TANZANIAN CASHEW NUT SUPPLY RESPONSE UNDER MARKET REFORMS

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A Research paper submitted to the school of Economics in partial fulfillment of the requirement for the award of the degree of Masters of Arts in Economics, University of Nairobi.

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DECLARATION

Student

I hereby declare that the research project entitled "**TANZANIAN CASHEW NUT SUPPLY RESPONSE UNDER MARKET REFORMS**" submitted for a Masters of Arts in Economics to the University of Nairobi, Kenya, embodies my original work and has not been presented anywhere for any degree award or any other academic qualification.

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Supervisor

This project has been submitted for examination with my approval as the University supervisor.

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Mr. Maurice Awiti

DEDICATION

This research project is sincerely dedicated to my mother; Helena Kyomo, my father; Renatus Mfumu, my two young sisters and three young brothers. I deeply appreciate the unconditional love, care and support that I have received from family and friends throughout the whole period of my studies. I am very much grateful and God bless you all.

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I deeply give much appreciation to the almighty Lord, the intelligence designer and the creator of all beings for granting me with good health and mental stability. Not because I deserve it but simply because of his promises to all mankind.

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Lastly but not least, I'm very grateful to have been surrounded with good friends and allies including my classmates and work colleagues. I am very honored to have you people.

May the Lord's blessings, guidance and protection be upon you all and let the rain of his mercy, glory and success fall upon you all.

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ADF	Augmented Dickey-Fuller
ARDLM	Autoregressive distributed lag model
BoT	The Central Bank of Tanzania
CATA	Cashew nut Authority of Tanzania
CBT	Cashew nut Board of Tanzania
CPI	Consumer price index
CUSUM	Cumulative sum of residuals
CUSUM sq	Cumulative sum of squared residuals
ECM	Error Correction Mechanism
IMF	International Monetary Fund
OLS	Ordinary Least Squares
RCUs	Regional Cooperative Unions
RESET	Regression Error Specification Test
SAPs	Structural Adjustment Programs
TCMB	Tanzanian Cashew nut Marketing Board
US	United States

AN ABSTRACT

The title of this project is Tanzanian cashew nut supply response under market reforms. The main objective was to assess supply responses by the Tanzanian cashew nut industry under market reforms. The analysis employed secondary time series data from 1991-2012 using the ARDL bounds test approach.

The results have revealed that in the short run; a 1 percent increase in price leads to 1.42 percentage increase in the quantity of cashews supplied. In addition, a 1 percent increase in rainfall results to a 0.81 percentage increase in cashew supply. Apart from that, a 1 percent increase in price of maize results to a 0.69 percent decrease in the cashew supply. On top of that, a 1 percent raise in the rate of inflation forces cashews supply to increase by 0.23 percent. Lastly, a 1 percent increase in exchange rate leads to almost 3 percent reduction of cashews supplied.

These results imply that Tanzanian cashew nut supply is elastic in the short run to both price and non-price factors as well. However, the study failed to estimate long run elasticities due to lack of evidence to support the presence of co-integration.

Basing on the study results, the policy recommendations includes; for the sector to bare fruitful results, both price and non-price incentives should be a priority. Also, the BoT should avoid delays on exercising control on exchange rate volatility in such a way that, critical and necessary continuous intervention in the exchange rate markets must be a priority.

CHAPTER ONE

1.1 Introduction

Following the so called "The Elliot Berg Repor and the Model of Accumulation in Sub- Saharan Africa" (Loxley 1983); the World Bank volunteered to offer some help for individual African countries that were struggling from worsening economic hardships. For the assistance to be offered, countries had to accept and implement in good faith the structural adjustment programs (SAPs) as directed by the word Bank, Barratt (1995). The Berg report as well as other evidences suggested that most intervention efforts by governments at that time to facilitate economic growth were actually acting as an impediment towards growth. Such a case therefore, had left the World Bank, IMF together with other donors with no choice other than forcing the failing economies to adopt policy reforms, Akiyama et al (2003).

Since most African economies were heavily dependent on agriculture, it needed more than a miracle for such reforms not to affect the sector and thus, such reforms had to be initiated with no delays. Reforms in the agricultural sector had the aim of either reducing or eliminating distortions within the sector through the introduction of market forces. In other words, reforms were expected to make the sector receive world market prices for agricultural commodities apart from eliminating rent transfers to urban population, Lunberg (2004).

1.1.1 The Tanzanian Cashew nut Industry before Market Liberalization

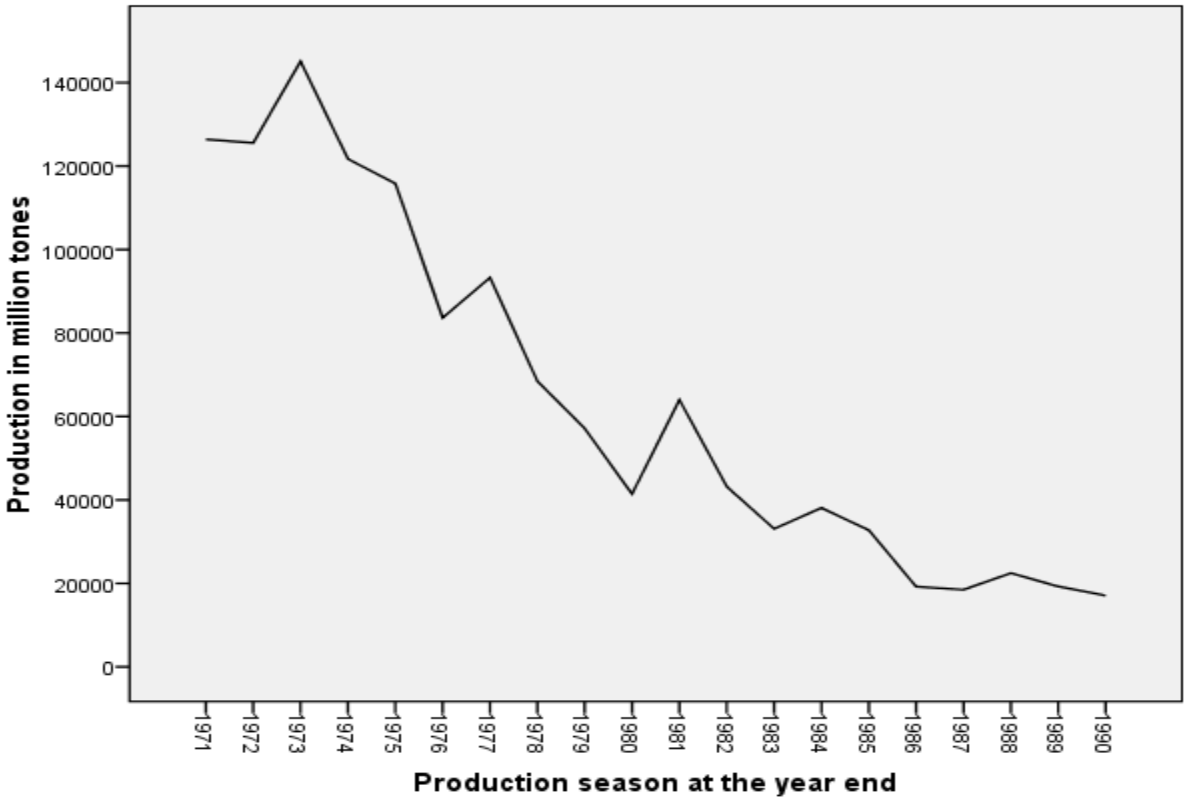
Cashews are among one of the major five traditional cash crops in Tanzania. It is the main back born of the economy of the southern coastal regions estimated to employ at least 280,000 smallholder farmers, Topper et al (1998). Before the market reforms, the sector was completely under the control of the government through the supervision of primary and secondary

cooperative societies which operated under the monopoly of Tanzanian cashew nut marketing board, TCMB which replaced the cashew nut authority of Tanzania, CATA, Topper et al (1998). In early 1970s about 68 percent of the total world cashew nut productions come from Africa, particularly in Mozambique and Tanzania, Jaffee and Morton (1995). However, the trend changed in 1980s with India and Vietnam emerging as the new major producers.

The Graph below, which depicts production trend, reveals that production continued to increase and picked in 1973/74 with 145,000 tones of raw cashew nut being produced. Then after, production started to decline reaching 18,490 tones in 1986/87 while the 1989/90 season recorded the lowest level of 17,060 tones only. Throughout this period, however, Lindi, Mtwara and Ruvuma regions accounted for more than 80 percent of the whole production.

In general, the pre-liberalization period was highly characterized by inefficiencies that acted as distortions or disincentives to farmers. Some of these marketing as well as administrative and procurement deficiencies include; frequent delays in the collection of the nuts from the farmers, delays of payments to the farmers and continued accumulation of huge debts by RCUs.

Fig 1: Tanzanian Cashew nut production trend before trade liberalization (1971-1990)



Source: African Development Bank

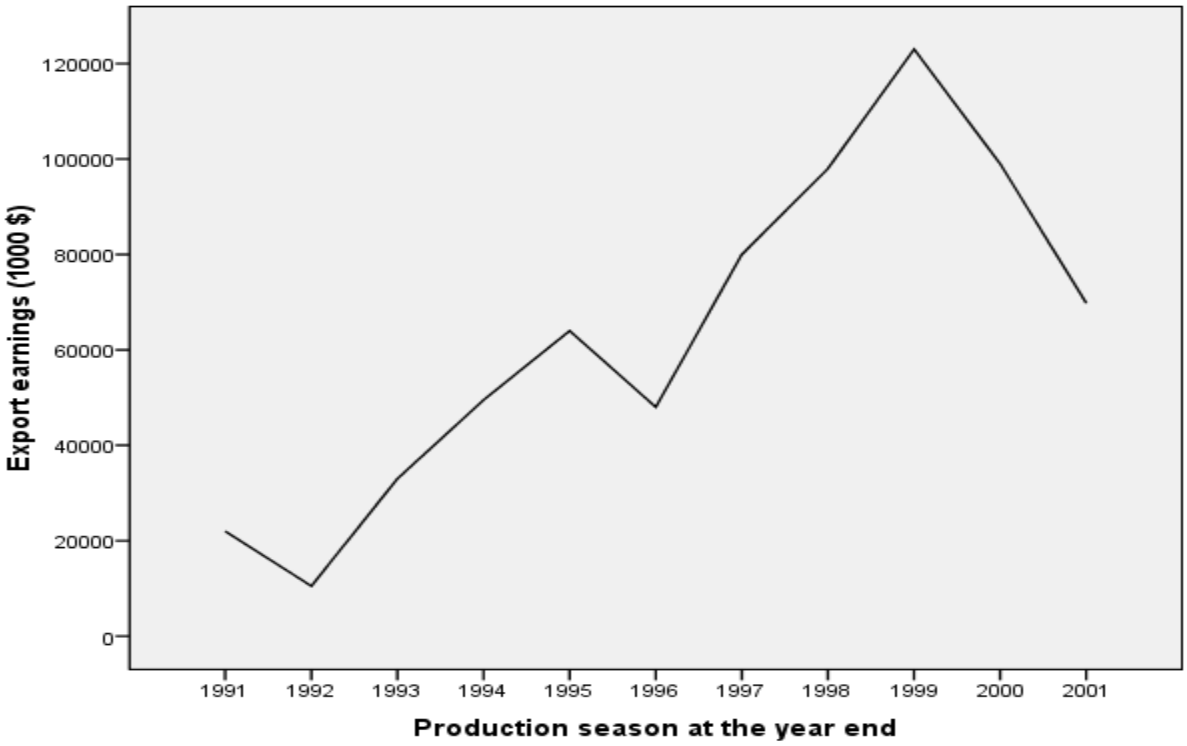
1.1.2 The social economic importance of cashew nuts

Cashews are among the major traditional agricultural export crop in Tanzania. They are ranked number four after tea, coffee and cotton. They are the major source of income for most smallholder farmers in the southern coastal regions of the country. A huge portion of cashew output is normally exported abroad leaving only a very small portion for domestic consumption, Mitchel (2004).

The commercial importance of cashew nuts steams from the fact that they happen to be highly rich in terms of nutrients. For instance, they posses almost as twice the amount of calories (per

kilogram) as compared to the cereals and thrice higher than what meat can produce (Nambiar et al 1990). The following graph shows the trend of cashew nut export revenue over the past first decade of market liberalization.

Fig 2: Tanzanian Cashew nut export revenue earnings in the first decade of market liberalization (1991-2001)



Source: Cashew nut board of Tanzania

Figure 2, above, shows a gradual increase of export revenue earnings in the first decade of market liberalization. The highest level of revenues was recorded in the 1998/99 season. However, in this season, total production and exports were a bit lower as compared to 1999/2000 and 2000/01 and so, good prices at the world market accounted for such high revenue earnings turn up.

1.2 Research Background

Poor pricing system and unreliability of good prices for farmers' produce has been the main problem of concern amongst farmers in most developing countries including Tanzania. For almost two decades now, Tanzania has been taking several economic reforms among which reforms in the agricultural sector stays at the centre of such efforts toward economic liberalization.

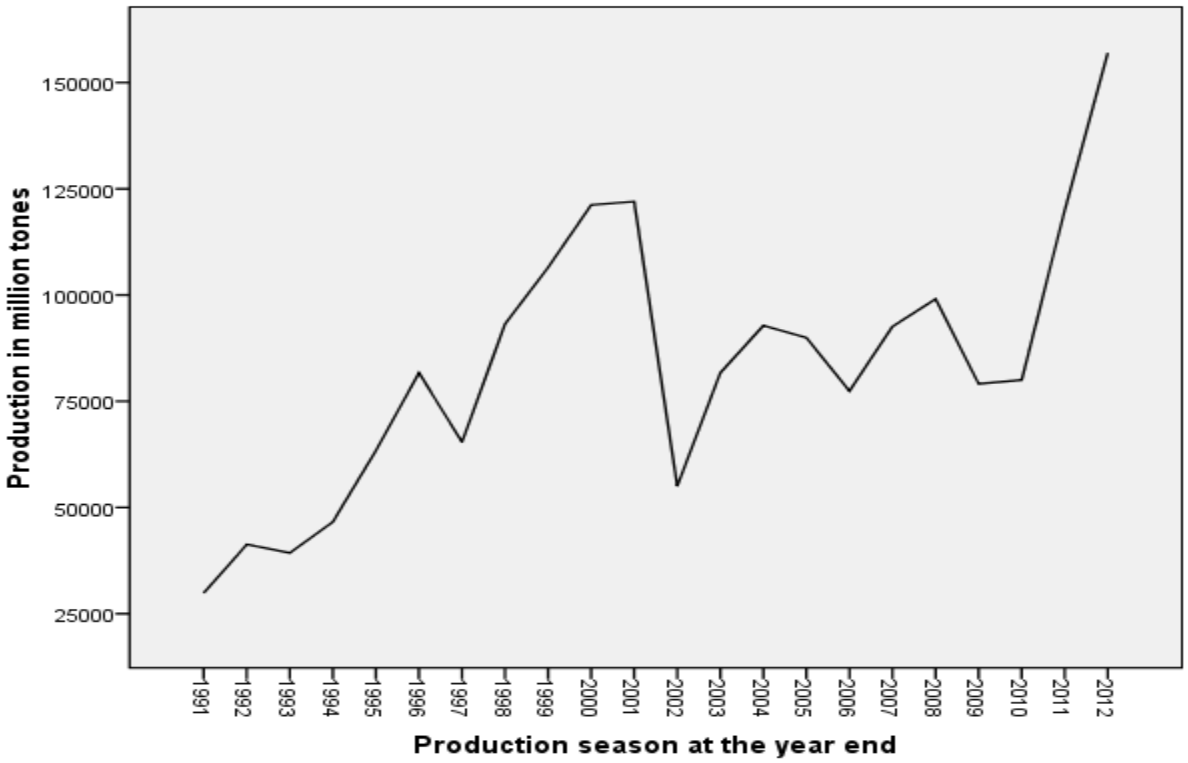
The reforms in agricultural sector in Tanzania can be traced far back in mid and late 1980s but with respect to the cashew nut industry, the reforms started in the early 1990s. Some of the reforms that impacted the industry includes: government withdrawal from direct production activities, relying on private sector for production processes as well as limiting the powers and scope of crops marketing boards so as to allow a more active role by the private sector.

The establishment of the Warehouse Receipt System as perpetuated by the Warehouse Receipt Act of 2006, is one among the notable reform efforts toward the sector. With this regard, the country intends to strengthen the Warehouse Receipt regulatory system hopping to arrest pricing and marketing agricultural produce related problems that appears to hinder farmers' initiatives on one hand and improving the performance of export crops on the other hand; cashew nut crop being one of them.

Under the reform period, smallholder farmers still carries out major production activities with more involvement of the private sector in procurement and marketing activities within the industry. During this period, the government decided to replace the TCMB with the CBT, Sijaona (2002).

The following figure displays the trend of cashew nut production in this period. From early 1990s production slowly started to pick up with 1993/94 season witnessing the highest prices ever received by the farmers before. In the 2000/01 season, production mounted to 122,000 tones, whereas, the 2011/12 season appeared to be a record-breaking season in the history of the industry by recording a total of 157,000 tones as displayed by the graph below.

Fig 3: Tanzanian Cashew nut production trend after trade liberalization (1991-2012)



Source: African Development Bank

However, in spite of such efforts, farmers are not yet to receive a complete benefit of the system due to either market imperfections or administrative failures and obstruction by the cashew nut board of Tanzania, which is charged with the responsibility of regulating the industry for the benefit of both farmers and buyers.

1.3 Statement of The Problem

Market reforms appear to possess a very promising future of success in the cashew nut industry in Tanzania. However, the existence of divergent views by different stakeholders on the performance of the industry since the inception of market reforms poses a very challenging query on whether such reforms have been worthwhile taking and if they really benefits the farmers on the ground, Rweyemamu (2002).

The sector has all potentials of growth in terms of output despite the prevalence of the pre-existed problems such as; inefficient and untimely supply of inputs, poor or limited access to financial facilities by the farmers, uncertainties related to good prices for the produce and delayed payments. Altogether provides the urge for conducting a more extensive study towards the sector and so proving the way forward.

Among the pre-supposed benefits of reforms in the agricultural sector is that we expected the removal of government monopoly would allow a more pro-active role by private traders and small farmers. This would result into more market competition and so creating a multiplier effect in the form of more employment, income to the farmers and foreign exchange revenue to the government; all from the industry. However, these authoritative, non-democratic ill-centered reforms with “one size fits all” character have not yet produced a clear realization of such promises.

The reforms have contributed to the stagnation of agricultural processing industry and creating new monopolies of few cashew nut traders. For instance, before liberalization, which privatized most processing factories, the country had twelve large cashew nut processing factories in operation but to date we have only one active processing factory in operation. The situation

resulted from stiff competition faced by local processors from efficient Indian processors. This has fueled the exportation of raw nuts, which in turn reduce foreign exchange revenues and employment chances following the closure of such processing plants.

Thus, market reforms may be encouraging production and exportation of raw cashew nuts on one hand, but on the other hand, they have crippled agricultural processing industry and so restraining the benefits related from processing the nuts. Such losses include, reduced employment opportunities, less foreign exchange earnings due to lack of value addition for the exportable nuts and stagnation of the process of technology diffusion as related to processing activities which ultimately reduces substantial income for the farmers.

1.4 Main Objective

- Assessing supply responses by the Tanzanian cashew nut industry under market reforms.

1.5 Specific Objectives

- To determine short run and long run responses of cashew nut output supply.
- To determine the rate of cashew nut output adjustment under market reforms.
- To draw conclusions and make policy recommendations according to the research findings.

1.6 Research Justification

Just like any other formerly recognized socialist state, market reforms in Tanzania was not an easy or sweet pill to swallow. But, since such reforms were inevitable, they had to happen gradually and still under way until today. The World Bank report of 1994 on the performance of

Tanzanian agriculture called into question the earlier stories of success of the sector under market reforms which was backed by evidence from earlier studies. This argument was backed by the fact that majority of such studies were likely to have overstated the performance of the sector since they suffered from inadequate or unreliable information base. This reality therefore calls upon the need of more study towards the issue.

CHAPTER TWO

2.0 The Literature Review

This chapter has examined different literature including the theoretical as well as empirical works done by other researchers using either similar or different approaches, apart from reviewing the approaches used in modeling agricultural supply responses. The chapter has then concluded by generating an overview of the literature reviewed.

2.1 The Analysis of Agricultural Supply Responses

The interest on agricultural supply analysis has long history since it can be traced back far before the works related to the production function, and it was generally disassociated with it. Initially, the analysis on supply response had a lot to do with policy issues instead of application issues or the development of formal econometric analysis. The reason accounting for this perception is, perhaps, explained by the work of Johnson (1950) who observed that during the great depression, both product prices and factor prices as well displayed a decreasing tendency. However, the central focus of the influence of price in determining output has changed a lot since then. Furthermore, there have been some notable additions and modifications on the public agenda especially when the question with regard to the ability of expanding food supply to meet growing demand comes into play. Thus, while the role of prices relates to the behavior under given supply conditions on one hand, the aspect of growth can be related to the changes within such conditions on the other hand.

Traditionally, the empirical supply function used to regress output on prices and other variables with the aim of deducting supply responses to price incentives. Thus, most studies have employed time series data though there are some exceptions. The theoretical framework that

underlies the formulation of most such studies, however, has based on static assumptions giving an indication that price signals were not well captured.

A tremendous work by Marc Nerlove (1956, 1958) shifted the attention from static to dynamic consideration through the inclusion of distributed lags in the analysis of supply with the formulation of both adaptive expectations and partial adjustment as well. An interesting phenomenon, however, is that both of these two effects appear to produce similar outcomes; a gradual response in output adjustment. Thus, in the analysis of agricultural supply response, two main approaches can be considered; the Indirect Structural form approach on one hand and the Direct Reduced form approach on the other hand.

(i) The Indirect Structural Form approach

The approach derives both, input demand function together with the supply function through the consideration of the available information as related to the production function, data availability and individual behaviors as well. So, the approach follows a more or less static approach to agricultural supply response. The approach is rigorous theoretically but it appears weak in capturing partial adjustments in production and the mechanisms used by the farmers in formulating their price expectations.

Moreover, the approach requires comprehensive detailed information on input prices, something that seems to be an issue in most developing countries simply because markets for agricultural inputs in these countries are less efficient in the competitive environment. A lot of government interventions and price distortions significantly prevail in such markets.

(ii) The Direct Reduced Form approach

The approach embraces more of a dynamic framework in the estimation of supply response through incorporating partial adjustments and price expectations directly. Unlike the former, the approach is strongly able to capture and correct the weaknesses of the first approach to the larger extent. The approach, as noted earlier, is highly attributed to the work of Marc Nerlove who was the pioneer in modeling agricultural supply response through incorporating price expectations with other exogenous factors.

2.2 The theoretical review

The first decade of market liberalization witnessed a growing number of literatures focusing on the assessment of the impact of market reforms on the agricultural sector. Such literature ended up on creating a disagreement among researchers, dividing them between pro and anti reformers. With respect to Tanzanian agriculture and the implementation of reforms, earlier studies especially in the late 1980s and early 1990s mostly funded by the World Bank and the IMF created a consensus that market reform measures towards the agricultural sector were actually creating positive results. For example, agricultural GDP was noted to have increased by 4.9% annually between 1986 and 1991, the sales of export traditional crops increased by 68% while that of non-traditional agricultural exports increased almost five times within the same period (Mans, 1994).

However, the earlier consensus started to disappear following new evidence resulted from studies that extended the data beyond 1991, and so creating a disagreement with the earlier findings. The following literature shows how far this division was in terms of findings with regard to the performance of the agricultural sector following market reforms.

Jaffee (1994), carried out a study specific on the cashew nut industry focusing on private traders' response to market liberalization in Tanzania. The study noted the emergence of positive trends; that private traders have actually started to eliminate some past crowded inefficiencies within the sector apart from creating some new incentives for farmers to improve their output production.

Meertens (2000), on the other hand, investigated Tanzanian agricultural performance before and after market liberalization. The study realized that there was no clear sign that structural adjustment program objectives on agricultural sector have been reached. Productivity per capita has been declining for both food and cash crop. The reported increased producer share of world market price of export crops was of no use since there was no real price increase that were actually realized for tradables due to devaluation of the local currency.

Such view was also shared by McMillan et al (2002), investigating the impact of structural adjustment program in Mozambican cashew nut industry. Their study weighed the stand gains from liberalization against the efficient losses resulted from idling processing plants in Mozambique. They realized that the loss of real income by workers within the cashew nut industry were roughly equivalent to the gains resulted from liberalization; which ultimately washed away all the claimed benefits.

Another study that refuted the earlier consensus was done by Skarstein (2005), who surveyed on market reform initiatives and Tanzanian small holders' productivity. The study argued that, agricultural market liberalization has forced small farmers to seek for income diversification apart from being dragged into a subsistence fallback phenomenon. That is to say, volatility in

markets and declining ratio of crop prices to input costs; has forced small farmers to produce only for covering their basic consumption (subsistence fall back) on one hand, and seeking cash income outside their holdings by engaging in other activities apart from agriculture (risk spreading) on the other hand. The study therefore concluded that, instead of fueling specialization, structural adjustment programs have resulted to opposite outcomes in Tanzania.

A recent study by Tiberti (2012), however, acknowledges a remarkable improvement of output for the past decade in Tanzania. But more importantly, the study suggests that such effect could not influence poverty reduction for small farmers since large share of agricultural output growth was driven by large plantations and after all, the resulted growth was not evenly distributed among the regions country wide. This claim is supported by the earlier study done by Mashindano and Limbu (2002).

In spite of the sound argument presented by these studies, there's one conspicuous weakness that all of them share; that most of their arguments have not been formulated basing on econometric empirical framework. Thus, we can't rely strongly on findings of such studies to draw general conclusions about the performance of the Tanzanian agriculture under market reforms.

2.3 Empirical review

Thiele (2000) proposed three arguments that appear to be evident in most studies which investigate agricultural supply response to price incentives. The first argument claims that non-price factors pose the main constraint towards agricultural development and supply elasticity with respect to non-price factors appear to be high. The study by Platteau (1996) concurs with this argument.

The second argument claims that natural factors such as weather plays a crucial role in agricultural development and that both, price elasticity and non-price elasticity appear to be inelastic especially in most sub-Sahara African countries. Study by Bloom and Sacks (1998) affirms this hypothesis. The last argument suggests that appropriate price incentives are substantially enough to foster development in agriculture. In this case, price elasticity is expected to be high as observed by Kruegar et al (1992).

2.3.1 Studies carried out within Africa

In Tanzania, Mckay et al (2006) investigated aggregate supply response of Agriculture by assuming the claim that market reforms have improved market efficiency and thus inducing the farmers to react positively to it by employing co-integration and error correction model. Their study revealed that liberalization of agricultural markets have actually improved effectiveness of prices received by farmers and so act as an incentive towards improving production. The general belief, that aggregate response to price changes appear to be inelastic in the short run but can somehow be relaxed in the long run when more resources are either being diverted

towards the sector or there are technological improvements; seems to be consistent with the results of this study.

Elsewhere in Nigeria, Rahji et al (2008) modeled rice supply response by applying the Nerlovian model. The study concluded that short run supply elasticity with respect to price was 0.08 while long run elasticity was 0.33 *i.e* inelastic supply. Apart from that, the study also revealed that adjustment coefficient was found to be 0.5 (less than one) which implied a sluggish behavior in output response to price incentives.

In Nigeria, another study was done by Obayelu and Salau (2010). They examined agricultural response to prices and exchange rate. Their study however, employed Co-integration and Vector Error Correction Model (VECM) approach. They concluded a positive response of output to the changes of interest rate in the short run. The speed, with which agricultural output adjust to prices and exchange rate, was found to be 0.86 in the short run while 1.44 in the long run. Such results however appears to be centrally to the general belief.

Muchapondwa (2008), on the other hand, investigated agricultural supply response to price and non-price factor in Zimbabwe by employing a different approach to co-integration called ARDL approach but the study results confirmed the general belief about agricultural supply response to prices. Study results produced a price elasticity of 0.18 and so suggesting that price policy was rather a blunt tool for stimulating growth in aggregate agricultural supply.

Gosalamang et al (2012), however, applied the Nerlovian model to study supply response of beef farmers in Botswana but the result obtained were centrally to the general belief. Short run

price elasticity appeared to be 1.51 while the long run elasticity was 1.06. The study therefore, concluded that price policies were actually effective in inducing the improvement on output.

The other related study in Africa was done by Gatete (1993), carrying out an economic analysis of coffee supply in Kenya. The study utilized the bootstraps technique by assuming that Kenyan government policy was to increase producer price by 15 percent as an attempt to favor producer surplus for smallholder farmers. Although the study employed a different technique, it ended up with the same reduced form supply function as the Nerlovian supply reduced equation form. The study finally concluded that major coffee producers (estates) were inelastic in terms of response to price incentives apart from suggesting that impact of price variability on coffee producers was quite substantial.

2.3.2 Studies carried outside Africa

The evidence from Indonesia presented by Ketut and Bamang (2004), seem to clearly refute African experience with structural adjustment program and agricultural performance as they studied the impact of such reforms on cashew nut industry in Nusa Taggara Barat province in Indonesia. They argued that market liberalization has made the cashew industry in Indonesia more competitive and efficient by applying the policy analysis matrix approach.

In India, Mythili (2006) applied the Nerlovian model with panel data to study supply response by Indian farmers to price incentives. The study supported the argument that farmers respond slowly to price incentives in the short run and that speed of adjustment was also very slow especially for food grains. On top of that, the study strongly rejected the hypothesis that market liberalization has improved output or acreage response to price incentives.

Elsewhere in China, Yu et al (2010) studied agricultural supply response to price under economic transformation in Henan province. Their study employed a dynamic panel data technique and concluded that price elasticity for grains was 0.27 in the short run and 0.81 in the long run. However, the speed or magnitude of elasticity appeared to vary significantly across varieties of agricultural produce. The study therefore supported the conventional view that, agricultural response to price changes in developing countries is inelastic.

Koo (1982) conducted an econometric analysis of the U.S. wheat acreage response by evaluating farmers' response to market prices. The study employed the Nerlovian geometric lag model assuming that there is a tendency of price effect on agricultural produce to decline geometrically with respect to time when measured backward from current period. The study revealed, however, that wheat price elasticity for winter was more inelastic than in the case of spring season. The reason accounting for the situation was that, spring wheat production was somehow replaceable with other crops; such replacement was very limited in winter wheat producing region.

In the U.S., another study was conducted by Lafrance and Burt (1983). They investigated aggregate U.S. agricultural supply response using the modified partial adjustment model. Their study results revealed a short run price elasticity of 0.1 while 0.3 price elasticity accounted for the long run.

2.4 An overview of Literature.

In general, most researchers have employed different approaches trying to model the responses of agricultural produce to both price incentives and non-price incentives as well. There is a wide variation in-terms of methodological approach to the issue indicating the view that no single approach has gained a general acceptability among researchers. Each approach is suitable depending on the circumstance and variables of interest under investigation.

The Nerlovian approach in modeling agricultural responses appears to have dominated earlier studies from late 1950s to late 1980s. Most studies which have been carried out in the past two decades, have tried to employ rather a different approach apart from the Nerlovian though there are some few exceptions. But, irrespective of the approach used, all of these studies still considered pricing policy as the key variable factor in their analysis though there is a considerable disparity when it comes to what non-pricing factors to be included.

However, most literature still agrees with the conventional argument that agricultural supply response to price is generally inelastic. Furthermore, the results may be similar in different regions or countries but the reasons behind such results appear to differ significantly across the regions.

CHAPTER THREE

3.1 Theoretical Framework

The model originated from the pioneering work of Marc Nerlove (1958). It follows a partial adjustment mechanism through assuming farmers' reactions in terms of price expectations and production adjustment. Thus, the approach encompasses the general form supply function of partial adjustment mechanism together with the equation that captures the supply dynamics, Askari and Commings (1977).

However, in modeling the supply response of agricultural produce, one may chose to employ different variables such as, yield, desired area under cultivation or output, as a part of farmers' reaction toward incentives such as prices (Yu et al 2010). Furthermore, in most empirical works, there have been some modifications and changes applied to the model. Askari and Commings (1977) have argued that most of such modifications can generally be categorized under the following three groups;

- The modifications on the variables used within the model
- The inclusion of factors of particular interest in the situation under investigation corresponding to variable Z.
- The attempt to include some other aspects that are thought not to have been included by the earlier steadies such as; the duration of crops to maturity and the seasonal effects of the agricultural produce.

The basic Nerlove model however can be presented by the following three equations;

$$Q_t^* = a_1 + a_2 P_t^* + a_3 Z_t + U_t \dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$

$$Q_t - Q_{t-1} = \beta(Q_t^* - Q_{t-1}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

$$P_t^* - P_{t-1}^* = \alpha(P_{t-1} - P_{t-1}^*) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where by:

Q_t^* is the desired output at period t

Q_t is the actual output at period t

Q_{t-1} is the actual output in the previous period

P_t^* is the expected price at period t

P_{t-1}^* is the expected price of the previous year

Z_t is a set of the exogenous factors entering the supply function

β is the coefficient of output adjustment and (o < β < 1)

α is the coefficient of price expectations and (0 < α < 1)

U_t is the error term

Since the model assumes adoptive expectations and that Q^* is unobservable, it is therefore correct to conclude that $Q^* = Q_t$. Focusing on partial adjustment hypothesis, it can further be noted that farmers make their decision basing on their knowledge about real prices (since P* can't be observed) that prevails immediately in the preceding year. We can be proud to assume that $P_t^* = P_{t-1}$ i.e. α = 1.

Taking into consideration the above assumptions, we can now substitute equation (2) into (1) as follows:

$$Q_t = a_1 + a_2 P_{t-1} + a_3 Z_{t-1} + U_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

But $Q_{t=}\, Q_{t-1} + \beta Q_t - \beta Q_{t-1}$

Thus $Q_t = Q_{t-1} + \beta(a_1 + a_2 P_{t-1} + a_3 Z_t + U_t) - \beta Q_{t-1}$

$$= a_1\beta + a_2\beta P_{t-1} + (1-\beta)Q_{t-1} + a_3\beta Z_t + U_t\beta \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Where by:

a_2 is the long run supply elasticity with respect to price

$a_2\beta$ Is the short run supply elasticity with respect to price

β Is the output adjustment coefficient

Alternatively, one can also derive the model by considering the adaptive expectations and so combining equation (1) and (3) which ultimately end up with similar structural equation as that presented by equation (5) above. This is perhaps the main setback of the model as it becomes uneasy to distinguish between the partial adjustment and price expectation coefficients unless further restrictions are being put forward.

Apart from such above identification problem of the model, most literature in econometrics argue that most time series variables are always suspicious of being non-stationary, a problem which ultimately result into spurious regressions. This is a common phenomenon with most lagged variable models, the Nerlovian approach in particular. The situation therefore calls upon a more improved approach as an initiative to ratify the situation. Thus, the study resorts to the application of co-integration analysis and error collection mechanism as a supplement to our model. Thus, the study resorted to the application of ARDLM bounds technique to co-integration.

The ARDLM bounds technique to co-integration have thus been introduced purposefully for the aim of overcoming spurious regression problems since the approach tends to produce

consistent and distinct estimates of both short run and long run elasticities which satisfies the assumptions of classical linear regression analysis. This appears to be more general than the partial adjustment mechanism, since it allows a wider concrete and precise way of modeling dynamic adjustments in agricultural supply responses.

3.2 The ARDL M bounds test Approach to Co-integration.

The approach was developed by Pesaran et al (2001) through the use of bounds test to examine the long run relationship among time series variables. The main strong hood of this approach rests upon the fact that; it can be used regardless of whether the variables are at I(0) or I(1) unlike most co-integration techniques. It also formulates the dynamic or unrestricted ECM derived from ARDLM bounds test through a simple linear transformation. The approach involves the estimation of the following general conditional version of the ECM:

$$\Delta Y_t = \theta_0 + \theta_1 Y_{t-1} + \theta_2 X_{t-1} + \theta_3 Z_{t-1} + \sum_{i=1}^{p} \beta i \, \Delta Y_{t-1} + \sum_{j=0}^{p} \sigma i \, \Delta X_{t-j} + \sum_{s=0}^{p} \delta s \, \Delta Z_{t-s} + \omega_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

We can now notice that the conditional ECM from the bounds test differs from the traditional ECM through the replacement of the error correction term with the lagged variables of the variables under consideration. The approach estimates $(p+1)^k$ number of regression where as to obtain optimal of lag length for each series; p is the maximum lag length and k stands for the number of variables in the respective equation.

According to Pesaran et al, therefore, for co-integration to exist, the null hypothesis of no long run relationship *i.e.* $H_0\colon \theta_1 = \theta_2 = \theta_3 = 0$ must be rejected. The two asymptotic critical bounds provides a test for co-integration when the independent variable $I(d)$ where by

$(0 \leq d \leq 1)$. The lower bound implicates that the regressors are of $I(0)$, where as the upper bound implies that the regressors are of $I(1)$.

If the F-statistic value exceeds the upper critical value, we conclude that there is long run relationship regardless of the order of integration. If the F-statistic falls below the lower boundary we cannot reject the null hypothesis of no co-integration. When all variables are known to be of $I(1)$the decision is made in favor of the upper boundary and when they are of $I(0)$, we then regard the lower boundary. If the variables appear to be co-integrated, then all the differenced variables equals zero and thus, the long run conditional model becomes;

$$Y_t = \beta_0 + \beta_1 X_t + \beta_2 Z_t + V_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

To check for the goodness of fit in this model, both the stability test together with the diagnostic test have to be performed. The tests checks for serial correlation, functional form of the model, normality of the error term and heteroskedasticity as well. The stability of the model is checked by conducting both CUSUM and CUSUMsq tests.

3.3 Model Specification

The model to be estimated can be specified by the following supply function;

$$Q_t = f(P_t, S_t, R_t, W_t, M_t \; and \; T) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

Whereby;

Q_t Represents the amount of cashew nut output supplied by the farmers over time

P_t Represents the price of the cashew nut output as given to the farmers my market forces over time

S_t Represents the price of maize as a substitute crop for cashew nuts

R_t Represents market determined exchange rate between Tanzanian shilling and the US dollar over time

W_t Represents average annual rainfall measured country wide over time

M_t Represents the rate of inflation over time

T Is the time trend variable

Setting up the Nerlovian Model;

$$Q_t = a_0 + a_1\beta P_{t-1} + a_2 S_{t-1} + a_3\beta R_t + a_4\beta M_t + a_5\beta T + (1-\beta)Q_{t-1} + \beta\mathcal{E}_t \dots (9)$$

In the reduced form;

$$Q_t = \delta_0 + \delta_1 P_{t-1} + \delta_2 S_{t-1} + \delta_3 R_t + \delta_4 M_t + \delta_5 T + \delta_6 Q_{t-1} + V_t \dots\dots\dots\dots\dots\dots (10)$$

Whereby;

$\delta_0 = a_0$

$\delta_1 = a_1\beta$,

$\delta_2 = a_2\beta$

$\delta_3 = a_3\beta$

$\delta_4 = a_4\beta$

$\delta_5 = a_5\beta$

$\delta_6 = (1-\beta)$

$V_t = \beta \mathcal{E}_t$

In the log-log form, the equation appears as follows;

$$lnQ_t = \delta_0 + \delta_1 lnP_{t-1} + \delta_2 lnS_{t-1} + \delta_3 lnR_t + \delta_4 lnM_t + \delta_5 lnT + \delta_6 lnQ_{t-1} + V_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots. (11)$$

3.4 The estimation procedure

As the initial step before estimation, the study had to apply the DF test to check for non-stationarity in each of the variables represented by equation (11) above by testing the null hypothesis of non-stationarity against the alternative hypothesis; the series are stationary, before establishing the order of integration.

The study proceeded through the formulation of the dynamic or unrestricted ECM derived from ARDLM bounds test with a simple linear transformation. Thus, the approach specified and estimated the following general conditional version of the ECM containing only variables of $I(0)$and $I(1)$ since the inclusion of variables with greater than $I(1)$ violates the underlying foundations of the approach (Ouattara, 2004):

$$DlnQ = \theta_0 + \theta_1 DlnP + \theta_2 Dlnmaize + \theta_3 LDlnex + \theta_4 LDlninvrain + \theta_5 LDlninf + \theta_6 LlnP + \theta_7 Llnex + \theta_8 Llninvrain + \theta_9 Llninf + V_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (12)$$

Where by:

$lninvrain$ = $(1/lnrain)$^2

D stands for the first difference of the respective variable and

L stands for the first lag of the respective variable

V_t is the residual

3.5 Variables used and their expected relationships

The study identified the dependent variable as Q_t which represented cashew nut output as produced by farmers from 1991-2012. The explanatory variables used, together with their expected relationship with the dependent variable have been presented in the following table:

Table 1: Variables used together with their expected relationships

Variable	**Measure**	**Expected relationship with the dependent variable (Q_t)**
Price of Cashew nut (lnP)	Cashew nut output prices as determined by market forces from 1991-2012.	Positive; cashew nut supply increases as cashew nut prices increase.
The Exchange rate ($lnex$)	Market determined exchange rate from 1991-2012..	Positive; cashew nut supply increases as the real exchange rate increases.
Precipitation level ($lninvrain$)	Average annual rainfall variation from 1991-2012.	Positive; cashew nut supply increases with the increase in the level of precipitation.
Rate of inflation as a % change in CPI ($lninf$)	Changes in cost of living as well as the affordability of farm inputs from 1991-2012	Negative; cashew nut supply increases as the rate inflation decreases over time.
Price of Maize ($lnmaize$)	Price of maize as a substitute commodity 1991-2012	Negative: cashew nut supply increases as the price of maize decreases.

3.6 Data type and Sources

The data used by this study were mainly secondary time series data covering a period starting from 1991 to 2012. The data were extracted from The African Development Data Bank, Bank of Tanzania together with the Cashew nut board of Tanzania.

3.7 Statistical diagnostic tests performed

(i) The JB test for Normality

The Jarque-Bera (JB) test was employed to check for the normality of both Skewness and kurtosis of the error term by assessing whether or not, the coefficients of skewness and excess kurtosis are jointly equal to zero. The null hypothesis that the residuals are normally distributed was tested against the alternative hypothesis that the residuals are not normally distributed..

(ii) The Breusch-Godfrey test for serial correlation

Breusch-Godfrey (BG) test is the valid test in the presence of higher order autocorrelation. For first order autocorrelation, the test is asymptotically equivalent to the Durbin-Watson *h* statistic, which may be considered a special case of the BG test statistic. However, Durbin-Watson *h* test is not applicable for testing second or higher order autocorrelation in dynamic models. The BG test computed Lagrange multiplier test for non-independence in the error distribution. For a specified number of lags say (*p*) , it tested the null hypothesis of independent errors against the alternative hypothesis that the errors either follows the *AR*(*p*) or *MA*(*p*) .

(iii) The Breusch –Pagan test for Heteroskedasticity

The test involved regressing the squares of the OLS residuals on a set of explanatory variables. It was conducted by considering the Lagrange multiplier statistic: LM = $n\ x\ R^2$ from the auxiliary

regression. The null hypothesis that there's homoskedasticity was tested against its alternative hypothesis which assumed the presence of heteroskedasticity.

(iv) Ramsey's RESET test

This is the general test for misspecification of functional form of the model. The test for the null hypothesis which assumes that the model is correctly specified, against the alternative hypothesis that the model is incorrectly specified, was conducted by considering the F-test on the powers of predicted values.

(v) The Akaike Information Criterion

The criterion has been used to test for how well our model fits the data i.e. it measured the relative quality of the model given the available set of data. It thus deals with the trade-off between the complexity of the model and the goodness of fit of the model. It was thus used to determine the lag length.

CHAPTER FOUR

4.0 Introduction

This chapter focuses on presentation of the results of analysis. The results under consideration include the summary statistics, the unit root test and other post estimation diagnostic tests. The chapter also makes a comparison of obtained results with the findings of other studies.

4.1 Summary statistics and Unit root test

To start with, the study transformed all the original variables into natural logarithms so as to avoid scale effect among the variables. The variable "$lninf$" also had to be transformed into "$lninvinf$" for correcting and satisfy some of the diagnostic tests upon the model. The summary statistics for the modeled series have been presented in table 2(a) while table 2(b) presents correlation matrix.

Table 2(a) Descriptive Statistics

Variables	$\boldsymbol{lnQ}$	$\boldsymbol{lnP}$	$\boldsymbol{lnmaize}$	$\boldsymbol{lninvrain}$	$\boldsymbol{lnex}$	$\boldsymbol{lninf}$	$\boldsymbol{lnn}$
Mean	11.25703	6.673178	4.95094	2.237135	6.726998	2.08294	7.601647
Maximum	11.97035	7.046595	5.73883	2.51598	7.389132	3.49923	7.606884
Minimum	10.30394	6.383844	4.37952	2.001739	5.454894	-3.5066	7.596392
Std. Deviation	0.4144093	0.1937736	0.42259	0.1295225	0.5112027	1.48587	0.0032444
Skewness	0.1634	0.6440	0.5500057	0.6655	0.0861	0.0000	0.9929
Kurtosis	0.7197	0.3670	2.088199	0.7749	0.5537	0.0002	0.0664

Table 2(b) Correlation Matrix

	Correlation Matrix						
	lnQ	lnP	$lnmaize$	$lnex$	$lninvrain$	$lninf$	lnn
lnQ	1.0000						
lnP	-0.1407	1.0000					
$lnmaize$	0.1750	0.0825	1.0000				
$lnex$	0.7828	-0.2390	0.4947	1.0000			
$lninvrain$	-0.2598	0.1307	0.1798	-0.1634	1.0000		
$lninf$	-0.3104	0.2833	0.1788	-0.3853	0.23511	1.0000	
lnn	0.7177	-0.1807	0.6563	0.9591	-0.0258	-0.3319	1.0000

Results from the correlation matrix shows that cashew nut price, rainfall, and inflation; altogether relates negatively to the quantity supplied. The rate of exchange, price of maize together with time trend variable, however, relates positively to the quantity of supply. Furthermore, there is a very high positive correlation among quantity of supply, the time trend and the exchange rate.

The tables below, on the other hand, presents the results of a unit root test for both the ADF and Phillips-Perron test. Table 3(a) indicates P-values tested at 5% critical level in which all variables have been tested at their level.

Table 3(a) Results: Unit Root test (Level variables)

	Augmented Dickey-Fuller Test	Phillips-Perron Test
Variable	P-Value at 5%	P-Value at 5%
lnP	0.2087	0.2407
$LlnP$	0.0458	0.0511
$LlnQ$	0.0951	0.0889
$Llnmaize$	0.8100	0.7352
$lnex$	0.5819	0.0016
$lninvrain$	0.0060	0.0000
lnn	0.9575	0.9914
$lninf$	0.0229	0.0219

The results tabulated above suggests that all variables are non-stationary at their levels since their P-Values have exceeded the critical value (5%) at least in one of the two tests with an exception of "$lninf$" and "$lninvrain$" which appears to be stationary at level.

All non-stationary variables were then differenced so as to induce their stationarity. The test results, which include the variables' order of integration, have been presented below:

Table 3(b) Results: Unit Root test (Differenced variables)

	Augmented Dickey-Fuller Test	Phillips-Perron Test	Order of Integration
Variable	P-Value	P-Value	
$DlnP$	0.0000*	0.0000*	$I(1)$
$LDlnP$	0.0000*	0.0000*	$I(1)$
$LDlnQ$	0.0000*	0.0000*	$I(1)$
$LDlnmaize$	0.0001*	0.0000*	$I(1)$
$Dlnex$	0.0000*	0.0002*	$I(1)$
$D2lnn$	0.0838**	0.0000**	$I(2)$

Notice: * indicates significance at the 5% level while ** indicates significance at the 10% level.

The results from Table 3(b) indicates that the P-Values for all $I(1)$ variables were less than the 5% critical value forcing the rejection of the null hypothesis which suggests that the series has

unit root. However, the "D2lnn" variable had to be tested at 10% critical value since further differencing on it would imply a significant loss of degrees of freedom.

4.2 The Co-integration Test and the ECM

The Engel and Granger (1987) test for co-integration requires all variables to be non-stationary for their long run equilibrium to be tested. In other words, the procedure demands all variables under consideration to be integrated of the same order *i.e.* order one, for their error correction term to be formed. However, results from table 3(b) indicate otherwise since we have different orders of integration among the variable. Such results, therefore, invalidates the test for co-integration together with the formulation of the ECM. This is one of the reasons to why the study resorted to the use of ARDLM bounds approach to co-integration.

4.3 Regression results

The Nerlovian model in the natural log form was estimated in Stata 12 with OLS approach. The results have been presented in table 4. The signs of all the coefficients are as predicted in the theory except for the exchange rate variable, which contradicted the priori assumption. Result shows that the log of supply output increases as the log of exchange rate together with the lag of log inflation declines. The rest of the variables appeared to exert a positive influence on the dependent variable. All of these variables explain about 90% of the variations in Tanzanian cashew nut supply.

Table 4(a): OLS Regression results for the Cashew nut supply response from 1991-2012

Dependent Variable $DlnQ$			
Independent Variable	Coefficient	t-value	P-value
Constant	-9.119196	-4.77	0.001*
$DlnP$	1.420948	6.71	0.000*
$Dlnmaize$	-0.6903198	-5.12	0.001*
$LDlnex$	-2.983909	-6.75	0.000*
$LDlninvrain$	0.8111361	2.30	0.047*
$LDlninf$	0.2275446	5.65	0.000*
$LlnP$	1.521947	6.24	0.000*
$Llnmaize$	-0.061464	-0.52	0.615
$Llnex$	-0.3878616	-2.56	0.030*
$Llninvrain$	1.096801	1.73	0.117
$Llninf$	-0.0660379	-1.81	0.104
Adjusted R^2 = 0.8087			Observations = 20

Notice that: * indicates significance at the 5% level while ** indicates significance at the 10% level.

From the table; $Llninf$, $Llninvrain$, and $Llnmaize$ are statistically insignificant while the rest of the variable are statistically significant at 5% level of significance.

4.4 The ARDL Co-integration Test

The following tables present the test results for co-integration together with the diagnostic test results obtained.

Table 4(b) The ARDL co-integration results

Bounds Test to Co-integration		
Estimated Equation	$lnQ= f(LlnP, lnmaize, lnex, lninvrain, lninf)$	
F-statistics	9.03 (0.0014)	
Significant level	Lower Bounds $I(1)$	Upper Bound $I(1)$
1 percent	5.856	7.578
5 percent	4.154	5.540
10 percent	3.430	4.624

The table above shows that the study has failed to conclude the presence of co-integration among the variables since the F-statistics lies below the lower boundary of the bounds test at all critical levels for a case of unrestricted trend with an intercept. The bounds level values were obtained from the minimum number of observation as presented by Narayan (2005), since Narayan employed fewer number of observations as compared to Pesaran et al. With this regard , therefore, the study can only estimate the short run responses.

However, the model have been found free from heteroskedasticity and serial correlation problems, apart from the residuals being normally distributed as displayed in the table of results presented below.

Table 4(c) Diagnostic Test results

Test conducted	**Value of statistics test**
JB normality test	3.49 (0.1749)
Breusch & Godfrey LM test	0.424 (0.5148)
Breusch & Pagan Heteroskedasticity test	0.36 (0.5474)
Ramsey RESET test	0.08 (0.9693)
CUSUM	Stable
CUSUMsq	Stable

4.5 Short run elasticities

The short run results indicates that cashew nut supply responds positively to price incentives where by a 1 percent increase in price leads to 1.42 percentage increase in the quantity of cashews supplied. In addition, a 1 percent increase in rainfall results to a 0.81 percentage increase in cashew supply. Apart from that, a 1 percent increase in price of maize results to a 0.69 percent decrease in the cashew supply. The rate of inflation on the other hand, influences positively the output supply in which a 1 percent raise in the rate of inflation forces cashews

supply to increase by 0.23 percent. Lastly, the rate of exchange rate appears to have negative effect on cashew supply by which a 1 percent increase in exchange rate leads to almost 3 percent reduction of cashews supplied.

4.6 Stability Tests

Both, the CUSUM and CUSUM squared statistics do not strays out of the 95% confidence band as indicated in figure 4 and 5; in which, the null hypothesis that the model is well specified and the parameters are stable cannot be rejected, (Bahmani-Oskooee, M and Nasir, AM 2004). Thus, the test results suggest that indeed, the parameters used in the model are reliable and well fits for statistic inferences.

4.7 The Comparison of Study Results

The results from this study have suggested that pricing policy is elastic and effective towards influencing the level of output in the short run. These results seems to share a similar, in terms of short run responses prices, as earlier studies done by Gosalamang et al (2012) in Botswana and Lafrance & Burt (1983) in USA. These results, therefore, refutes the conventional belief which claims that agricultural output supply response is generally inelastic.

CHAPTER FIVE

5.0 Conclusion, Policy Implications and Recommendations

The chapter presents a summary result of the main findings apart from pointing out the policy implications such obtained results together with making some policy recommendations to be worked upon by both private and public stakeholder in making sure that the sector keeps on improving.

5.1 Conclusion

The results from this study have clearly indicated that that farmers or suppliers of the cashew nuts respond well to price incentives. The study reported short run price elasticity of 1.42, which is elastic. However, the study failed to extract the long run responses since the evidence rejected the presence of co-integration. The results indicated that price incentives, amount of rainfall as well as the rate of inflation, altogether exerted a positive influence on the cashew nut supplied on one hand. On the other hand, exchange rate together with price of maize had a negative influence on the cashew supply in the short run.

5.2 Policy implications and Recommendations

In the context of policy implications, the study is helpful to both public as well as private stakeholders involved in the cashew nut sector in Tanzania. The CBT must understand the strength of price signals to the farmers. The announce of good indicative prices will be well received by the farmers. However, such announcements won't be of any use to the farmers if they fail to benefit from it. This suggests further that there is still a need of proper supervision

on the sector to prevent middle traders from exploiting the farmers through collusion practices among the buyers.

Such measures will allow price incentives to work more effective on benefiting the farmers at the ground and improve the government revenue ripped from the sector for at least in the short run. On the same account, for price incentives to be fruitful, the non-price incentives also need to be incorporated at least in the short run. These two must work hand in hand with each other for the greater good at the greatest number.

It should be also noted that, exchange rate in the floating regime still poses great challenge on today's economy. Any appreciation of local currency against the US dollar is more likely to hurt harder the farmers at the ground. However, the impact may be less intense if most of the supplied cashews would have been processed locally due to the fact that currency appreciation would have ease the burden for the importation of spare parts for processing machines. The results, therefore, calls upon the B0T to exercise control on exchange rate volatility in such a way that, critical and necessary continuous intervention by the BoT in the exchange rate markets must be a priority.

5.3 Limitations of the Study

To the reasonable extent, the study has been successful in meeting the research objectives. However, there has been some challenges and limitations that are not worthwhile being ignored. The main limitation in this study has to do with the reliability and availability of data. The study could have included more variables in the analysis but most of the data are either unavailable or need to be compiled from different sources, something which may alter the

authenticity of the data. In fact, one notable reason to why the study has failed to estimate long run elasticities, is deeply embodied into the problems associated with the nature of the data used in the analysis.

5.4 Areas for further research

Cashew nut sector in Tanzania plays a very crucial role not only to the government but also to the farmers especially in the southern east part of the country. Despite two decades of liberalization, still there are no clear explanations to why the private sector has failed to significantly excelling the sector. Much work needs to be done on this area to shed enough light on the problem and provide numerous solutions or alternatives with the aim of improving the sector.

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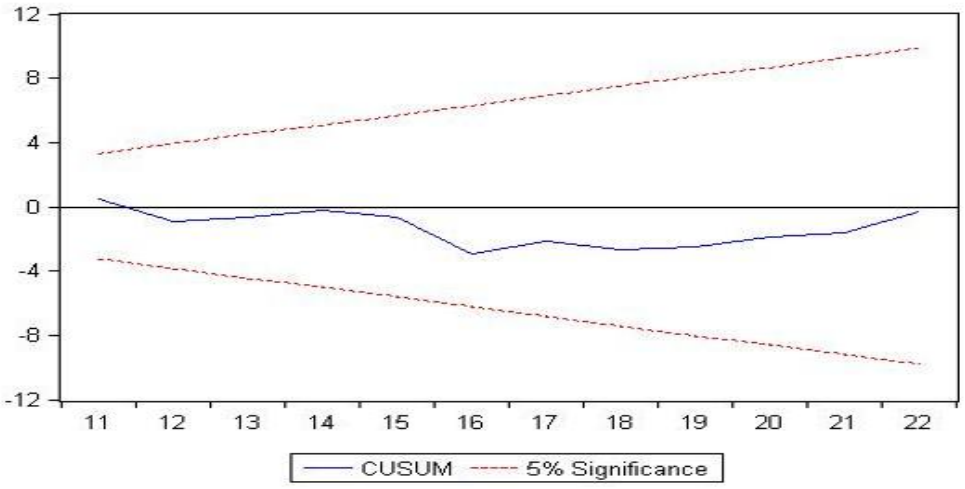
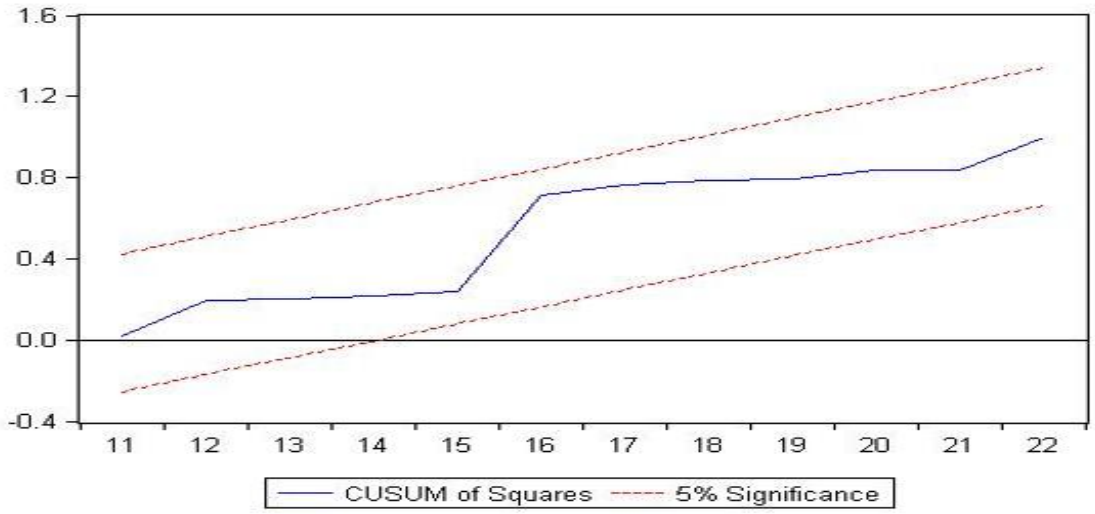
Appendix 1

Plot of CUSUM of Recursive Residuals



Plot of CUSUM Squares of Recursive Residuals



Appendix 2

Years	lnQ	lnP	lnmaize	lnex	lninvrain	lninf
1991	10.30394	6.807935	4.960744	5.454894	2.51598	3.356897
1992	10.62862	6.706667	4.865224	5.81413	2.290435	3.084201
1993	10.57898	7.046595	4.767289	6.173515	2.227767	3.230014
1994	10.74936	6.948609	4.593098	6.260441	2.188077	3.499231
1995	11.05722	6.709646	4.629863	6.310573	2.151937	3.345685
1996	11.31081	6.723351	4.763882	6.389637	2.182196	3.04357
1997	11.08828	6.46616	5.005958	6.437063	2.198032	2.778198
1998	11.4425	6.66037	4.930148	6.523562	2.158107	2.549445
1999	11.5759	6.527797	4.379524	6.681269	2.235567	2.065596
2000	11.7052	6.870251	4.398146	6.688678	2.220663	1.778336
2001	11.71178	6.431798	4.436751	6.820344	2.141219	1.635106
2002	10.91509	6.383844	4.72473	6.88377	2.444696	-0.0202
2003	11.31081	6.559898	4.802381	6.969433	2.005095	1.264127
2004	11.43831	6.702206	4.607168	6.949818	2.380727	-3.50656
2005	11.40734	6.621539	4.712229	7.060914	2.001739	2.155245
2006	11.25674	6.387553	5.298317	7.140168	2.377655	1.859418
2007	11.43604	6.431492	5.023222	7.031821	2.188077	1.950187
2008	11.50388	6.732925	5.633002	7.15485	2.254649	2.116256
2009	11.27847	6.576748	5.738828	7.190676	2.09255	2.557227
2010	11.28978	6.65325	5.490589	7.288162	2.270239	2.493206
2011	11.69525	6.968945	5.562987	7.381097	2.327617	2.370244
2012	11.97035	6.892337	5.596569	7.389132	2.363949	2.219203