	**Short run elasticity estimates**			
	Coefficients	**Standard Errors**	**T-Statistics**	**P-values**
CointEq1	-0.4012	0.1148	-3.4785	0.0013
ΔLnExpQuanty(-1)	-0.0075	0.0277	0.2809	0.7809
ΔLnExpQuanty(-2)	-0.2751	0.1502	-1.8320	0.0780
ΔLnRiceprice(-1)	6.0724	2.5152	2.3742	0.0112**
ΔLnRiceprice(-2)	0.0497	0.1331	0.3559	0.7210
ΔLnRealGDP(-1)	-0.1898	0.1924	0.9862	0.3304
ΔLnRealGDP(-2)	0.8743	0.2655	3.3125	0.0141**
ΔLnRealExch(-1)	0.0078	1.4514	4.9708	0.0054**
ΔLnRealExch(-2)	0.0436	27.890	2.5430	0.0170**
ΔLnQuantityP(-1)	0.4014	0.1404	-2.8760	0.0078**
ΔLnQuantityP(-2)	-5.0615	0.1412	-0.5798	0.5667
ΔLnAinternPric(-1)	6.0723	1.2033	2.2124	0.000***
ΔLnAinternPric(-2)	9.5828	4.3644	2.1956	0.0024**
ΔLnAGDPofimp(-1)	4.4589	1.3478	3.1514	0.0019**
ΔLnAGDPofimp(-2)	5.3221	13.3949	3.3611	0.0023**
ΔLnAnnualRain(-1)	0.4192	0.4347	0.9641	0.5102
ΔLnAnnualRain(-2)	1.374	0.0395	1.9373	0.2969
C	2.5917	0.2364	0.0598	0.1934
R-squared	0.8437	F-statistic	9.864	
Adj. R-squared	0.5843	Prob(F-statistic)	0.0302	
		Durbin-Watson	1.5242	

* indicates 90% confidence level, ** indicates 95% confidence level and *** indicates 99 level of confidence

An R-squared of 0.8437 indicates that, 84.3% of variation in rice supply for export markets can be explained by the variables in the model. With an F-Statistic probability of 0.0302 we can conclude that the Vector Error Correction model as a whole is statistically significant at 0.05 significance level.

4.7.1 Interpretation of short-run elasticities

Equation 21 shows the short run estimates of the variables estimated by the Vector Error Correction Model where by rice price, average GDP per capita of importing countries, international price, production lagged one period and real GDP of Tanzania, are statistically significant by influencing rice export supply. The equation can be illustrated as follows:

$$\Delta LnQe_{t-1} = -0.4021ECT_{t-1} - 0.0075\Delta LnQe_{t-1} - 0.2751\Delta LnQe_{t-1} + 6.0724\Delta LnRiceprice_{t-1} + 0.0497\Delta LnRiceprice_{t-2} - 0.1878\Delta LnRealGDP_{t-1} + 0.8743\Delta LnRealGDP_{t-2} + 0.0078\Delta LnRealExch_{t-1} + 0.4041\Delta LnQp_{t-1} - 5.0615\Delta LnQp_{t-2} + 6.0723\Delta LnInternPrice_{t-1} + 9.5823\Delta LnInternPrice_{t-2} + 4.4589\Delta LnGDPofimpor_{t-1} + 5.3221\Delta LnGDPofimport_{t-2} + 0.4192\Delta LnAnnualRain_{t-1} + 1.374\Delta LnAnnualRain_{t-2} + 2.5917 \quad \text{.....(21)}$$

The coefficient of the ECT_{t-1} measures the speed of adjustment at which the dependent variable (Qe_{t-1}) returns to equilibrium after changes in the explanatory variables in the model. From the results of VECM in the short run, the ECT of 0.4021 indicates that, about 40.21% departure from long-run equilibrium is corrected in each period. Meaning that, if there is a departure in the long run equilibrium caused by the previous year's deviation, it will be corrected in the current period at an adjustment speed of 40.20%. Given a p-value of 0.0013 which is less than the 0.05 level of significance, it indicates that the speed of adjustment is statistically significant ($P<0.05$).

Variations in the volume of rice quantity exported is not only a function of changes in the endogenous variables in the model but also previous years changes in the dependent

variable (Qe_{t-1}). However, this is not the case in the present study as the results show that, rice quantity exported lagged for one and two periods both had negative effects to the current rice supplied to the export markets. Meaning that, previous years exports have no influence on the current year's rice export supply.

In the short-run, a percentage increase in existing capacity of the previous year is estimated to cause an average decline of 0.0075% in current rice quantity supplied to the export markets holding all other factors constant. It is also estimated that increase in exporting capacity of rice traders in Tanzania for the previous two periods increase by 1 %, average quantity of rice exported will decrease by 0.2751% all other factors remains constant. These two variables were found not to be statistically significant at any level of significance as their p-values of 0.7809 and 0.0780 are all greater than 0.001, 0.05 and 0.1 significance levels.

4.7.2 Elasticity estimates of price and non-price factors on the dynamics of rice export supply

4.7.2.1 Elasticity estimates of rice price

As stipulated in theory, the own price elasticity of rice is positive showing a positive relationship between price of rice and quantity of rice supplied to the export markets. In the short-run, rice price on quantity of export supply is captured in two periods; $Riceprice_{t-1}$and $Riceprice_{t-2}$ with their short run elasticities of 6.0724 and 0.0497 respectively. As expected, rice price has positive effect on rice export supply however this is the case only in period t-1. In the short run, it is estimated that, if rice price in period t-1 increases by 1%, the mean rice export supply will increase by 6.0724, holding other

variables constant. Based on the p-values, rice price in period t-1 is statistically significant at 0.05 level of significance with the p-value of 0.0112 (P<0.05). These empirical results are in line with the theory that the higher the price, the higher the quantity of rice supplied (ceteris paribus). Based on the periodic nature of rice, an increase in the price of the previous two years will cause farmers to switch more resource into rice farming hence a delayed but subsequent increase in the output of rice supplied to the export markets. However, it estimated that if rice price in period t-2 increases by 1%, the mean rice export supply will increase by 0.0497% holding other factors constant. Based on the p-value, rice price in period t-2 is not statistically significant (P>0.05) indicating that the previous two years increase in rice price has no effect on the current increase of rice export supply (Table 10).

4.7.2.2 Elasticity estimates of real exchange rate

It is estimated that in the short run, if real exchange rate in period t-1 increases by 1%, the mean rice export supply will increase by 0.0078 % holding all other variables constant. Likewise, it is estimated that 1% increase of real exchange rate in period t-2 results to 0.0436% mean increase of rice export supply holding all other variables constant. Based on the p-values, $Real\ exchange\ rate_{t-1}$ and $Real\ exchange\ rate_{t-2}$ are both statistically significant at 0.01 and 0.05 levels of significance with their p values of 0.0054 and 0.0170 respectively. When the exchange rate Tanzanian shillings with dollars increase due to devaluation policy, then exports becomes cheaper to the importing countries, and hence increases rice export. These results are in line with the study done by Jagdambe (2016) who found that, the adjustments of the exchange rate policy in India resulted to the decrease of Indian's price of rice compared to others in international markets hence rise competitiveness of Indian rice as well as it supported improvements of rice exportation.

However, the study done by Paltasingh and Goyari (2013) who were determined the supply elasticity of agricultural produced crops in India using the Vector Error Correction Model (VECM) revealed that, rainfall was found to be highly significant on increase of supply of agricultural produced than other factors (Table 13).

4.7.2.3 Elasticity estimates of average international price of rice in competing countries

Short-run elasticities of international rice price is captured by two variables, which are $InternPrice_{t-1}$ and $InternPrice_{t-2}$. As expected, international price of rice to the competing countries have a positive effect on rice export supply. In the short run it is estimated that, increase of international rice price in period t-1 to the competing countries by 1% results to the increase of mean rice export supply by 6.0723% holding other variables constant. Similarly, 1% increase of international rice price in period t-2 in the short run results to the mean increase of rice export supply by 9.5828 holding other variables constant. Based on the p-values, international rice price has a statistically significant influence on rice export supply both in period t-1 and in period t-2 given the p-values which are significance at 0.01 and 0.05 level of significance respectively. When rice price to the competing countries such as India, Vietnam, Thailand and Pakistan increases, importers will be attracted to Tanzanian rice due to price competitiveness (holding other things constant). Therefore, international rice price is highly significant with positive elasticity indicates that increase of rice price to the competing countries has a positive effect on the increase of rice exports in Tanzania. This is because increase of rice price to these competing countries attracts the importers to shift towards Tanzanian rice due to price advantage hence increases competitiveness of Tanzania rice in international markets. Furthermore, this indicates the role of the government of Tanzania to set rice

price below that of competing countries so as to increase rice competitiveness and rice supply to the export markets (Table 13).

4.7.2.4 Elasticity estimates of production

Short run elasticities of quantity produced is captured by two variables; Qp_{t-1}andQp_{t-2}. In the short run, it is estimated that, 1% increase of quantity of rice produced in the country in period t-1 results to 0.4014% mean increase of rice supply to the export markets holding other things constant. Based on the p-value, quantity produced lagged in one period found to be statistically significant at 0.01 level of significance given the p-value of 0.0078 ($p<0.05$). This means that, rice export is more influenced by the previous year's production, when more rice is produced in the previous year; more export is expected in the current year. Continuous higher rice production adds to stock of rice, indicating that the government should take initiatives to increase production (Table 13).

4.7.2.5 Elasticity estimates of average GDP of importing countries

Short run elasticities of average GDP of importing countries is captured by two variables; $AvGDPImporting_{t-1}$ and $AvGDPImporting_{t-2}$. As expected, increase of the GDP per capita of the importing countries indicates the increase of the purchasing power, holding other things constant; this will increase rice purchases by importing countries from Tanzania. In the short run, it is estimated that 1% increase of average GDP of the countries that imports rice from Tanzania in period t-1 results to 4.4589% mean increase of rice export supply holding other variables constant. Furthermore, in the short run it is estimated that, 1% increase in average GDP of importing countries in period t-2 results to 5.322% mean increase of rice export supply holding all other variables constant. Based on the p-values, average GDP of importing country found to be statistically significant in

influencing rice export supply given the p-values of 0.0019 and 0.0023($p<0.01$) (Table 13).

4.7.2.6 Elasticity estimates real GDP of Tanzania

Short run elasticities of real GDP of Tanzania is captured by two variables; $RealGDP_{t-1}$ and $RealGDP_{t-2}$. Contrary to the expectationreal GDP of Tanzania had negative effect on rice export supply. In the short run, it is estimated that, 1% increase of real GDP in period t-1 will decrease mean rice export supply by 0.1878% holding other variables constant. It is estimated that in the short run, if real GDP of Tanzania in period t-2 increase by 1%, mean rice export supply will increase by 0.8743% holding all other variables constant. Based on the p values, real GDP in period t-1 found not to be statistically significant in influencing rice export supply given the p value of 0.3304 which is greater than 0.05 level of significance ($p>0.05$) (Table 13). This empirical result is contrary to the theory that high level of GDP of the country indicates better performance of Tanzania economy thus better infrastructures and investments in rice-sub sector hence prospects to increase rice export supply. The negative effect of real GDP to the increase of rice export supply in Tanzania may be due to the fact that, large share (50%) increase of GDP of the country is highly influenced by exports such minerals which involves few Tanzanians rather than agriculture sector which employs more than 75% of Tanzanians (FAO, 2015). The apparently little effort on implementations of government policies towards improving agriculture sector in Tanzania so as to improve the national GDP and the economy as a whole have led to this upshots (Table 13).

4.7.3 Elasticity estimates of price and non-price factors on rice export supply in the long run

Table 14 shows the long run elasticity's estimates of the influence of price and non-price factors on rice supply to the export markets. Results indicates that variables such as quantity produced, international price, average GDP per capita of importing countries and rice price are statistically significantly influencing rice export supply however rice price has negative influence on rice export supply. This indicates that in the long run, increase of rice price in Tanzania will decreases the amount of rice to be exported. This is because, increase in rice price in the country, assuming rice price in competing countries remains constant, this reduces the number of rice importers in Tanzania due to higher prices hence decreases rice export supply in the country. The results are further illustrated in Table 14.

Table 14: Results of the long *run elasticity estimates of the influence of price and non-price factors on rice supply to the export markets*

Variable	**Long run elasticity estimates**			
	Coefficients	**Standard Errors**	**T-Statistics**	**P-values**
LnExpQuanty(-1)	1.000			
LnRiceprice(-1)	-4.004	0.2951	-3.117	0.001***
LnRealGDP(-1)	-0.507	0.1441	1.271	0.104
LnRealExch(-1)	0.188	0.4621	0.115	0.914
LnQuantityP(-1)	5.139	0.9431	-8.481	0.000***
LnAinternPric(-1)	4.001	1.3842	5.814	0.003***
LnAGDPofimp(-1)	1.019	1.1894	3.442	0.042**
LnAnnualRain(-1)	-3.380	1.2292	1.721	0.347
Trend	-8.567	1.3405	-1.325	1.3405
C	0.943	0.0249	-0.0416	0.3869

* indicates 90% confidence level, ** indicates 95% confidence level and *** indicates 99 confidence level

4.7.4 Interpretation of long-run elasticities

The long run model results revealed that previous year's changes in rice export supply (Qe_{t-1}); real GDP of Tanzania, annual rainfall and real exchange rate had no long run effects on the quantity of rice export supply.

The Co-integrating equation of the long run model is given as follows;

$$ECT_{t-1} = 1.0000LnQe_{t-1} - 4.0036LnRicePr_{t-1} - 0.5068LnReal\ GDP_{t-1} + 0.188LnRealExch_{t-1} + 0.0002LnQp_{t-1} + 4.001LnInternaPric_{t-1} + 1.0189LnAveGDPofImpo_{t-1} - 3.3801LnAnnual_{t-1} + 0.943 \quad \ldots\ldots\ldots\ldots (22)$$

ECT relates the fact that, the last period deviation from the long run equilibrium influences the short-run dynamics of the dependent variable.

Contrary to the expectation, rice price has negative effect on rice export supply in the long run. It is estimated that if rice price in period t-1 increases by 1%, the mean rice export supply will decrease by 4.0036% holding all other variables constant. These results reveal that, increase of rice price in Tanzania, assuming price in the competing countries remain constant, this decreases rice export in Tanzania as rice importers will purchase rice from other competing countries (Table 14).

In the long run, it is estimated that, 1% increase of rice production in period t-1 results to mean increase of rice export supply by 5.1392% holding all other variables constant. Given the p value of 0.000, quantity produced is statistically significant at 0.01 level of significance. These results confirm the theory that, increase in production results to the increase of quantity supplied, holding other factors constant (Table 14).

In the long run, it is estimated that 1% increase in the international price of rice to the competing countries in period t-1 results to the mean increase of rice export supply by 4.001% holding all other variables constant. Given the p value of 0.003($p<0.05$), international rice price is statistically significant in influencing rice export supply in the long run at 0.05 level of significance This reveals that in the long run, increase of international rice price (assuming rice price in Tanzania remains constant), this will increase price competitiveness of Tanzanian rice to the international markets thus increasing rice export supply (Table 14).

In the long run, it is estimated that if GDP of importing countries increase by 1% in period t-1, mean rice export supply will increase by 1.089% holding all other variables constant. Given the p-value of 0.042 which is less than 0.05, GDP of importing countries is statistically significant at 0.05 level of significance in influencing rice export supply in the long run (Table 14).

4.8 Diagnostic Tests

These tests are conducted to see how accurately our results can be taken. In terms of model adequacy, the diagnostic tests show that VECM statistically performs quite sufficient in explaining rice supply response. In this model, the diagnostic tests conducted includes; autocorrelation test and test for heteroskedasticity.

4.8.1 Autocorrelation test

Null hypothesis states that, there is no serial correlation between variables while alternative hypothesis states that there is serial correlation between variables in the model.The Breusch-Godfrey was used to test for autocorrelation problem between the variables. Results of the test shows that the probability values are higher than 5% level

therefore there is no serial correlation between the variables in this model, thus we fail to reject the null hypothesis. The results are illustrated in Table 15.

Table 15*: Autocorrelation test results*

Lags	LM-Stat	Prob
1	58.42007	0.1678
2	41.77860	0.7582

4.8.2 White Heteroskedasticity Test

The Breusch-Pagan test was employed to check for the presence of heteroskedasticity. A significant observed R-squared implies presence of the problem of heteroskedasticity (Gujarati, 2004). The null hypothesis states that, the residuals are homoscedastic while the alternative hypothesis states that the residuals are heteroskedastic. Results of this test showed that at 5% level the probability value is 31.76 therefore this model is not heteroskedastic therefore we reject fail to reject the null hypothesis (Table 16).

Table 16*: Results of white heteroskedasticity test*

Chi-sq	Df	Prob
858.9156	840	0.3176

4.9 The Competitiveness of Tanzanian Rice Supplied to the Export Markets

The second specific objective aimed to assess the competitive advantage of rice supplied to export market was addressed by using Revealed Comparative Advantage to estimate Relative Export Advantage (RXA) of Tanzania rice in export. The results are presented in Table 17.

Table 17: Estimate of Relative Export Advantage of Tanzania rice

Year	Export value of rice in Tanzania to the neigh bouring countries (in '000 USD)	Total exports of Tanzania to EAC block, Congo and South Sudan(in '000 USD)	Total rice export value of competing countries to EAC block, Congo and South Sudan (in '000 USD)	Total exports of the competing countries to EAC block, Congo and Sudan (in '000 USD)
2018	1245	15 397.63	26 209.928	94 615.971
2017	1211	17 112.98	24 682.356	111 598.861
2016	2765	19 648.96	20 749.716	128 432.044
2015	1049	31 210.78	23 215.966	148 914.859
2014	1919.3	29 824.04	26 450.157	115 684.220
2013	2003	39 216.33	24 060.336	143 700.180
2012	5427	47 349.59	23 680.443	172 583.167
2011	1271.9	55 472.29	23 985.454	171 335.161
2010	1448	44 125.48	20 143.661	178 023.579
2009	216	57 046.53	19 306.929	176 541.492
2008	1648	58 542.30	20 236.398	152 750.954
2007	3974	47 419.24	13 748.857	148 554.885
2006	1410	41 781.09	10 593.462	165 678.258
2005	1734	36 692.12	9612.789	150 019.782
Total	27 321.2	809 439.37	286 675.963	2 058 433.413
Ratio of Tanzania rice export to Total exports of Tanzania	0.03375			
Ratio of total export competing countries to total exports of competing countries	0.13933			
Relative Export Advantage	0.24223			

The results of the analysis show that RXA (0.24223) is less than one. This implies that Tanzania rice exported is less competitive in the international markets compared to the rice exported from other rice growing countries such as Pakistan and India. This can be attributed to poor production and low usage of better-quality varieties by rice producers in Tanzania results to poor quality of rice produced. Other reasons could be due to lack of

membership of cooperative societies by rice traders which all these minimizes the bargaining power of rice traders in international markets and increase of production costs thus minimizes competitiveness of rice exported to the international markets (Ngailo, 2017).

These findings are consistent with the study done by Sampaothon (2016) on factors affecting the performance of Thailand export market in Chinese using revealed comparative advantage which found that Thailand is less competitiveness in Chinese market compared to Vietnam due to high labor cost, high production cost, high transport cost and existing discouraging government policies towards export market. To sustain and increase rice exports, rice has to be competitive in the international market. The analysis of competitiveness showed that, Tanzanian rice found to be less competitive for their export compared to other competing countries in the international markets as evident from RXA which is less than 1. Apart from competitive pricing, other factors such as quality, honoring export commitments, regularity of supply play important role in capturing international rice markets (Jagdambe, 2016).

4.10 Factors Affecting Participation in Export Markets by Rice Traders

Results from the binary logistic model shows that the Log-likelihood Ratio (LR) for all coefficients were found to be highly significant at $p < 0.01$ level of significance (Table 18). This means that the explanatory variables included in the model jointly influenced rice traders' probability of participating in rice export market. Overall, these results indicate a good model fit with the predictor likelihood of export market participation, suggesting that the model is well fitted. Given the foregoing goodness of fit measures, it can be concluded that the binary logistic model employed is reliable and hence appropriate for this objective. These factors that influence rice traders participation in export markets are illustrated in Table 18.

Table 18*: Factors affecting market participation to the export markets*

Market participation	Coefficient	S.E.	Sig.	Exp(B)
Sex	1.748	0.775	0.024**	5.740
Education	-0.082	0.272	0.764	0.922
Years of experience	3.538	0.920	0.000***	34.407
Membershipincooperative	-0.891	0.918	0.332	0.410
Accesstomarketinformation	4.534	0.782	0.000***	93.087
Overallfinancialcapital	1.125	0.4713	0.002***	1.000
Constant	-1.857	1.745	0.287	0.156

Numbers in parenthesis are standard errors. Significant at *** P<0.01, ** P<0.05, and * P<0.10.

Table 18 shows that using binary logit model, among the seven variables tested; five variables are statistically significantly contributed to the likelihood of rice traders participating in rice export markets. The variables includes; sex, age, years of experience, access to market information and overall financial capital with p-values of 0.024, 0.000, 0.000 and 0.002 respectively.

4.10.1 Sex of the trader

Sex has an implication on the roles and responsibilities in the society and therefore influences rice trader's participation in export markets. Results display that 77.3% of the respondents were male traders while only 22.7% were the female rice traders. Results show that, sex is statistically significant in influencing rice trader's participation in export markets at 0.05 level of significance (Table 18). Sex of rice traders increases the likelihood of participation in export markets by 1.748%. These results are similar to the study conducted by Dawana *et al*. (2018) who also found that age of the respondent was one of the factor influencing rice traders participation in in export markets in Ethiopia.

4.10.2 Years of experience

Results show that one increase in year of experience among rice traders increases the probability of rice export more rice by 3.538% (ceteris paribus). Years of experience in rice trade by rice traders is found to be statistically significant at 0.01 level of significance (P<0.01). The number of years of experience that the rice trader has in rice trade had a positive expected sign, meaning that higher the number of years of experience in rice trade the higher the likelihood that rice traders will participate in rice export. Increase in the number of years of experience of rice traders in rice trade increase social capital and export network with other rice traders hence simplify the access of market information. Furthermore, this increase the awareness of the market stability, requirements and procedures required in exporting rice and together with export demand. This increase profit assurance by rice traders thus increases the likelihood of rice traders to participate in rice export. These results are similar to Mkuna (2014) who found that years of experience smooth trading activities within EAC due to that the more traders are experienced in exportation, the more conversant they become in trading activities together with the procedures required in engaging to EAC cross border trade therefore increase the likelihood of rice traders to participate in export markets.

4.10.3 Access to market information

As expected, access to market information by rice trader has a positive influence on rice trader's participation in export markets. Access to market information is statistically significant in influencing rice trader's participation in export markets at 0.01 level of significance given the p value of 0.000 (P<0.000) (Table 18). The results show that access to market information increase the likelihood of rice traders participating in rice export by 4.534%. This reveals that, the more the rice traders are aware with market information such as market stability, export demand and export price, the more the likelihood of rice

traders participating in export markets. The more rice trader is accessed with market information, the more they will be aware of what is needed in the market, this increases awareness of the market potential hence assurance of the profit to be obtained thus increases the probability of rice traders participation in export markets. Rice traders who received market information prior exporting their rice are more likely to participate in export markets than those who do not receive information before exporting rice. Rice traders will therefore export their commodities after they know market potential and possibility of generating profit. Furthermore, access to market information reduces the risk of obtaining loss in rice trade as rice traders they become assured of obtaining potential buyers in the markets thus high possibility of participating in rice export markets. These results are similar with that of Kyaw *et a*l. (2018) who found that access to market information increases the likelihood of rice traders participation in rice exports due to that market information increases awareness on what is exactly needed in the market henceforth rice traders becomes aware with the customers' needs thus increases the chances of participation to the export market.

4.10.4 Overall financial capital

Table 18 shows that, overall financial capital of rice trader is statistically significant in influencing rice traders participation in export markets at 0.01 level of significance ($P<0.01$). Results show that, increase of the overall financial capital of rice trader increases the odds ratio (likelihood) of rice traders to participate in export markets by 1.125% (ceteris paribus). This is due to the fact that with higher capital, rice traders in Tanzania will be in position to meet the necessary requirements such as export permit, afford the transaction costs such as transport costs as well as to export large quantity of rice to the countries of destinations such as Rwanda, Burundi, Kenya, Uganda and Democratic Republic of Congo.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The main objective of this study was to analyse the performance of rice sub sector and its potential to increase of rice supply to the export market in Tanzania. Empirical results show that, rice supply to the export market in Tanzania is a result of the dynamics of price and non-price factors, competitiveness of Tanzanian rice supplied to the export markets and the probability of rice trader's participation to the export markets.

Using the Vector Error Correction Model to estimate the rice supply function, the results show that, rice price, real exchange rate, rice production lagged for one period, international rice price in the competing countries and GDP of the importing countries have positive implications to the rice supplied to the export markets in the short run. Meaning that if exchange rate is depreciated through devaluation policy in Tanzania, Tanzanian rice becomes cheaper abroad hence attracts more importers to buy rice from Tanzania due to price competitiveness, this increases rice export supply. On the other hand, in the short run it has been realized that previous years increase of rice production results to the current year's increase of rice export supply (ceteris paribus). This show that, previous year lagged one period increase of rice production in Tanzania, results to sufficient rice for domestic consumption and surplus rice to be exported hence this increases rice supply to the export markets, other things such as export price of rice remains constant.

The results of this study support other studies conducted by other researcher's on performance of export market in Tanzania which also concluded that exchange rate, GDP

and quantity produced domestically have positive implications to the increase of rice supply for export markets in Tanzania (Mwinuka and Mlay, 2015). Furthermore, the results of this study support other studies done on determinants and performance of rice exports from India which also discovered that rice price, lagged production for one period and exchange rate are the major determinants of rice exports from India (Adhikari *et al.*, 2016).

International price of rice in the competing countries found to be statistically significant on influencing rice export supply in Tanzania both in the long run and in the short run. This shows that, for Tanzania export supply to increase, the government policy should control rice price so as to grab exporting opportunities within EAC region and attracts more importers from the neighbouring countries to buy rice from Tanzania.

Moreover, empirical results and analysis presented show that participation in rice export markets by rice traders in Tanzania is driven by age and sex of rice traders, years of experience and access to market information and overall financial capital of rice trader. This means, access to market information by the rice traders in Tanzania should be improved so as to simplify information availability to the rice traders concerning export price, export procedures and arrangements required together with market information thus increase rice trader’s participation to the export markets.

The findings also reveals that RXA is less than one (0.24223) indicating that rice supplied to foreign markets is less competitive in international markets. This designates that, there is a room for improvement of rice competitiveness so as to increase rice supply for export markets in Tanzania.In order to improve rice competitiveness in export markets,

production should be improved by using improved rice varieties so as to produce quality rice that is competitive enough in the international markets.

5.2 Recommendations

Based on the findings of this study, the following recommendations are suggested for consideration by the government, policy makers and all other stakeholders concerned.

i. The government of Tanzania should improve market infrastructures and quality of rice produced as well as to remove restrictions on exports such as export bans thus increasing export share of Tanzanian rice to the world hence achieve competitiveness.

ii. The government of Tanzania should pay much attention on rice production by improving irrigation schemes, supplying credits to the rice producers and subsidizing farming inputs such as improved seeds and fertilizer so as to increase production hence increasing rice export supply.

iii. The government should develop means to provide market information and credits to the rice traders so as to increase their participation in export markets hence increase rice export supply.

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APPENDICES

Appendix 1: Questionnaire for rice traders in Tanzania

Determinants of rice supply for export market in Tanzania

Name of enumerator…….Date of interview……..…

Name of the Respondent……

Respondent's location details

Section A: General information of the respondent

1. Sex 1= Male 0=Female

2. Age of the respondent ( ) years

3. Education level (years)

4. What is the area of specialization in your education?

……

5. Do you export rice??

1= Yes….0= No….

6. If yes then what motivated you to be engaged in rice export

business?.....

7. If not why?.....

What is the country of destination where you export rice?.....

8. Marital status?

a) Single b) Married c) Widowed d) Divorced

9. Do you have experience in exporting rice?

1= Yes 0= No

10. If yes, what is your experience in exporting rice? ( ) years

Section B: Factors affecting participation on foreign markets

11. Did you engage in rice exports during last 12 months**?**

1=Yes…. 0= No…..

12. If yes, why???

……

13. If no, why??

……

14. If yes, what quantity of rice you exported?

……..

15. Do you sell your rice in domestic market?

1= Yes…0=No…..

16. How much quantity of rice you sold in domestic market in the 3 months?

…….…….

17. What motivates you to sell in domestic market?

……

18. Have you ever sold large quantity of rice to domestic market?

1= Yes 0= No

19. If yes, why?

……

20. If no, why?

……

21. Do you also sell rice in international markets?

1= Yes 0 = No

22. If yes, why?

……

23. If no, why?

……

24. On average on 3 months, what is the quantity of rice that you export? (Tones) () tonnes

25 What is your highest financial capital that you use to run your business? (Millions) ()

TZS

26. What is the financial capital that you use in rice transportation for exports? (TZS)

……

27. On average, how much quantity of rice do you export per year?? ( ) tones

Section C: Competitiveness of rice supplied to export markets

28. How do you see the quality of rice that you are selling?

a. High quality
b. Moderate quality
c. Low quality

29. Does it meet the standard needed in export market?

1= Yes 0 = No

30. How do you pack the rice that you are exporting?

a. Rice plastic bags
b. Rice packaging bags
c. Others (specify…….)

31. Are you a member of any cooperative to export rice?

Export rice
1=Yes
0=No

32. If yes, have you succeed to export rice though cooperative in foreign markets?

……

33. After joining the cooperative to export rice, how do you see the trend in exporting rice? ……

Section D: Challenges facing rice exporters in Tanzania

34. Do you have access to information on export price?

1= Yes…0=No…

35. Does the export price motivate you to export rice??

1= Yes…0= No…..

36. Are you always exporting rice?

1=Yes….. 0=No…..

37. If yes, why??

……

38. Are you familiar with any trade policies that favor rice export??

1=Yes…..0=No….

39. What are the challenges do you face during rice exportation??

……

40. What are your opinions on what should be done so as to improve rice export markets in Tanzania?? ……

THANK YOU

Appendix 2*: Rice production trends, import and export trends in Tanzania*

Year	Production quantity	Export quantity (X)	Import quantity (M)	Trade balance (X-M)
1990	194 700	0	230 000	-230 000
1991	184 800	0	260 000	-260 000
1992	184 800	0	260 000	-260 000
1993	196 700	0	220 000	-220 000
1994	173 000	0	198 000	-198 000
1995	145 000	0	185 000	-185 000
1996	118 000	0	200 000	-200 000
1997	148 000	1151	155 000	-153 849
1998	132 000	11 922	80 000	-68 078
1999	881 000	15 931	70 000	-54 069
2000	938 000	5686	85 000	-79 314
2001	886 000	6432	100 000	-93 568
2002	818 000	9047	60 000	-50 953
2003	764 000	10 906	150 000	-139 094
2004	556 000	2434	90 000	-87 566
2005	720 000	9286	185 000	-175 714
2006	645 000	4390	225 000	-220 610
2007	569 000	20 156	150 000	-129 844
2008	511 000	5589	219 000	-213 411
2009	511 000	808	225 000	-224 192
2010	530 000	48 275	200 000	-151 725
2011	360 000	35 176	105 000	-69 824
2012	524 000	17 494	75 000	-57 506
2013	409 000	51 433	66 000	-14 567
2014	400 000	47 862	66 000	-18 138
2015	415 000	7902	46 000	-38 098
2016	255 000	12 395	92 000	-79 605
2017	405 000	888.479	58 000	-57 633
2018	460 000	921.560	52 000	-52 000

Source: FAOSTAT (2018)