RELATIONSHIP BETWEEN TEA PRODUCTION, BALANCE OF PAYMENTS AND EXCHANGE RATE IN KENYA, 1996-2018

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October, 2023

DECLARATION

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

Sign ………………………………. Date ………………………………

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I confirm that the work in this thesis was done by the candidate under my supervision

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OPERATIONAL DEFINITION OF TERMS

- **Trade Balance**: Net value of a nation's exports minus imports, indicating a trade surplus (positive) or deficit (negative).
- **Balance of Payments**: Comprehensive record of a country's international financial transactions, including the current and capital accounts.
- **Exchange Rates**: Relative value of one currency compared to another, influenced by supply, demand, and economic factors.
- **Net Exports**: Value of a country's exports minus imports, affecting economic health and contributing to GDP.
- **Trade Deficit**: When a nation's imports exceed its exports, creating a negative trade balance and economic concerns.
- **Foreign Inflows**: Funds, investments, or capital flowing into a country from foreign sources, supporting economic development.
- **Inflow of Foreign Currency**: Receipt of foreign currencies due to international transactions, impacting foreign exchange reserves and rates.
- **Trade-offs**: Decision-making concept where one choice involves sacrificing something for another based on benefits and drawbacks.

LIST OF ACRONYMS/ABBREVIATIONS

ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criteria
ARCH	Autoregressive Conditional Heteroscedasticity
ARDL	Autoregressive Distributed Lag
CBK	Central Bank of Kenya
CTC	Curl, Tear and Cut
EATTA	East African Tea Trade Association
ECM	Error Correction Model
FAO	Food and Agriculture Organization
FPE	Final Prediction Error
GARCH	Generalized Autoregressive Conditional Heteroscedasticity
GDP	Gross Domestic Product
RoK	Republic of Kenya
IPS	Im Pesaran and Shin
KNBS	Kenya National Bureau of Statistics
KTDA	Kenya Tea Development Agency
MASD	Moving Average Standard Deviation
MENA	Middle East and North Africa
PMG	Pooled Mean Group
PP	Philip Perron test
SVAR	Structured Vector Autoregressive
VAR	Vector Autoregressive models

VECM	Vector Error Correction Models
OECD	Organization for Economic Co-operation and Development
IMF	International Monetary Fund
AFA	Agriculture and Food Authority

ABSTRACT

Compared to other tea producers, Kenya is the third largest behind India and China. Tea production has doubled over the last two decades due to new small-scale farmers' entrance and acreage under Tea. Tea is one of Kenya's major exports, and an increase in tea production results in higher exports, which, in turn, positively impacts the country's trade balance. A favourable BOP is crucial for overall macroeconomic stability. However, despite the continued increase in tea production and export in Kenya, the effect of foreign inflows does not seem to strengthen the Kenya shilling against the dollar. Furthermore, the balance of payment has remained negative and even deteriorating since 1996. Whether (or not) tea production affects exchange rates and balance of payment or whether (or not) the effects are eroded by increased imports of other goods, thus lowering the balance of payment, is a policy question not adequately covered in the empirical review. This study investigates the intricate relationships between tea production, balance of payments (BOP), and exchange rates in Kenya from 1996 to 2019. It seeks to shed light on the extent of these connections and their policy implications for Kenya's economic landscape. The study adopts a quantitative approach, utilising secondary time series data from reputable sources, including the Central Bank of Kenya, the East Africa Tea Auction, and the World Bank database. An Ordinary Least Squares regression model was used to estimate the model of the data. Unit root testing was carried out using the Augmented Dickey-Fuller and Phillip Perron techniques. A causality test was also performed to determine whether the variables' correlations were unidirectional or bidirectional. Through the utilisation of an Ordinary Least Square (OLS) regression model, the study unveils a significant and negative relationship between tea production and the BOP. In essence, this signifies that an increase in tea production leads to a subsequent increase in tea exports, reducing the BOP deficit. Notably, the model demonstrates that approximately 60.2% of the variability in the BOP can be explained by changes in tea production. The study also conducts Granger causality tests further to elucidate the connection between tea production and the BOP. The results reveal a one-way relationship: tea production significantly influences the BOP, while the BOP has no discernible impact on tea production. Subsequently, the study delves into the association between tea production and the Kenyan exchange rate. However, unlike the relationship with the BOP, the study uncovers that tea production has a negative, but statistically insignificant, effect on exchange rate volatility. The relationship between these variables appears to be weak, with variations in tea production accounting for just 3.6% of the changes in exchange rate volatility. Granger causality tests reinforce the findings, indicating a lack of directional causality between tea production and exchange rate volatility. In other words, changes in tea production do not lead to significant shifts in exchange rate volatility. These findings present a vital tool for the National Treasury, the Ministry of Trade and the Ministry of Agriculture in designing agricultural policies as a means of reducing the BOP deficits. There is a need for the National Treasury and Ministry of Trade to explore this linkage in managing the deficits by increasing agricultural production through policies such as subsidisation of agricultural imports like fertilisers and equipment by 1% in order to realise up to 3150.9% results.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Agricultural sector is a leading contributor to Kenya economic growth, employment and foreign exchange earner. Thus, balance of payment, price, income distribution and stabilization relate directly to the agricultural sector. At independence time agriculture contributed 40% of total GDP, but growth in industries and service sector have lowered its contribution to 26% by 2016 (KNBS, 2015). Food crops such as maize, rice and wheat as well as cash crop such as horticultural coffee and tea products are key components of Kenya agricultural output. Of these, tea is the largest single employer with over 10% of population directly and indirectly depending on it (KNBS, 2015). More than 90 percent of the Kenyan Tea is for exportation purposes whereby 84% sold through the Mombasa auction, 10% is exported directly with local consumption comprising 5% of tea produced (EATTA, 2016). This makes tea the largest foreign income earner after tourism generating over US$1.25 billion in 2015 (EATTA, 2016)

Policy focus on planned action dating back to 1965 *Sessional Paper Number* 10 to *Vision 2030* blue print has placed tea production among strategic sectors for promotion to improve real exchange rate stability and improvement of economic performance (Ogutu, 2014). Tea was among the anchor sectors identified under *Sessional Paper Number* 10 of 1965 for development of production and value addition capacity in agriculture. This set the stage for government focus on high potentiality of tea growing area through establishment of research institute and support structure for the sector.

This has seen increase in small scale holders from 19,000 in 1963 to over 637,000 farmers in 2016 under the management of Kenya Tea Development Agency (KTDA). The progressive nature of tea sector as well as growth in demand in the global market kept the sector on the forefront of transforming Kenya into a prosperous middle-income country under the *Vision 2030* blue print. Indeed, flagship projects on environmental conservation, value addition and employment creation were defined under the sector. A review by Kenya National Bureau of Statistics (KNBS) on the progress of *Vision 2030* in 2014 noted plausible improvement in production of tea with marginal rise in earning despite price fluctuations in the global market.

Like any other sector, tea demand and supply are affected by global prices while earnings for tea value chain are pegged on real exchange rates. OECD, (2009) noted that tea production decision is made in advance and as such, price stability and real exchange certainty are key concern to farmers and player across the value chain. For the last five-decade, tea has played a central role in macroeconomic stability especially improving balance of trade and foreign exchange adjustment. Indeed, Ndung'u (1999) observed that fluctuation in tea production in 1980s and 90s was responsible to significant extent in depreciation of exchange rate of Kenya shillings against United States dollar.

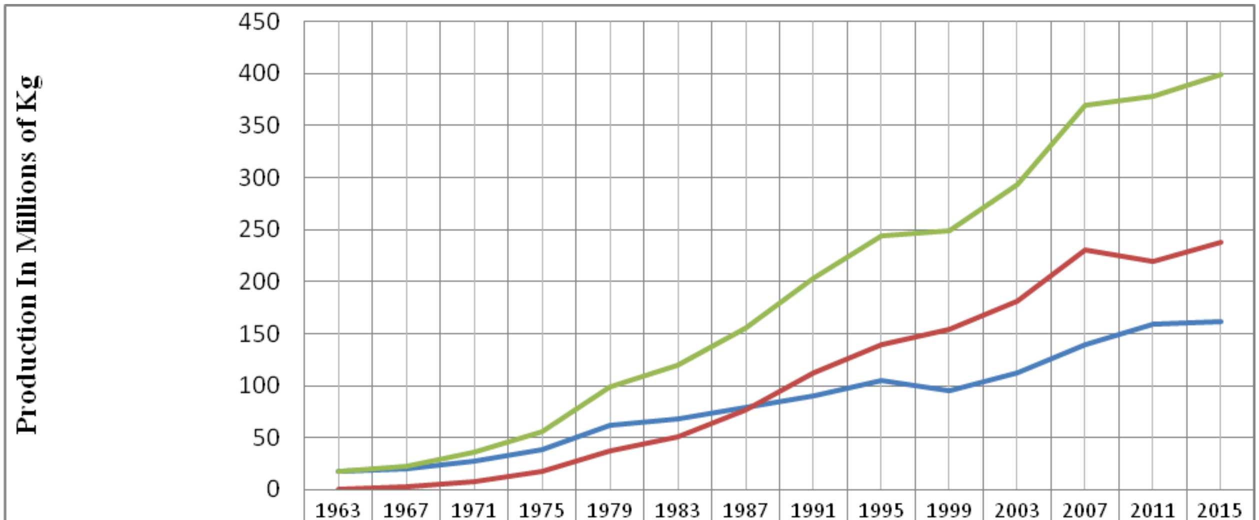
1.1.1 Tea Production in Kenya

Tea was first introduced to Kenya in 1904 and became fully commercialized in 1924 by Malcolm Fyers Bell for Brooke Bonds. Some further expansion of tea production in pre independence Kenya was by multinational companies who controlled the sector' production until 1954 when small holder tea cultivation commenced under the Swynnerton plan which later saw the first small holder factory established in Ragati, Nyeri county in 1957 (EATTA, 2016).

Further development in the industry followed in post-independence Kenya where government implemented a policy where an umbrella, that is KTDA was formed to include small tea growers. Although KTDA has gone through a number of transformations to Kenya Tea Development Agency Ltd, it is still the umbrella for small scale tea growers with 68 factories serving over 637,000 small farmers by 2016 up from 19,000 at independence time (Bordoloi, 2012).

Tea production is an important economic activity in Kenya, accounting for 26% of total foreign exchange, 2% of GDP, and 11% of agricultural earnings (Brouder et al., 2013). Additionally, tea supports the livelihoods of 10% of Kenya's population with 637,419 small holder farmers directly involved in its production (Tiampati, 2014; Inter governmental group on tea, 2016). Globally, compared to both India and China, Kenya is the largest exporter of green tea but it is ranked at number three in production. It boosts of a 25% export share in global tea market (MoLF, 2016). Unlike China and India where much of the tea is locally consumed, Kenya exports 95% of its tea to the global market making it a net exporter.

Tea in Kenya is grown in large scale by large private farmers (estates), multinational companies, and small scale by small scale growers. Tea grown by smallholders accounts for 65% of total tea acreage in Kenya, accounting for 63% of total tea, while large scale tea growers account for 37% of total tea acreage, accounting for 35% of total tea acreage. Figure 1.1 depicts the trends in Kenyan tea production between 1963 and 2015.



	1963	1967	1971	1975	1979	1983	1987	1991	1995	1999	2003	2007	2011	2015
Estate (Kgs in Millions)	17.8	20.56	28.22	38.81	61.64	68.77	78.88	90.85	105.56	94.85	112.88	139.99	159.36	161.62
KTDA (Kgs in Millions)	0.31	2.25	8.07	17.92	37.63	50.96	76.93	112.74	138.95	153.86	180.79	229.61	218.55	237.6
Total (Kgs in Millions)	18.11	22.81	36.29	56.73	99.27	119.73	155.81	203.59	244.51	248.71	293.67	369.6	377.91	399.22

Figure 1.1: Tea Production in Millions of Kgs (1963-2015)

Source: EATTA, (2016)

The production trends indicate that tea has followed an upwards trajectory from 1963. Estates dominated tea production in the first 24 years rising from 17.8 million kilograms to 78.88 million kilograms in 1987 where the share for small holders increased from above 300,000 kilograms to 76.93 million kilograms over the same period. However, in 1988, small holders dominated the production at 84.64 million kilograms against estates production of 80.03 million kilograms.

The gradient for small holders' tea production steepened faster than the estate curve thus widening the gap up to the year 2015 where their production touched 237.6 million kilograms equivalent to 60% of tea production against the estates 161.62-Million-Kilogram equivalent to 40% of total tea production. This growth is attributed the increased number of small tea growers as well as the expansion in land under tea for the earlier small growers.

1.1.2 Trend in Balance of Payments in Kenya, 1996-2016

Kenya has experienced deteriorating trade balance in goods and services since 1996 with net exports being less than net imports. Figure 1.2 below shows the trends for net trade in goods and services between 1996 and 2016.

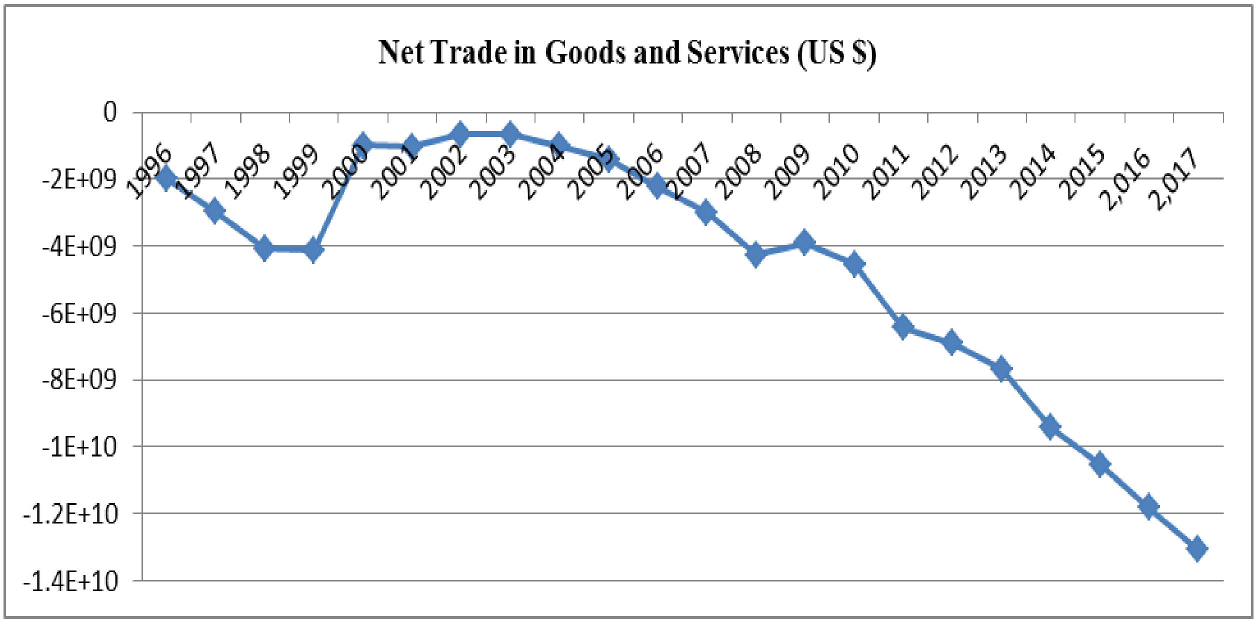


Figure 1.2 Net Trade in Goods and Services, 1996-2016

Source: *World Bank Data (2017)*

As shown in Figure 1.2, besides an increase in BOP between the year 2000 and 2003, there has been a steady decrease up to the year 2017. The trends indicate that the imports into the current were more than the exports thereby indicating a negative BOP (World Bank Data, 2017).

1.1.3 Trend in Exchange Rates in Kenya, 1996-2016

Kenya has over the years pursued liberal trade policies where exchange rate and trade regulations and price are a subject of market forces. Though structural adjustment was introduced in the country in 1980s it was not until 1985 that realization of liberal market was manifested and free-floating exchange rate structure established. Political and economic changes that swept across the world as well as internal shift in political system in Kenya in the 1990s had significant bearing on Kenya shillings. Kenya currency weakened steadily against major currencies from the mid-1990s.

Figure 1.3 below shows the trends in Exchange rate (Kenya Shillings to US Dollars) in Kenya between 1996 and 2016.

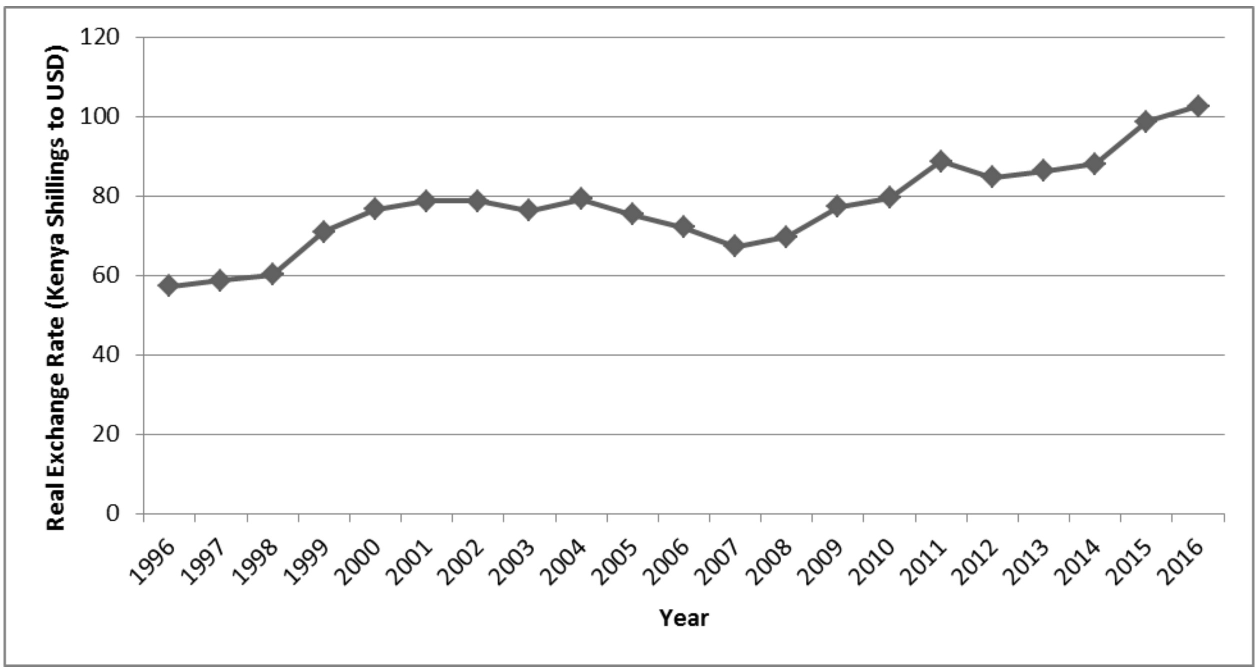


Figure 1.3 Exchange Rates in Kenya, 1996-2016

Source; *IMF Financial Data (2015) CBK end period data (2016)*

The figure shows trends in exchange rates for the period 1996-2016. The exchange rates against US dollar averaged 57.2 in 1996. In 1999, the shilling depreciated to 70 shillings per dollar hitting a high of 79.1 shillings per dollar in 2004. The dollar eased against the shilling in 2007/8 period with an average of 67.2/69.6 respectively. The shilling depreciated further to pass 80 shillings per dollar in 2010 and 98.7 in 2015. Macroeconomic regulations, local market behavior as well as international market conditions have determined trends exchange rates in Kenya over the last three decades (World Bank, 2014).

1.1.4 Export and Imports in Kenya, 1996-2017

The main exports in Kenya include tourism, tea and coffee. Trends on exports have been on a upwards trajectory although not as steeper as the graph for imports.

Figure 1.4 below shows the exports and imports trends in Kenya between the year 1996 and 2017.

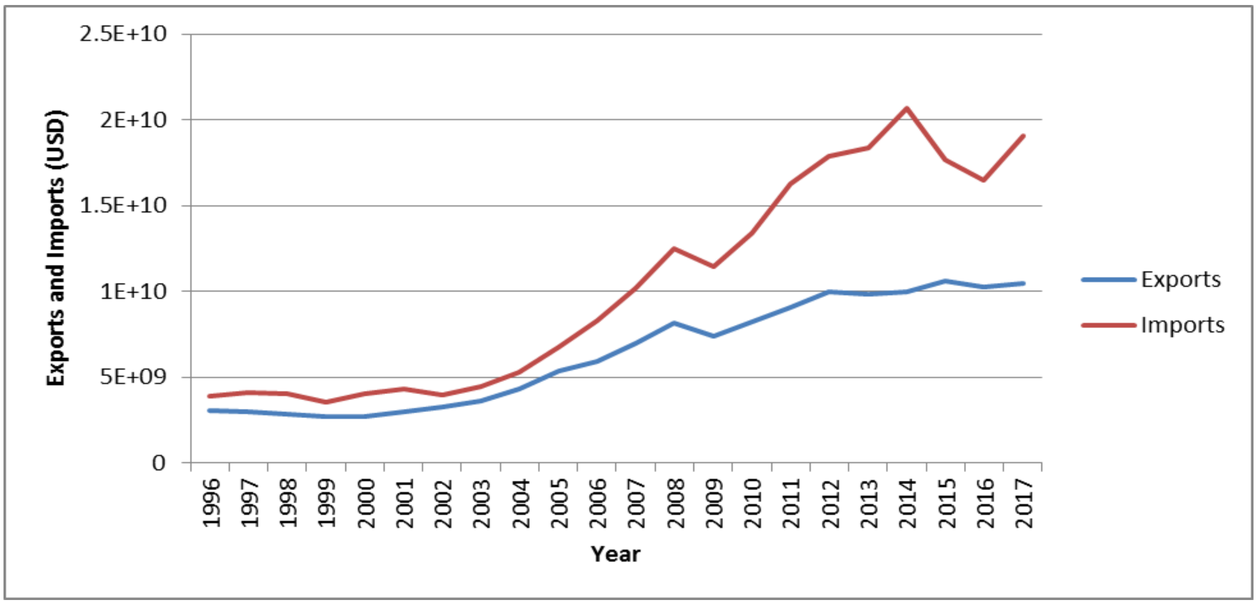


Figure 1.4: Exports and Imports in Kenya (1996-2017)

Source: OECD, (2016)

Kenya's net exports have been negative for the last two decades, as shown in Figure 1.4. Between 1996 and 2004, the gap between Kenyan exports and imports was narrower. However, the gap widened after 2005, with imports reaching US$ 18 billion and exports reaching US$ 6 billion. The growing trade deficit can be attributed to increased imports of machinery and textiles, as well as increases in the prices of petroleum (oil lubricants), fertilizers, and food grains (Kennedy, 2013). The turning point in the trade balance in Kenya was the year 1997 which had a large deficit in comparison to preceding years. The main reason attributed for this was the slow growth of exports of products such as textile, and agricultural products like tea and faster imports growth of products such as machinery, petroleum products, motor vehicle and steel products (Kennedy, 2013).

1.2 Statement of the Problem

Ranking behind China and India, Kenya produces the world’s nearly 0.5 billion Kgs of tea (EATTA, 2016). Over the last two decades, tea production has doubled owing to entrance of new small-scale farmers and acreage under tea. A total of Ninety-five percent of the Kenyan produced tea is auctioned through Mombasa auction for global market. This has made it the second largest export earner after tourism averaging US$ 1billion with a high of US$1.25 in 2015. Indeed, the contribution of tea to Kenyan GDP is in the tune of 4 percent and 26 percent of the earnings obtained from exports (KNBS, 2016).

However, despite the continued increase in tea production and export in Kenya, the effect of foreign inflows does not seem to strengthen the Kenya shilling against the dollar. According to Central Bank of Kenya currency review, Kenya shilling has weakened over the dollar from an average of 67.2 in 2007 to 103 in 2017 whereas tea export earnings have increased by more than 25%. Furthermore, despite the increasing tea production, the BOP has remained negative and even deteriorating further as the World Bank Data (1996-2017) indicate. Whether (or not) tea production is related to exchange rates and BOP or whether (or not) the relationship is eroded by increased imports of other goods thus lowering balanced of payment is a policy question not adequately covered in empirical review.

Among the studies conducted in this area is a study by Muriithi (2009) on the effect of tea production on GDP growth, Toros (2011) on Kenya tea earning on export easing and Mwikali (2012) on comparative advantage of tea production efficiency. These studies not only differed in focus but also methodology and conclusions. This study thus sought to bridge this knowledge gap by assessing the relationship between tea production, BOP and exchange rate in Kenya.

1.3 Research Questions

i. What is the relationship between Tea production and BOP in Kenya?

ii. What is the relationship between Tea production and Exchange rate in Kenya?

1.4 Objectives of the Study

The study's primary purpose was to evaluate the link between Kenya's tea output, Balance of Payments, and exchange rate between 1996 and 2019. The study's precise aims were:

i. To establish the relationship between Tea production and BOP in Kenya

ii. Find out the relationship between Tea production and Exchange rate in Kenya

1.5 Significance of the Study

Kenya’s economic growth is largely dependent on agriculture with tea production comprising the largest share, both in production and exports. This study is therefore projected to make a substantial contribution through analyzing high impact areas on the relationship between tea production, BOP and exchange rates. This is critical in guiding government policy making seeking to improve the BOP position through agriculture.

For future economists and researchers, aiming to interrogate a similar theme, the study has presented a theoretical and empirical evidence to support future studies. Specifically, the study is projected to increase knowledge on literature and methodology from which future studies can borrow from.

1.6 Scope of the Study

Secondary data on tea production, BOP, and exchange rate variables were used in the study. This is a Kenyan study, and all data and information pertain to the Kenyan economy. Time series data from 1996 to 2019 were used in the analysis. Exchange rate data were obtained from the CBK data base, tea production data from the Agriculture and Food Authority (AFA) tea directorate, and BOP data from the World Bank repository. The research was carried out quantitatively using econometrics tools.

1.7 Organization of the Study

This project is structured into five chapters. In the first chapter, the main concepts of tea production, exchange rate, and BOP are interrogated, and trends are vividly used to indicate figurative points of reference. The problem is also mentioned in this chapter, as well as the objectives. The second chapter provided a theoretical foundation for the study by interrogating theories related to the study themes. Other studies on the subject have been presented and critiqued in areas where research gaps have been identified. The methodology for achieving the study objectives was presented in the previous chapter. Chapter four contains findings of the study as per the objectives while chapter five presents, summary, conclusions and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Theoretical Literature

This section provides the study's theoretical literature and investigates priori theories in economic literature that explain agricultural production and BOP. Specifically, it delves into the theoretical postulations on how study variables respond and relate to each other. Theories covered in this section include; Mundell-fleming model, Marshall-Lerner Condition, J-Curve effect and Porters National Competitiveness Theory.

2.1.1 Mundell-Fleming Model

This model brought forth by Robert Mundell and Marcus Fleming extends IS-LM model to a small open economy exhibiting short run relationships between output, interest rates and nominal exchange rate. The model introduces net exports (*Nx*) to national accounts equation;

$$Y = C + I + G + Nx \quad \ldots\ldots 2.1$$

The model states that net export is a function of nominal exchange rate (*e*), GDP (*Y)* exporting country and combined GDP (*Y**) the export destination countries as shown in the equation;

$$Nx = Nx\ (e,\ Y,\ Y^*) \quad \ldots\ldots 2.2$$

If domestic incomes increase, imports go up which lowers net exports and flow of foreign currency while higher foreign income increases exports which in turn increase net exports and inflows of foreign currency.

2.1.2 Marshall-Lerner Condition

Propounded by Marshal A. and Lerner A., the model explains the behavior of exchange rates in response to policy and shifts in trade balances (Imports and exports) (Andrews, 1991). The theory's general argument is that an improvement in trade balance will only occur after currency depreciation if the long run sum of export and import demand elasticity is greater than unity. In the short run, trade balances deteriorate as export demand remain inelastic due to lags in delivery time, change in real variables, delays in decisions, inventories replacement and production lags (Paul, 2009). Price becomes flexible in the long-term which then encourages more exports than imports, in the process improving trade balance. Taking net exports as the difference between Exports (X) and Imports (Q) normalized to one, the following equation is derived;

$Nx = X-Qe$ ……………………………………………………………………………2.3

Differentiating the equation with respect to *e:*

$$\frac{\partial N_X}{\partial e} = \frac{\partial X}{\partial e} - e\frac{\partial Q}{\partial e} - Q \quad \text{……} \quad 2.4$$

The equation is further modified by dividing through by *X*, then multiplying through by *e* and taking equilibrium level *X*= *Qe* the resulting equation is expressed as;

$$\frac{\partial N_X}{\partial e}\frac{e}{X} = \frac{\partial X}{\partial e}\frac{e}{X} - e\frac{\partial Q}{\partial e}\frac{e}{Q} - 1 \quad \ldots\ldots 2.5$$

Summarized into:

$$\frac{\partial N_X}{\partial e}\frac{e}{X} = \eta X_e - \eta Q_e - 1 \quad \ldots\ldots 2.6$$

In the equation the elasticity of export is denoted by ηX_e, while imports elasticity is expressed as ηQ_e. According to the Marshall–Lerner condition, depreciating the currency encourages more exports therefore improving trade balance (Paul, 2009).

2.1.3 J-Curve Effect

The J Curve effect is a theoretical postulation of the behavior of a state's trade balances following currency depreciation. It is a graphical representation of the behavior of trade balances across time after currency depreciation (Figure 2.1).

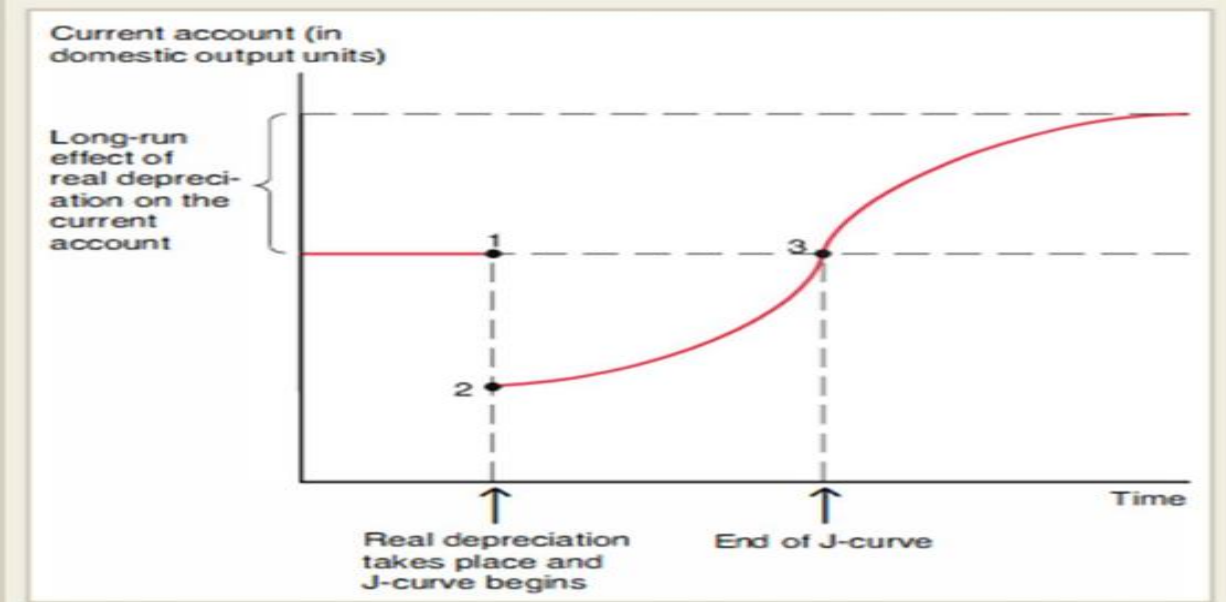


Figure 2.1: J- Curve effect

Source: Krugman and Obstfeld (2008)

As shown in figure 2.1, devaluation of currency makes a country's export cheaper and imports expensive which leads to more exports and less imports thus raising trade balances (Hacker & Hatemi, 2004). More elaborately, the immediate effect of currency depreciation is manifested in sharp deterioration of domestic output since imports and exports exchange rates contracts had already been set months earlier. Thus, import and export decisions are influenced by the old exchange rate level, resulting in an increase in the value of precontracted imports while exports out remain unchanged, deteriorating the current trade balance.

In the medium run, the new contracts based on relative prices that favor domestic products which prompt producers expand foreign consumption of domestic products through building additional capacities. Importers, on the other hand, use new production techniques to enhance efficiency of intermediate inputs and shift demand of their products from foreign to domestic consumption. These interactions lead to improvement in trade balances thus the curve moves from point 2 to point 3. With real depreciation of currency, the long run trend of trade accounts continues to improve moving from point 3 (Krugman & Obstfeld, 2008).

2.1.4 Porter's National Competitive Advantage Theory

Michael Porter developed the model in 1990 after building on earlier works by Heckscher-Ohlin and Ricardian trade theories that postulated productivity advantages within an economy that determines its export capacity. Heckscher-Ohlin model argued that a country's production on export is comes from resources that are abundant within its border and imports what is scarce. Ricardian model narrowed the abundance of resources to labor availability and productivity as determining a country's export advantage.

For the competitive advantage theory, Porters (1990) argues that export patterns of a country are determined by its own advantage over other country as well as prevailing economic conditions of trading partners. Economic policies supporting sectorial production, factor and demand conditions in export market determine the competitive level of a country and thus it's trading balances. Economic policy includes fiscal (taxation and government spending) Monetary (interest rates, exchange rate, money supply and banking policies) as well as trade policies (customs regulations). Factors conditions include; climate, soil fertility, natural resources and location and advanced determinants available include; deregulation of markets, communication, research and development, technological levels as well as skilled labor. According to the competitive advantage theory, a country's production and exports are heavily influenced by how its sectors are strategically positioned in relation to the conditions.

2.1.5 Gravity Theory

The model first got recognition when in the early 60s it was used in international trade field by Tinbergen (1962). Later in 1963, Poyhonen (1963) also adopted the model. It is mainly used to evaluate trade flows, regional agreements as well as FDIs. The model is also used to evaluate monetary union impacts as well as export and BOP potential. In its general form, the model argues that exports between two countries, i and j (destination), can positively be linked to their economic mass which can be captured by the income and the population and negatively to the distance between the two countries as well as institutional characteristics which can be captured through dummy variables (Eita & Jordaan, 2007).

In general, the model postulates that the trade value between two countries can be positively promoted by their incomes but affected negatively by the distance between them (Thursby & Thursby, 1987). This model contradicts other trade models such as Hecksher-Ohlin (H-0) which had previously assumed that trade between two countries is frictionless (Salvatore, 1998). The equation developed follows the work of Thursby and Thursby (1987) as shown in 2.7:

$$X_{jj} = ao \quad (Y_i)^{a}i(Y_j)^{a}{}_2(N_i)^{a}{}_3(N_j)^{a}{}_4(D_{ij})^{a}{}_5(A_{lj})^{a}{}_6(P_1,)^{a}7U_{ij} \quad \ldots\ldots 2.7$$

Where:

X_{ij} is the value of the trade flow from country i to country j

Y_i and Y_j are the values of nominal GDP in i and j

N_i and N_j are the size of population in both countries

D_{ij} is the physical distance from the economic centre of country i to that of country j

A_{ij} is any other factor either aiding or hindering trade among i and j

P_{ij} is trade preferences among the countries

U_{ij} is a log-normally distributed error term with E (lnU_{ij}) = 0.

2.2 Empirical Literature

Many studies have examined the behavior of tea or agricultural commodity production, exchange rates and net exports across the globe. This section has reviewed some of the empirical studies and findings from related studies across the world, in Africa and Kenya.

Export performance for leading agricultural commodities has been examined against currency devaluation in North Africa and Middle East (MENA) countries. The basis for devaluing is to increase competitiveness of agricultural exports and improve trade balances. However, in Bangladesh, Hussain, (2000) observed that, devaluation of currency had no significant effect on agricultural exports as most commodities from the country were price inelastic. This posed a policy dilemma since depreciation had varied impacts on other subsectors in Bangladesh economy. A study by Arize *et al.,* (2004) confirmed the above results using nonlinear regression to analyze tea exports in Sri Lanka and China. It was demonstrated that tea exports deteriorates when exchange rates change constantly.

Gligoric (2010) investigated the J-curve effect linking exchange rate and trade balance in a study conducted in Serbia. The study demonstrated, using ARDL, that reduced exchange rate fluctuations were required for a positive trade balance. ECM and impulse response were used to investigate the short run effect.

Similarly, Bhattarai and Armah (2005) observed that currency depreciation in Ghana had contractionary effects on exports of cocoa while in South Africa, Todani and Munyama (2005) established same trend on differential impacts of currency depreciation on agricultural commodities. On the other hand, Nabli and Marie-Ange (2002) found out that a counter policy of currency over valuation led to export losses of agricultural exports in MENA since it lowered commodity competitiveness from these countries. Indeed, over valuation led to reduction of agricultural commodity export by an average of 18 percent in countries under study.

Iyoboyia and Olarinde (2013) interrogated the link between depreciating exchange rate and BOP between the year 1961 and 2012 in Nigeria. An ECM was adopted. The findings revealed a long-term relationship between the study variables, proving the existence of bidirectional causality.

Cohen (2007) study established significant inverse relationship between relative price and India export of tea, goat skin, cattle skin, manganese and cattle hide to UK. In Sri Lanka, Ekanayake and Charna (2010) generated a measure for real exchange rate using Generalized ARCH and fitted it on Sri Lankan sectorial data. Mixed effects were established. The results for tea showed a negative relationship between exports and exchange rate fluctuations, whereas tea export had no significant effect on the real exchange rate, as it did for industrial products. The results yielded similar outcome with an earlier study by Welwita *et al.* (1999) that established increased exchange volatility strongly affected tea exports. From the study, increased in tea exports did not have significant effects on exchange rates meaning the effects of exchange rates were persistence even with favorable tea exports in the country.

Batten and Belongia (2000) focused on the nexus between the three variables considered for this study. The results revealed that agricultural exports earnings had a significant but weak positive correlation with trade balances and a negative nexus with fluctuations in real exchange rates. On a similar study, Fabiosa (2002) examined the real exchange sensitivity of pork and live swine production and export in Canada, Japan, Denmark and United states as well as their contribution to net exports. In the study, the researcher expressed pork production and supply as a function of expected real exchange rates. It was shown that depreciation in currency had a significant and positive impact on pork ad live swine export earnings. However, the study did not conclusively address causality and inter relationships among the study variables.

Kong (2016) established how changes in exchange rates affected tea export in China. The study used time series and an ECM to examine the data and model's robustness using the unit root test, co-integration, and autocorrelation tests. According to the findings, changes in the actual exchange rate affect the value of China's tea exports, with appreciation of the Chinese currency increasing the value of the country's tea exports in the short run but decreasing in the long run.

In India, Bhowmik (2016) analyzed the relationship between tea production, domestic consumption, exports and macro-economic performance. Using time series data for period 1952-2013, semi-log linear trend model revealed a 6.43% significant annual increase of India tea export over the period. The findings revealed uni-directional causality between tea export and macro-economic variables with cointegration between GDP growth and tea export. Although tea export was volatile, the error correction term for VECM model was negative and significant revealing quick error correction process.

Abdulai and Jaquet (2002) investigated a similar relationship in Cote D'Ivoire using data from 1961 to 1997. Using an ECM, the results revealed a significant long run equilibrium relationship for the three variables. The findings also revealed a short and long run causal relationship between exports and GDP. The effects of agricultural commodities such as tea and coffee on net exports and exchange rates are determined by a plethora of variables, most notably price elasticity and other export market characteristics (Ferris, 2005). Several studies have concentrated on price elasticity in estimating the impact of agricultural commodities on net exports and exchange rates.

Kariuki (2008) conducted research on the local level to investigate the elements that determine Kenya's current account balance. The study took an intertemporal approach to their research. Individual and state savings, along with the exchange rate, were found to be the primary contributors to the CA's massive deficits. Despite the fact that it was demonstrated that there is a link between the variables in both the short and long run, the results differed.

Mungami (2012) investigated the effect of the Kenyan exchange rate on BOP. He observed that the exchange rate is an important factor in determining whether or not a country's economy will remain competitive on the global market. It plays a significant part in effectively allocating the use of economic resources, which helps to ensure that a nation will continue to be competitive on the global stage. When trying to enhance the balance of payments, the exchange rates are a crucial factor to consider.

Were *et al.,* (2002) established that short run effect of tea export had no significant effects on net export and exchange rates in Kenya, Rwanda and Uganda, while one or more period lagged results revealed significant effects. Tea is among Kenya's agricultural commodity exports with which coffee and horticultural products contribute significant proportion of earnings. Kiptui (2007) investigated long run relationships and the effects of real exchange rates on Kenya's export demand framework for tea, coffee, horticultural, and manufactured products using bounds testing and an ARDL with error correction model. It was shown that although the short run relationships were not statistically significant, coffee and manufactured goods had high and positive short run elasticity. Based on income levels of export destination countries, the study revealed a close to one for the three commodities. The researchers concluded that even though real exchange rates affect export of the three commodities, increase in incomes in export destination country strongly affect export demand.

Otieno and Mudaki (2011) investigated the agricultural export determinants of real exchange rates in Kenya focusing on major agricultural export commodity of tea, coffee and horticulture. The findings showed that agricultural exports had statistically insignificant effects on the exchange rates in the short run although short run price elasticity for tea and horticultural products were significant and highly positive. The results further revealed that long run effects of changes in exports for tea and horticultural products had significant effects on real exchange rates in Kenya.

Rurro and Ondiek (2014) investigated the role of tea in Kenya's economy and the effects of tea export real exchange volatility. Data from 1970 to 2008 were used and analyzed using a multivariate cointegration approach developed by Johansen and Julius to determine the variables' short- and long-term behavior. The investigation revealed that actual exchange rate fluctuations harmed tea exports. Similarly, Mwangi et al. (2014) used monthly time series data spanning January 1990 to December 2011 to investigate the magnitude and direction of the effects of French bean exports to key European Union trade partners on real exchange. Exchange rate volatility was measured using generalized auto regression conditional heteroscedasticity model. Further, ECM demonstrated significant short run effects.

Chirchir *et al.,* (2017) did an empirical validation of export theory focusing on tea production in Kenya. The study used census monthly data for tea production of 54 firms spanning from January 2008 to December 2012. The study showed that export performance and production of tea firms was significantly affected by exchange rates fluctuation and domestic tea prices with insignificant effect from tea substitute's prices. Further, tea export performance had significant interdependence with macroeconomic stability as well as real exchange rates.

Chepn'geno (2018) examined the determinants of black tea production and export in Kenya using panel data for the period 1997-2010. The study included exchange rates, foreign income and price volatility for the same period. Moving Average Standard Deviation (MASD) was used to compute a measure for exchange rates and price volatility. The study established significant short and long run price fluctuations, foreign income growth and exchange rate volatility. Black tea export was negatively related to exchange rates volatility but significantly positive with changes in prices and foreign income.

2.3 Critical Review and Gaps

From literature, the relationship between tea production, net export and exchange rates is explicitly postulated in theory. Mundell Fleming model introduces net exports in national accounts showing that changes in domestic and foreign incomes have effects on net export with increase in local income negatively affecting exchange rates and net income. Marshall-Lerner condition shows that depreciation of currency has short run negative effect on net imports as exports remain inelastic, becoming flexible over the long run thus improving export production and trade balances.

J curve effect illustrates the reaction of trade balances to real exchange rate depreciation and how it affects production and exports in the short, medium and long run. Porter's competitive advantage theory postulates that export production capacity of country is determined by its advantage and control over factors of production as well as better structural, policy and regulatory framework. These theories give insights over the behavior of domestic production (tea in this case), net exports (imports and exports) and exchange rates. However, though widely used to guide the studies relating to agricultural production, exports and real exchange rates, these theories have not been subjected to rigorous empirical validations.

On the other hand, the review has shown empirical studies seeking to understand the nexus between tea productions, effects on net exports and exchange rates locally and globally. The study results varied from showing devaluation of currency affects agricultural commodity production and export (Hussain, 2000; Arize *et al.*, 2004; Bhattarai & Armah, 2005, Todani & Munyama, 2005) to over valuation led to losses in agricultural commodity exports (Nabli Marie-Ange, 2002). In addition, most studies have shown that exchange rates relates negatively with agricultural production and net exports (Welwita *et al.*,1999; Cohen, 2007; Ekanayake and Charna, 2010; Kong, 2016) while in other studies positive effects were realized (Batten and Belongia, 2000; Fabiosa, 2002).

Conversely, tea production, domestic consumption revealed a unidirectional causality (Abdulai and Jaquet, 2002; Bhowmik, 2016) while elasticity approach established no short run effects of tea production and price change on exchange rates and net exports (Were *et al.*, 2002; Otieno & Mudaki, 2011).

Generally, it is evident that plausible examination of the effects of agricultural production on net exports and exchange rates has been carried out, with robust conclusion from each study.

However, the results of the studies are scattered and time-conflicting owing to methodology, data employed and prevailing macroeconomic conditions of the country under focus. This poses a challenge for policy decisions to be drawn from the findings.

Additionally, Tea being a leading export earner in agriculture has not been given sufficient attention in empirical studies as it has been analyzed in context of other commodities whose market strength has weakened. This study aimed to bridge this gap by analyzing tea sector specific performance in Kenya, production changes and how relates to net exports and exchange rates.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Research Design

The explanatory research design was used in the study. According to Mackey and Gass (2015), an explanatory research design is the best choice when testing causal relationships between phenomena. There was a need in this study to establish the relationship between tea production, balance of payments, and exchange rate in Kenya. As a result, this research design could only support causal relationships, making it appropriate for this study.

3.2 Theoretical Framework

The study built its theoretical underpinning on the Gravity Model. The simplest form of the model argues that exports from country *i* (Kenya) and *j* (other countries) depends on the GDP and population of both countries, distance between the countries as well as other factors as indicated in model 3.1.

$$X_j = P_0 Y_i^p Y_j^p 2 N_i^p 3 N_j^p 4 DYA_{ij} \langle\langle \leq ij \quad \ldots\ldots\ldots \quad 3.1$$

Where:

i denotes the exporter and j the importer,

X - is the export of goods,

Y_i and Y_j are the GDP of the exporting and importing country respectively.

N_i and N_j being the population of the exporting and importing countries respectively.

D- is the distance in Kilometers between the economic centers.

A denotes any other factors that stimulates exports from Kenya to other countries (the relative prices proxied by real exchange rate, Tea production)

The Logarithmic expression of the Basic model therefore becomes:

$$Ln(X, j) = P_o + P_i Ln(Y_i) + feLn(Y_i) + P_3 Ln(N_i) + P_3 Ln(N_j) + P_{jn}(N_j) + P_S LnD_{jj} + P,, Ln(A_y) + f_{tj}$$

…………………………………………………………………………………………... 3.2

The 'A' component augments the fundamental gravity model with those variables that have an effect on export levels, such as actual exchange rate volatility and tea output.

3.3 Measuring Exchange Rate Volatility

In Kenya, where exchange rates are free to fluctuate, currency valuation is expected to be volatile. The volatility of exchange rates is a measure of risk or uncertainty. However, estimating volatility from data is difficult, and it must be converted appropriately in order to achieve robust estimation. Several factors are considered when determining the best measuring technique, and the importance of period-to-period fluctuations led to the use of the Moving Sample Standard Deviation approach for calculating the proportion of actual exchange rates in this study. This strategy is one period ahead with a window of one or two years, minimizing short-term exchange rate fluctuations. It is represented numerically as follows:

$$V_t = \left[m^{-1} \sum_{i=1}^{m} (\ln R_{t+i-1} - R_{t+i-2})^2 \right]^{1/2} \quad \text{………………………………………………3.3}$$

Where R_t, is the real exchange rate at time t; *m* is the order of moving average, specified as two for this study. This considered the currency movement effects through uncertainty.

3.4 Econometric Model

This study aimed to examine the relationships between Tea Production, Exchange Rates and BOP in Kenya using Ordinary Least Square Regression Models indicated in equations 3.4 and 3.7.

$ExchangeRatesVolatility = f(Tea\,\mathrm{Pr}oduction)$ ………………………………………………… 3.4

$ERV_t = \alpha + \beta_i(TP_t) + \varepsilon_t$ ………………………………………………………………….3.5

$BOP = f(Tea\,\mathrm{Pr}oduction)$ ……………………………………………………………… 3.6

$BOP_t = \alpha + \beta_1(TP_t) + \varepsilon_t$ ………………………………………………………………….3.7

Where:

BOP = Balance of Payments

TP = Tea Production

β = Unknown Parameter

ERV = Exchange Rates Volatility

e_t = Error term

3.5 Definition and Measurement of Variables

Table 3.1: Definition and Measurement of Variables

Variable	Definition	Measurement
Tea Production	The quantity of tea produced in Kenya	Millions of Kilograms
Exchange Rate	The value of one currency (Kshs) for the purpose of conversion to another (US $)	Standard Deviation of real exchange rates of the Kshs to US $
BOP	It is an accounting record of the trade interactions between a country and her trading partners	Net Trade value (US $)

3.6 Pre-Estimation Tests

3.6.1 Unit Root Test

To meet the requirements for the econometric model estimation in this study as well as avoiding the risk for running a spurious regression, it's a prerequisite to test for stationarity of the time series data. A stationary time series exhibits mean reversion revolving around a long run constant mean; constant variance over time and time invariant co-variant.

To test for stationarity ADF and PP tests were adopted. Although the two tests give similar results PP test is more useful where the time series has structural breaks while ADF is parametric test generated using Monte Carlo simulations. Unit root was tested by ADF for the following three equations to assess the nature of random walk among the variables;

First is a random walk without drift and trend;

$$\Delta Y_t = \sigma Y_{t-1} + \alpha_i \sum_{i=1}^{m} \Delta Y_{t-1} + \varepsilon_t \qquad \ldots\ldots 3.8$$

Second, random walk with drift;

$$\Delta Y_t = \beta_1 + \sigma Y_{t-1} + \alpha_i \sum_{i=1}^{m} \Delta Y_{t-1} + \varepsilon_t \qquad \text{……3.9}$$

and; Random walk with drift and trend

$$\Delta Y_t = \beta_1 + \beta_{2t} + \sigma Y_{t-1} + \alpha_i \sum_{i=1}^{m} \Delta Y_{t-1} + \varepsilon_t \qquad \text{……3.10}$$

Where; ΔY_t is the difference between variable and its own lag, β_1 is a drift or constant trend, the β_2 is the parameter of time trend, σ is the unit root, $\sum_{i=1}^{m} \Delta Y_{t-1}$, is lag order of the autoregressive process and ε_t pure white noise error term. The joint hypothesis ($\beta_1 = \beta_2 = 0$) for model with drift and trend will be tested using restricted F test. The lag length will be optimally determined using Akaike Information Criteria (AIC) to generate appropriate representation of the model after which unit root test will be conducted. The null hypothesis and the alternative hypothesis for the model are as follows:

$H_o : \delta = 0$ (Y_t is not stationary)

$H_1 : \delta \neq 0$ (Y_t is not stationary)

Since τ statistic in Augmented Dickey fuller test negative, the null hypothesis will be rejected with higher τ, as it is indicative of stationarity.

In this study, the ADF was constructed using Tea Production (TPROD), Net Export (NX), and exchange rate (REFX). The ultimate ADF where drift and trend is considered was fitted as follows;

$$\Delta TPROD_t = \beta_1+\beta_2 t+\sigma TPROD_{t-1}+\alpha_i \sum_{i=1}^{m} \Delta TPROD_{t-1}+\varepsilon_t \text{……………………………………...…3.11}$$

$$\Delta REFX_t = \beta_1+\beta_2 t+\sigma REFX_{-1}+\alpha_i \sum_{i=1}^{m} \Delta REFX_{t-1}+\varepsilon_t \text{…………………………….……...…….3.12}$$

$$\Delta BOP_t = \beta_1+\beta_2 t+\sigma BOp_{t-1}+\alpha_i \sum_{i=1}^{m} \Delta NX_{t-1}+\varepsilon_t \text{……………………………………………......3.13}$$

Equations, 15, 16 and 17 show the model specification for ADF test for Tea production, exchange rate and BOP respectively. The intercept can be included in the test or left out as it has no effect on the outcome. However, the strength of ADF in testing for root test is sensitive to lag length. The optimal lag length in this study was determined using the Schwarz Bayesian Criteria (SBC), Final Prediction Error (FPE), and Akaike Information Criteria (AIC).

3.6.2 Causality Test

Causality demonstrates whether two variables have a relationship, and the direction as whether uni or bi-directional. It demonstrates the direction in which the connections are running from or toward (Brooks, 2008). A one-way path produces unidirectional causation, while a two-way direction produces bidirectional causality.

3.6.3 Stability Test

A model stability test was performed to determine whether or not the model is stable. The eigenvalue method was used, and the model was considered stable if the moduli of the remaining r eigenvalues were less than one. The result is represented by a circle of plotted eigenvalues. If the eigenvalues are all within the circle, the model is properly fitted and stable.

3.7 Data Type and Sources

In this study, secondary data was gathered from a variety of secondary sources, including the Central Bank of Kenya, the East Africa Tea Auction (EATTA), and the World Bank data base.

CHAPTER FOUR

EMPIRICAL FINDINGS

4.1 Introduction

The chapter includes a presentation of the findings from the timeseries data analysis. The findings presented in this chapter are descriptive, diagnostic tests of data, model diagnostics, and the models used to establish the relationship between the study variables. The chapter also included a discussion of the findings obtained, which guided conclusions.

4.2 Descriptive Statistics

Descriptive statistical analysis is used to understand the shape of data by revealing its distinguishing characteristics. The descriptive data used and reported in this section are summarized in Table 4.1.

Table 4.1 Descriptive Statistics

Descriptive Statistic	Tea Production (Kgs)	Trade Balance (US Dollars)	Exchange Rate (Kshs to USD)
Mean	349,934,938.50	- 2,965,343,232.33	80.40
Median	337,157,227.00	- 2,173,907,403.33	78.66
Maximum	492,998,723.00	132,419,234.80	103.41
Minimum	220,722,149.00	- 11,383,179,725.47	57.11
Std. Dev.	77,963,101.18	3,166,957,319.87	13.72
Skewness	0.14	- 1.49	0.19
Kurtosis	1.93	4.73	2.22
Jarque-Bera	1.23	11.88	0.76
Probability	0.54	0.00	0.68
Observations	24	24	24

Source: Timeseries Data (1996-2019)

The average amount of tea produced in Kenya between 1996 and 2019 was 349,934,938.50 Kgs with a median of 337,157,227.00 Kgs. This implies that the amount of tea produced was skewed to the right, implying that it increased over time. Tea production can thus be said to have been increasing over the years. The highest amount of tea produced in the period was 492,998,723.00 Kgs and the lowest was 220,722,149.00Kgs. The standard deviation was 77,963,101.18Kgs. This imply that between the years, the changes in tea production were very small.

The results also showed that the average Trade balance in Kenya between 1996 and 2019 was -2,965,343,232.33 USD with a median of -2,173,907,403.33. This implies that the BOP balance was skewed to the left meaning that the gap has been worsening (increasing) over the years. To mean that, in the study period, Kenya has been importing more than it has been exporting. The highest Trade balance in the study period was 132,419,234.80 and the lowest was -11,383,179,725.47. A positive standard deviation of 3,166,957,319.87 was recorded to mean that the difference in trade balance between the years has been widening. It had been shown in the background of the study that Kenyan trade balance is largely characterized by deficits with few surpluses.

The descriptive results additionally indicated that the average exchange rate of Kenya Shillings to USD between 1996 and 2019 was 80.40 with a median of 78.66. This imply that the exchange rate is skewed to the right demonstrating that it has been increasing steadily over the years. The increase show that the Kenya shilling has devalued against the USD over the years. The maximum exchange rate of Kshs to USD recorded in the study period was 103.41 and the minimum was 57.11.

A standard deviation value of 13.72 imply that the variation (difference) in the exchange rate of the Kshs. to USD between the years has been small over the study period (Appendix II).

Jarque-Bera was utilized to analyze the data in order to evaluate whether or not the observations followed a normal distribution. The trade balance data indicates that the null hypothesis for JB should not be accepted because the likelihood is lower than 0.05 ($P < 0.05$) (Table 4.1). Since the p-value for exchange rate and tea production is higher than 0.05, the normal distribution hypothesis was accepted. The normality results for trade balance, exchange rate and tea production can further be confirmed by Figure 4.1, 4.2 and 4.3.

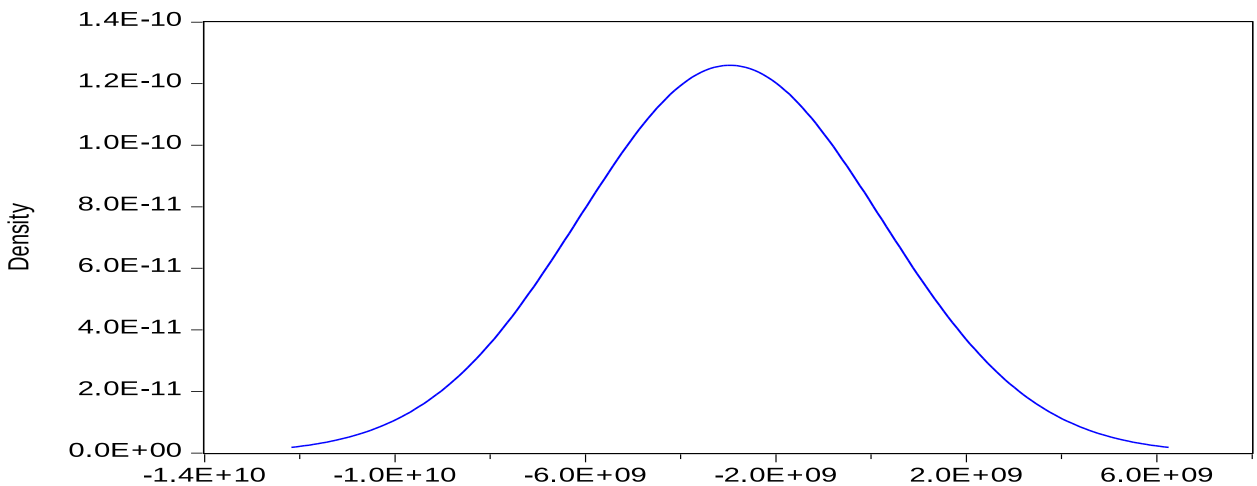


Figure 4.1 Distribution Curve for Trade Balance

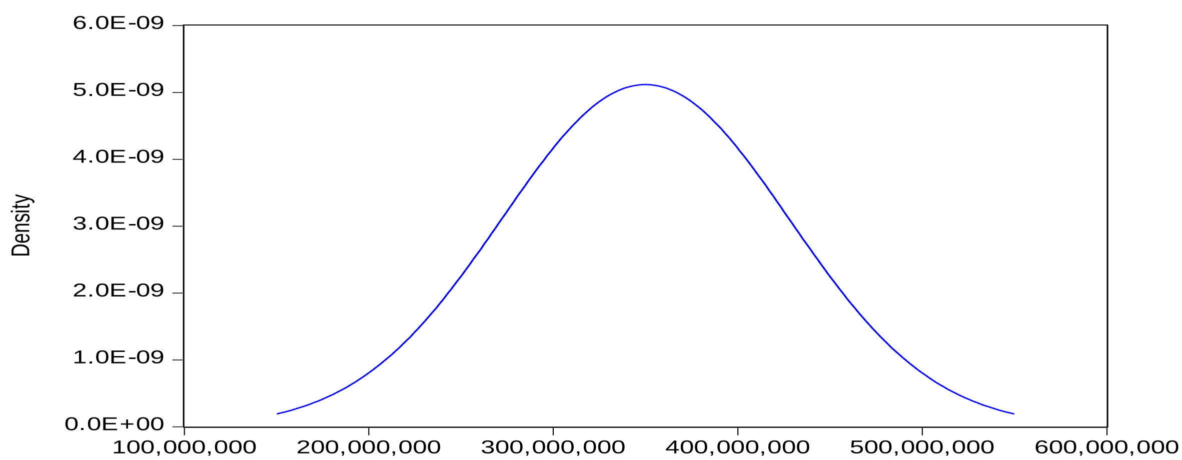


Figure 4.2 Distribution Curve for Exchange Rate

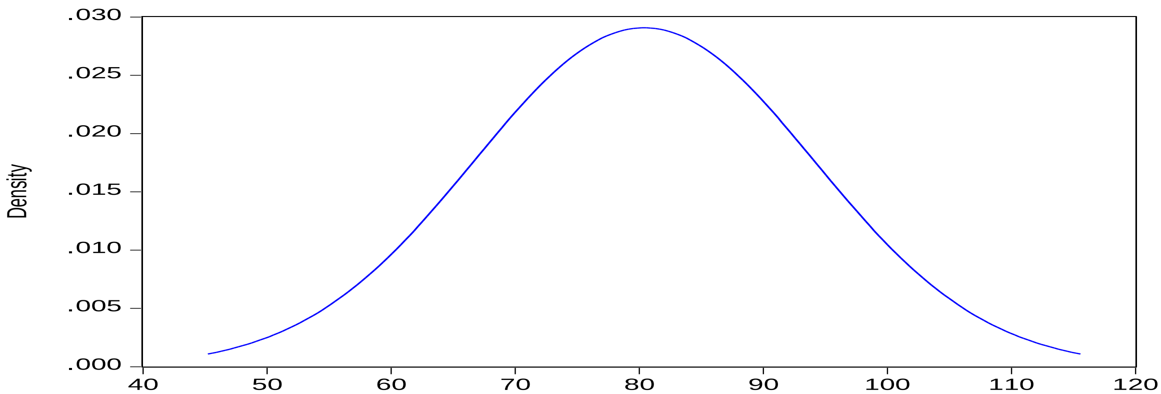


Figure 4.3 Distribution Curve for Tea Production

Box plots, as shown in Figure 4.4, can also be used to illustrate descriptive statistics.

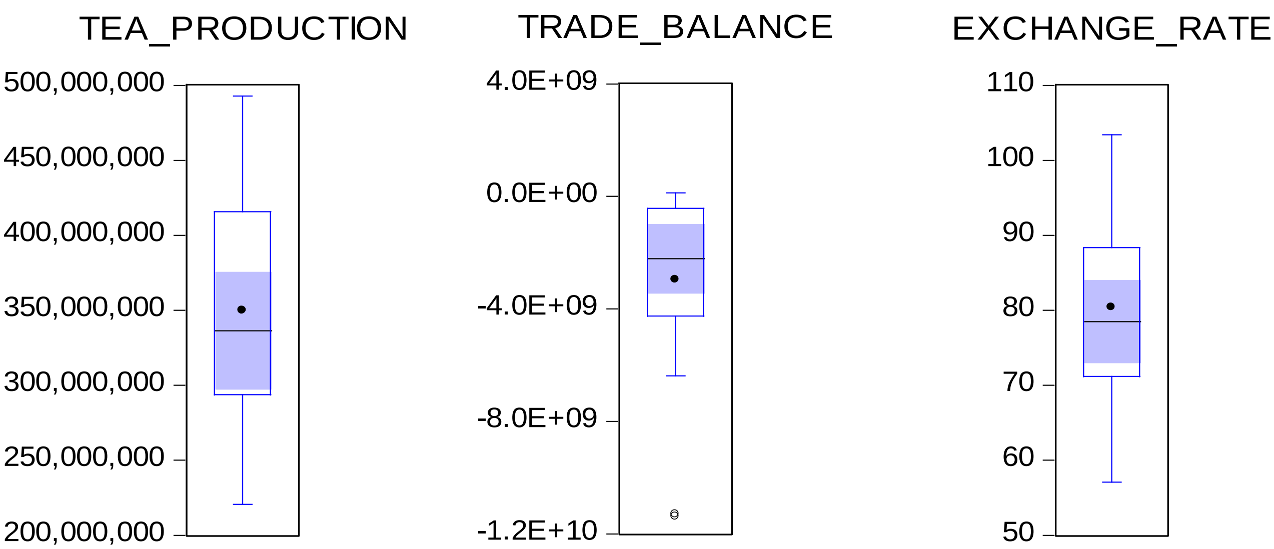


Figure 4.4 Multiple Box Plots for the Variables

Figure 4.4 shows that the trade balance has significant outliers. The data point outside the inner fences confirms the presence of outliers, as shown by the box plot of trade balance. These box plots show a long vertical line below the inner box for trade balance, which corresponds to the negative skewness of trade balance, as shown in Table 4.1. This implies that the trade balance was skewed to the left, and that the gap has been worsening (increasing) over time. That is, Kenya imported more than it exported during the study period.

The box plots for both tea production and exchange rate show a long vertical line above the inner box, confirming the presence of positive skewness, as shown in table 4.1. As shown in Figure 4.4, the mean of the variable is represented by a symbol or a large bold point, whereas the median is represented by a line through the center of the box. The graphs show that the mean of tea production and the exchange rate are greater than their medians, indicating a positive skewness, as shown in table 4.1.

The mean of trade balance is less than the median, resulting in the negative skewness shown in table 4.1. This implies that the amount of tea produced was skewed to the right, implying that it increased over time. Tea production can thus be said to have increased over time. Furthermore, it indicates that the exchange rate is skewed to the right, indicating that it has been steadily increasing over time. The rise demonstrates that the Kenya shilling has depreciated against the US dollar over the years.

4.3 Pre-estimation Tests

Before estimating the models in order to answer the research questions, preliminary tests were conducted on the timeseries data as was a recommendation by Brooks (2006). This was to ensure that spurious results would not result.

4.3.1 Lag Length Selection

Before conducting unit root tests, there was a need to determine the lag length as summarised in Table 4.2.

Table 4.2 Lag Length Selection

Lag	LogL	LR	FPE	AIC	SBC	HQ
0	-838.029	NA	5.63E+34	88.52938	88.6785	88.55461
1	-815.006	36.35196*	1.31E+34	87.05328	87.64977	87.15423
2	-806.74	10.44148	1.55E+34	87.13053	88.17438	87.30719
3	-788.923	16.87881	7.81E+33	86.20247	87.69369	86.45485
4	-766.743	14.00853	3.43e+33*	84.81508*	86.75367*	85.14317*

The results in Table 4.2 indicate that based on the Schwarz Bayesian Criteria (SBC), FPE and AIC criteria, the best lag length to be adopted when running unit root tests is 4. This study therefore adopted 4 lags in ADF and PP tests of unit root.

4.3.2 Unit Root Test

This test was conducted through ADF and PP. Because it addresses serial auto correction and structural breakdowns, the PP test is a higher standard. Table 4.3 gives the results. The null and alternative hypotheses tested in the study for Stationarity were:

H_o: $\delta = 0$ (Y_t is not stationary)

H_1: $\delta \neq 0$ (Y_t is not stationary)

Table 4.3 Unit Root Tests

Variable	Type of Test	Form	Asymptotic Critical Values (5%)	Test Statistics	Conclusions
Tea Production	ADF	Intercept	-3.021	0.758	Non-Stationary
	PP	Intercept	-2.998	-0.653	Non-Stationary
Trade Balance	ADF	Intercept	-2.998	0.382	Non-Stationary
	PP	Intercept	-2.998	0.847	Non-Stationary
Exchange Rate Volatility	ADF	Intercept	-3.004	-4.925	Stationary
	PP	Intercept	-3.004	-5.053	Stationary
1st Difference of Tea Production	ADF	Intercept	-3.021	-4.924	Stationary
	PP	Intercept	-3.004	-19.738	Stationary
1st Difference of Trade Balance	ADF	Intercept	-3.005	-4.057	Stationary
	PP	Intercept	-3.004	-4.011	Stationary

The results in Table 4.3 show that the test statistic for tea production and trade balance were less than the asymptotic critical values at 5% S.L, implying that they were non-stationary at none and thus integrated of order zero I. (0). Following the first difference, tea production and trade balance became stationary at FD, as I predicted (1).

4.3.3 Regression Model Diagnostic Tests

The study used two regression models to determine the effect of tea production on the BOP and exchange rate. However, diagnostic tests were performed prior to running the regression models. Normality, autocorrelation, heteroskedasticity, and model stability tests were carried out. The results and discussion for each model are presented in this section.

Model One: Effect of tea production on BOP

Model Two: Effect of Tea production on Exchange Rate Volatility

Normality Test

The basic premise of a successful regression model is that the error term has a normal distribution. To validate the normalcy test, the Jarque Bera probability should be greater than 0.05. Table 4.4 displays the findings for normalcy.

Table 4.4 Jarque Bera Test of Normality

Model	**Statistic**	**RESID**
	Skewness	-0.875
	Kurtosis	3.153
	Jarque-Bera	3.086
Model 1	Probability	0.214
	Skewness	1.105
Model 2	Kurtosis	3.257

	Jarque-Bera	4.743
	Probability	0.093

Table 4.4 displays the findings of the Jarque Bera statistics, showing that both the probability value and the percentile value are more than 0.05 (five percent). Thus, the residual was regularly distributed for both regression models, as the null hypothesis was not rejected.

Serial Correlation Test

The Godfrey Serial Correlation LM test was also used to investigate the relationship between two variables sequentially. If there is a connection between the residuals from one period and those from the prior period, then we have serial correlation. The following null hypothesis was proposed for the serial correlation test:

H_0: There is no serial correlation. If the probability (p-value) is greater than 5%, the null hypothesis is not rejected. Table 4.5 show the results.

Table 4.5 Serial Correlation Results

Breusch-Godfrey Serial Correlation LM Test:				
Model 1	F-statistic	6.527117	Prob. F (2,20)	0.007
	Obs*R-squared	9.478411	Prob. Chi-Square (2)	0.009
Model 2	F-statistic	0.255	Prob. F (2,19)	0.778
	Obs*R-squared	0.601	Prob. Chi-Square (2)	0.741

The investigation rejected the null hypothesis of no serial correlation because there was evidence of autocorrelation and the likelihood of the observed R-squared was less than 0.05, as shown in Table 4.5. To address this, the regression model linking the Balance of Payment to the amount of tea produced was evaluated using robust standard errors. Furthermore, because the likelihood of the observed R-squared was greater than 0.05 in the second model, the investigation did not reject the null hypothesis of no serial correlations. These findings support the use of an OLS regression model in the second regression model without robust standard error.

Heteroskedasticity test

Breusch-Pagan-Godfrey was used to test for heteroskedasticity. When the residual variance in a model is not constant, we say that the model is heteroskedastic. That which is being tested is the null hypothesis.

H_0: Variance is constant (homoscedasticity). If the probability value (p-value) is greater than 5 percent, the null hypothesis is not rejected. The results are as presented in Table 4.6.

Table 4.6 Heteroskedasticity Test Results

Heteroskedasticity Test: Breusch-Pagan-Godfrey				
	F-statistic	3.003293	Prob. F (1,22)	0.097
	Obs*R-squared	2.882781	Prob. Chi-Square (1)	0.089
Model 1	Scaled explained SS	2.607572	Prob. Chi-Square (1)	0.106
	F-statistic	0.400	Prob. F (1,21)	0.534
	Obs*R-squared	0.430	Prob. Chi-Square (1)	0.512
Model 2	Scaled explained SS	0.404	Prob. Chi-Square (1)	0.525

The results in Table 4.6 indicated that since the probability value, Prob. Chi-Square (1) = 0.089 and 0.512 were greater than 5 percent, the null hypothesis of variance is constant is not rejected, concluding there was no problem of heteroskedasticity in using both models.

Model Stability Test

Finally, the estimated equation was subjected to a model stability test of the two models' recursive estimates. In this regard, the CUSUM tests proposed by Brown and Durbin (1975) were used, as illustrated in Figure 4.5.

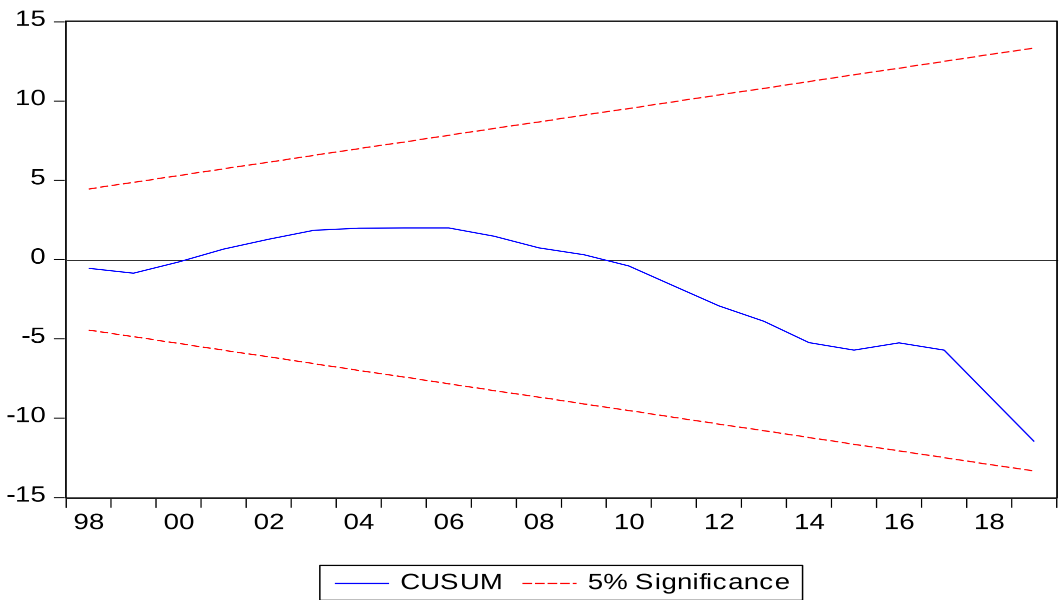


Figure 4.5 BOP and Tea Production CUSUM Model Stability Test

The results of the CUSUM stability test, shown in Figure 4.5, supported the claim that the model was stable because the residuals were within the dual standard error range. It was hence suitable to adopt this model in establishing the effect of Tea Production on BOP. Secondly, the model stability test of the second model was conducted as shown in Figure 4.6.

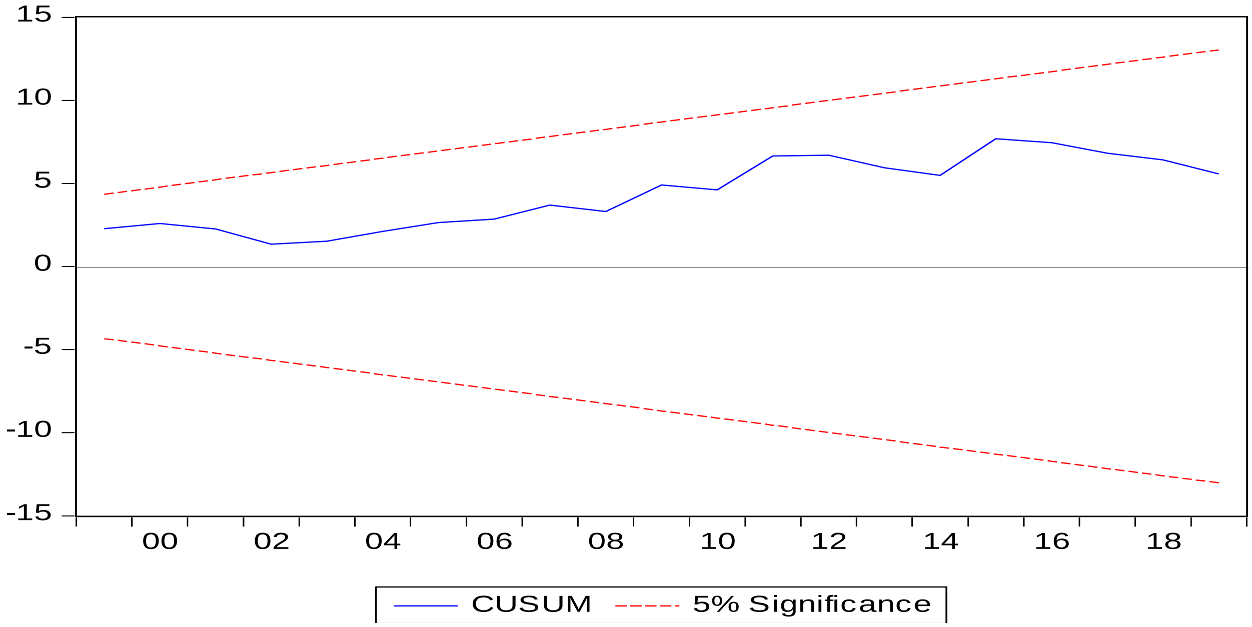


Figure 4.6 Exchange Rate and Tea Production CUSUM Model Stability Test

The CUSUM stability test results shown in Figure 4.6 provided enough evidence to reject the null hypothesis that model 2 was not stable at the 5% significance level. Because the residuals are within the dual standard error range, the results support the claim that model 2 is stable. As a result, it was appropriate to use this model in determining the effect of tea production on Exchange Rate Volatility.

4.4. Relationship between Balance of Payment and Tea Production

Objective one of the study was to establish the relationship between BOP and tea production. Both ganger causality and regression models are adopted.

4.4.1 Relationship between Balance of Payment and Tea Production (Granger Causality)

The study utilized the Granger causality test to determine the nature of the connection between BOP and tea production. The outcomes were displayed in Table 4.7.

Table 4.7 Granger Causality to test relationship between BOP and Tea Production

Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**
Tea Production does not Granger Cause BOP	22	4.696	0.019
BOP does not Granger Cause Tea Production	22	1.474	0.275

According to the results in Table 4.7, the null hypothesis that Tea Production does not Granger-Cause BOP was rejected (P = 4.696; P 0.05). The null hypothesis that BOP does not cause tea production, on the other hand, was not rejected (P = 0.275; P > 0.05). This implies that there is a one-way relationship between tea production and BOP, implying that while tea production has a significant impact on BOP, BOP has no impact on tea production.

4.4.2 Effect of Tea Production on Balance of Payment (Regression Analysis)

The effect of tea production on BOP was further estimated through the univariate regression model of the form below:

$$BOP_t = \alpha + \beta_1 (TP_t) + \varepsilon_t$$

Where: BOP = Balance of Payments; TP = Tea Production and e_t = Error term

After satisfying the OLS assumptions, the following regression model was established. In order to deal with the problem of Serial Correlation, the regression model was built using robust standard errors. Table 4.8 displays the regression results.

Table 4.8 Effect of Tea Production on BOP Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Tea Production	- 31.509	5.466	-5.764	0.000
C	8,060,586,982.953	1,957,710,095.619	4.117	0.000
R-squared	0.602	Mean dependent var		-2.97E+09
Adjusted R-squared	0.584	S.D. dependent var		3.17E+09
S.E. of regression	2043726924	Akaike info criterion		45.794
Sum squared residual	9.19E+19	Schwarz criterion		45.892
Log likelihood	-547.5233699	Hannan-Quinn criteria		45.820
F-statistic	33.229	Durbin-Watson stat		0.702
Prob(F-statistic)	0.000			

Substituted Coefficient:

BOP = 8,060,586,982.953 – 31.509 Tea Production …………………………………………………4.1

Table 4.8 shows that variations in the explanatory variable, tea production, explain 60.2 percent of the variations in BOP when all other factors are held constant. The remaining percentage of BOP variations are explained by variables not included in the model. When adjusted for degrees of freedom, an adjusted R-squared value of 0.584 percent indicates that the independent variable in the model accounts for 58.4 percent of the variations in BOP. If the modified R-Squared is greater than 50%, it indicates that the model fits the data well and can explain the shifts in BOP. The remaining percentage of BOP fluctuation may be due to factors not accounted for in the model.

BOP is found to be negatively affected by tea production (= - 31.509; P 0.05). This means that a 1% increase in Tea Production would result in a 3150.9 percent decrease in the BOP balance deficit due to increased exports. An increase in tea production would undoubtedly increase tea exports, lowering the BOP balance, which is currently negative, and thus improving it. The total model was significant in describing the relationship between BOP and tea output, as indicated by the F-p-value statistic's (0.000). (33.229). A Durbin-Watson statistic (0.702) less than 2 indicates that there are no serious autocorrelation issues.

The findings are consistent with that of Batten and Belongia (2000) who measured the connection between agricultural exports earnings, trade balances and exchange rate fluctuation in USA and established that agricultural exports earnings had a significant but weak positive correlation with trade balances. The findings also agree with that of Bhowmik (2016) who analyzed the relationship between tea production, domestic consumption, exports and macro-economic performance in India and revealed a uni-directional causality between tea export and macro-economic variables.

4.5 Relationship between Exchange Rate and Tea Production

Objective two of the study sought to determine the link between Tea production and Exchange rate in Kenya. Both ganger causality and regression models are adopted.

4.5.1 Relationship between Exchange Rate and Tea Production (Granger Causality)

The relationship between Tea production and Exchange rate in Kenya was established through Granger causality test. The results were presented in the Table 4.9.

Table 4.9 Granger Causality to test relationship between Exchange Rate Volatility and Tea Production

Null Hypothesis:	Obs	F-Statistic	Prob.
Tea Production does not Granger Cause Exchange Rate Volatility	21	0.076	0.927
Exchange Rate Volatility does not Granger Cause Tea Production	21	1.096	0.358

The results in Table 4.9 indicate that the null hypotheses that Tea Production does not Granger Cause Exchange Rate Volatility as well as Exchange Rate Volatility does not Granger Cause Tea Production were not rejected (P = 0.927; 0.358 > 0.05). This implies that there doesn't exists directional relationships between tea production and Exchange Rate Volatility. This means that there is no relationship between tea production and exchange rate volatility in Kenya.

4.5.2 Effect of Tea Production on Exchange Rate Volatility (Regression Analysis)

The effect of tea production on exchange rate volatility was further estimated through the univariate regression model of the form below:

$$ERV_t = \alpha + \beta_i (TP_t) + \varepsilon_t$$

Where: ERV = Exchange Rate Volatility; TP = Tea Production and e_t = Error term

Having satisfied the assumptions of OLS, a regression model was established. The regression results are shown in Table 4.10.

Table 4.10 Effect of Tea Production on Exchange Rate Volatility Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Tea Production	-5.23 E-09	5.87E-09	- 0.891	0.383
C	4.525	2.123	2.132	0.045

R-squared	0.036	Mean dependent var	2.675
Adjusted R-squared	0.009	S.D. dependent var	2.111
S.E. of regression	2.121	Akaike info criterion	4.425
Sum squared residual	94.508	Schwarz criterion	4.524
Log likelihood	- 48.887	Hannan-Quinn criteria	4.450
F-statistic	0.794	Durbin-Watson stat	2.064
Prob (F-statistic)	0.383		

Substituted Coefficient:

Exchange Rate Volatility =4.525 -5.23 $^{E-09}$*Tea Production ………………………………4.1*

Table 4.10 shows that variations in the explanatory variable, tea production, explain only 3.6 percent of the differences in Exchange Rate Volatility when all other factors are held constant. Other variables not included in the model explain the remaining percentage of Exchange Rate Volatility variations. When adjusted for degrees of freedom, an adjusted R-squared value of 0.009 percent indicates that the independent variable in the model accounts for 0.9 percent of the variations in Exchange Rate Volatility. The model does not fit well and cannot explain changes in exchange rate volatility because the adjusted R-Squared is less than 50%. This implies that the model may be missing some important factors that influence exchange rate volatility.

Tea production is found to affect Exchange Rate Volatility negatively but significantly (β = -5.23 $^{E-09}$; $P > 0.05$). This means that a change in Tea Production would have an insignificant effect on Exchange Rate Volatility. Given that the p-value for the F-statistic was 0.383 and the F-statistic was 0.794, it may be deduced that the overall model was not significant in its ability to explain the connection between exchange rate volatility and tea output. The Durbin-

Watson value, which is 2.064, suggests that there are no significant autocorrelation issues, as was previously proven.

The findings are consistent with that of Charna (2010) who generated a measure for real exchange rate using Generalized ARCH and fitted it on Sri Lankan sectorial data to reveal an insignificant relationship between tea exports and exchange rate. Similarly, Were *et al.*, (2002) established that short run price effect of tea export had no significant effects on net export and exchange rates in Kenya, Rwanda and Uganda. The findings are however not consistent with that of Arize *et al.* (2004) who confirmed that exchange rate volatility significantly affected tea exports negatively in Sri Lanka and China.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

5.1 Introduction

A summary of the findings is provided in this chapter, guiding the conclusions and recommendations. The chapter's conclusions are built solely on the established results.

5.2 Summary

The study's overarching goal was to gain a better understanding of the links that exist in Kenya between tea output, the Balance of Payments, and the exchange rate between 1996 and 2019. The study's specific goals were to determine whether or not there is a link between tea production and the BOP in Kenya, as well as to investigate whether or not there is a link between tea production and the Kenyan exchange rate. The study looked at the relationship between tea output, the Balance of Payments, and the exchange rate in Kenya during the chosen time period. It also investigated the nature of the causality between these three factors.

The study was motivated by Kenyan economists' concern about the country's ongoing BOP imbalance and the need to determine whether the situation could be alleviated through tea production and exports. The precise quantitative nature of the relationship between the variables would be useful to the National Treasury and the Ministry of Agriculture because it could guide government policy making aimed at improving the BOP position through agriculture. To meet the study's aims, secondary yearly time series data from 1996 to 2019 was acquired from the Central Bank of Kenya, the East Africa Tea Auction, and the World Bank database.

The study's initial goal was to determine the relationship between Kenyan tea production and BOP. An Ordinary Least Square regression model was used to achieve this goal, and the results indicated that tea production had a negative and significant influence on BOP. This implies that increasing tea output would increase tea exports, reducing the BOP deficit balance and thus improving the situation. Moreover, it was demonstrated that the differences in tea output explain 60.2% of the variability in BOP when all other parameters are held constant. The Granger causality test was also used in the study to determine the nature of the relationship between BOP and tea production. The presence of a one-way link between tea production and BOP suggests that tea production has a significant impact on BOP but has no impact on tea production.

The study's second objective was to determine the relationship between tea production and the Kenyan exchange rate. Similarly, an Ordinary Least Square regression model was developed to achieve this goal. According to the findings, tea production has a negative but not significant impact on exchange rate volatility. It implies that a change in Tea Production has a negligible impact on Exchange Rate Volatility. Variations in Tea production, in particular, can explain only 3.6 percent of the variations in Exchange Rate Volatility when all other factors are held constant. The Granger causality test was used in the study to determine the nature of the relationship between Exchange Rate Volatility and Tea Production. The results revealed that there are no directional relationships between tea production and Exchange Rate Volatility.

5.3 Conclusions

According to the study, tea production has a negative and significant effect on BOP. Another conclusion is that there is a one-way relationship between tea production and BOP, in that tea production has a significant impact on BOP but BOP has no impact on tea production. The study also concludes that Tea production affects Exchange Rate Volatility negatively but not significantly. Additionally, there doesn’t exists directional relationships between tea production and Exchange Rate Volatility.

5.4 Policy Implications

The study established that Tea production has a negative and significant effect on BOP and this relationship is uni-directional. This result can be a vital tool for the National Treasury, Ministry of Trade and the Ministry of Agriculture in designing agricultural policies as a means of reducing the BOP deficits. There is a need for the National Treasury and Ministry of Trade to explore this linkage in managing the deficits by increasing agricultural production through policies such as subsidization of agricultural imports like fertilizers and equipment by 1% in order to realize up to 3150.9% results.

5.5 Areas for Further Research

The study focused on the relationship between tea production, Balance of Payments and exchange rate in Kenya between the year 1996 and 2019. This time frame was delimited and thus other researchers can widen the time scope. The study did not consider weather shocks such as rainfall and temperature which can otherwise affect tea production. As a result, there is a suggestion for future research to consider structural breaks in the years which Tea production experienced these shocks. Other studies can also focus on the link between BOP and other macro-economic variables other than the Two in this study.

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APPENDICES

Appendix 1 Data Set

Year	Trade Balance (USD)	Exchange Rate (Kshs to USD)	Tea Production (Kgs)	Exchange Rate Volatility
1996	- 961,189,672.741	57.115	257,161,930	.
1997	- 1,790,669,371.427	58.732	220,722,149.00	1.143374
1998	- 2,632,734,196.171	60.367	294,165,097	1.156019
1999	- 2,365,219,129.993	70.326	248,708,113.00	7.042442
2000	- 199,391,622.202	76.176	236,286,068	4.136097
2001	- 320,276,833.921	78.563	294,631,338.00	1.688326
2002	- 117,669,073.526	78.749	287,102,233.00	0.131484
2003	132,419,234.801	75.936	293,670,241	1.989496
2004	- 131,773,010.476	79.174	324,608,570.00	2.289829

2005	- 252,316,724.245	75.554	328,497,624.00	2.559562
2006	- 510,433,478.210	72.101	310,578,042	2.441834
2007	- 1,032,048,240.785	67.317	369,606,176	3.382918
2008	- 1,982,595,676.671	69.176	345,816,830.00	1.314629
2009	- 1,688,505,911.101	77.351	314,198,371.00	5.780598
2010	- 2,368,671,949.984	79.233	399,006,377.00	1.331129
2011	- 3,819,304,011.333	88.812	377,912,178.00	6.772904
2012	- 4,216,145,262.615	84.530	369,561,924.00	3.027596
2013	- 4,842,146,887.503	86.123	432,452,700.00	1.126657
2014	- 6,377,926,517.122	87.923	445,104,734.00	1.272203
2015	- 4,288,946,563.454	98.179	399,211,367.00	7.252559
2016	- 3,697,337,384.133	101.504	457,330,000.00	2.35113
2017	- 5,018,267,205.449	103.410	439,832,745.00	1.347943
2018	- 11,303,908,362.232	101.302	492,998,723.00	1.491198
2019	- 11,383,179,725.470	101.991	458,852,949.00	0.487709

Source: CBK, World Bank & EATTA (1996 -2019)

Appendix II Graphical Tests of Normality

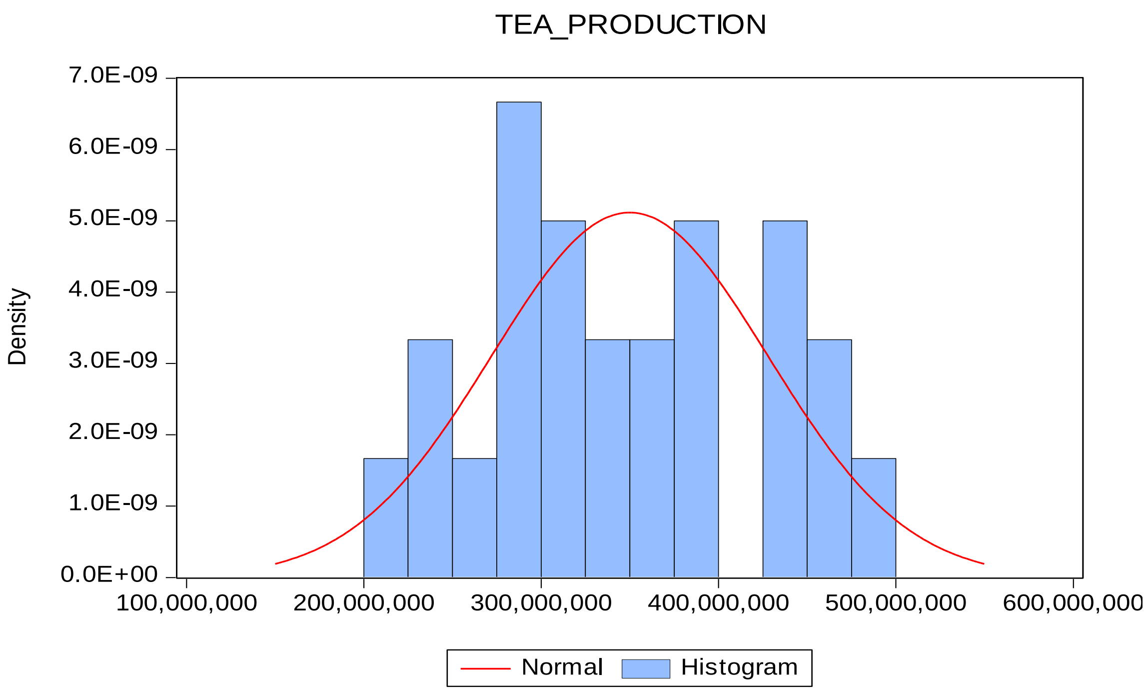

Figure 1 Histogram with superimposed normal curve for Tea Production

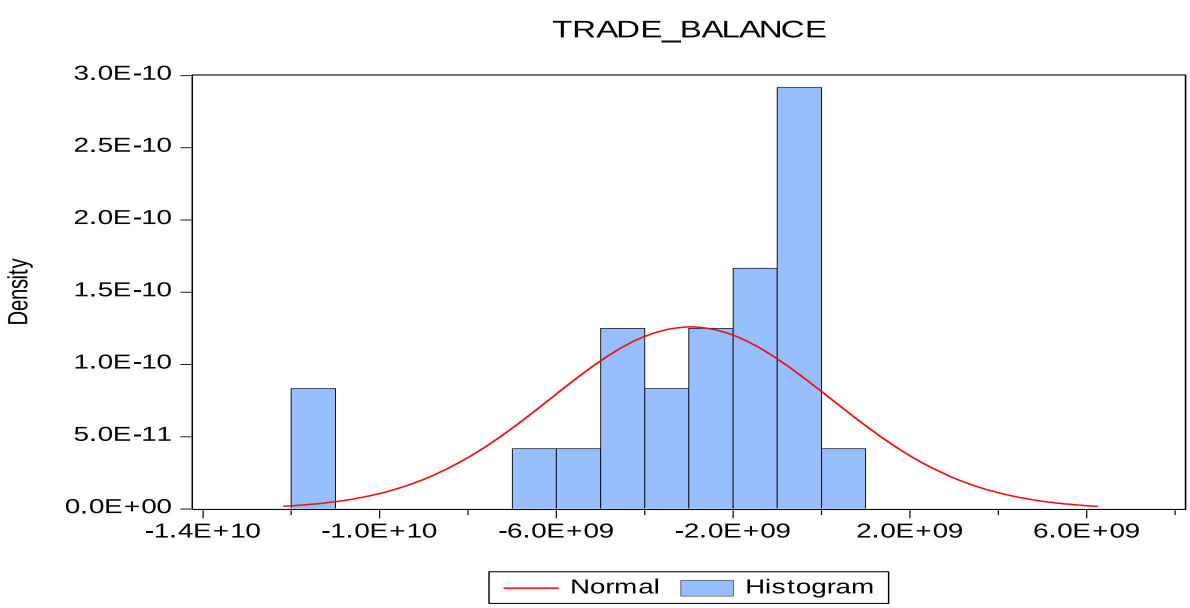

Figure 2 Histogram with superimposed normal curve for Trade Balance

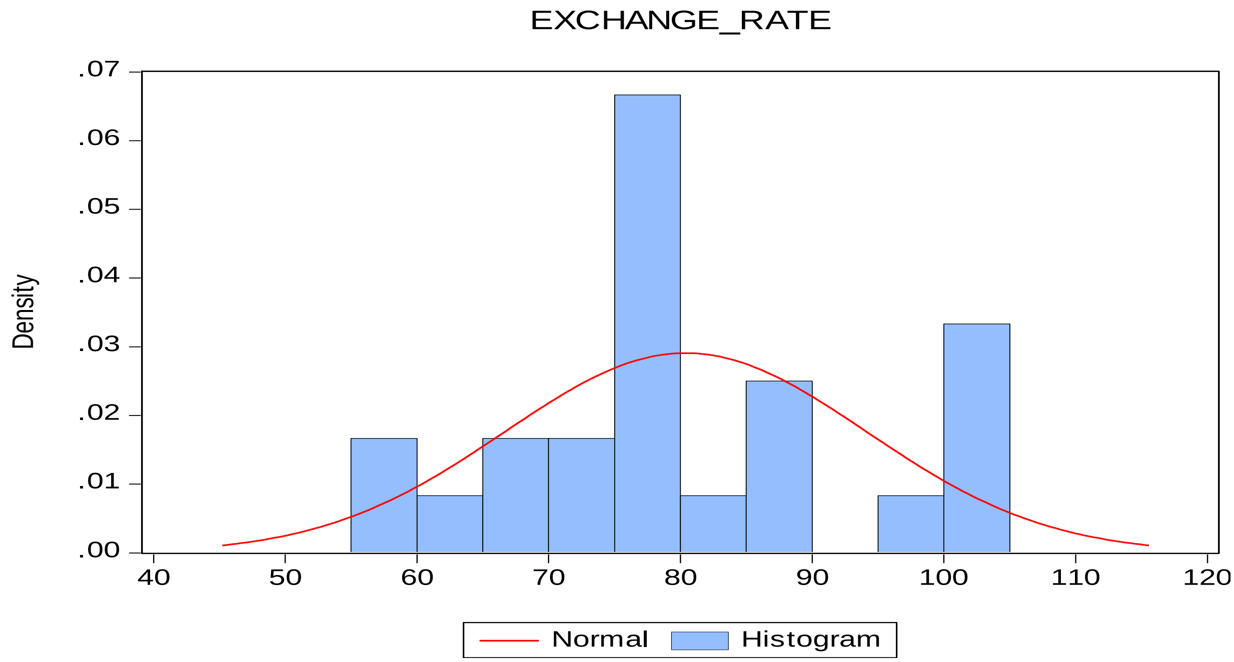

Figure 3 Histogram with superimposed normal curve for Exchange Rate