ANALYSING THE MAJOR EFFECTS OF EXPORTS AND IMPORTS ON THE BALANCE OF FOREIGN TRADE IN GHANA

By

KANYIRI DEKONGMENE YAKUBU

BSc. Mathematical Science (Statistics Option)

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DECLARATION

I hereby declare that this submission is my own work towards the MPhil and that, to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text.

Kanyiri D.Yakubu PG6201611	.....	13/05/2013 .....
Student Name	Signature	Date
Certified by:		
Dr. R.K.Avuglah	.....	.....
Supervisor	Signature	Date
Mr. E. Harris	.....	.....
Co-Supervisor	Signature	Date
Certified by:		
Mr. F.K. Darkwah	.....	.....
Head of Dept.	Signature	Date

DEDICATION

To the Almighty Allah, my lovely wife, Avanakwa Agnes Lordy and my son, Kanyiri Yensia Yasir.

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ABSTRACT

The primary objectives of this thesis were to find out which export and import commodities have significant effect on balance of trade in Ghana, and to make comparison on export and import commodities on balance of trade. Data was sought from Ghana Statistical Service (GSS) trade statistics division. The data was divided into three groups, food, textile and manufacturing. Various statistical techniques at our disposal were used in order to achieve the objectives of the study. These techniques were Principal Component Analysis (PCA), Stepwise regression and multiple linear regressions. The analysis shows that, the first group which is food, cocoa beans has significant effect on balance of trade on exports while rice has effect on imports. For the second group which is textile, kente also has significant effect on exports and boxes on imports for balance of trade in Ghana. The final group is manufacturing has monetary gold and aluminum sheet having effect on exports while that of buckets, shovels and gribs and machines have effect on imports of balance of trade in Ghana. The gap between exports and imports with regard to food commodities is closing especially export while that of manufacturing commodities is increasing.

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LIST OF ABBREVIATION

GSS	Ghana Statistical Service
GDP	Gross Domestic Product
IMF	International Monetary Fund
WB	World Bank
SAP	Structural Adjustment Program
SAS	Statistical Analysis System
SPSS	Statistical Package for Social Science
WTO	World Trade Organization
BOG	Bank of Ghana
MOTI	Ministry Of Trade and Industry
MOFEP	Ministry of Financial and Economic Planning
PSF	Point Spread Function
PCA	Principal Component Analysis
LISA	Laser Interferometer Space Antenna
EMRI	Extreme Mass Ratio Inspiral
DES	Data Encryption Standard

CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND OF FOREIGN TRADE IN GHANA

Ghana is a developing country in West Africa with a population of 24,658,823 million inhabitants, out of this females constitute 51.2 percent of the population and males 48.8 percent GSS (2012). According to Ghana Statistical Service (2007), Ghana, in terms of her economic activities is mainly dominated by agriculture which contributes 25.6 percent of the country's gross domestic product (GDP).

The economy of Ghana with its long standing tradition in international trade has experienced difficulties in the last three decades and it has well undergone several major macroeconomic and trade policy reforms. The late 1970's and early 1980's proved to be extremely trying economic times for the developing countries. Throughout these trying moments, a number of combinations of exogenous shocks, such as worsening terms of trade, falling growth rates in the cost of living and availability of foreign financing, created serious macroeconomic management problems for policy makers in developing countries (Ghana country studies, 2004).

In the climate of declining exports value and rising imports, the balance of trade position of Ghana was dislocated resulting in the widening of the existing account deficit. In response to the persistent adverse trade balance and the unstable balance of payments, the Ghana government accepted the stringent IMF and World Bank loan

conditions under the Structural Adjustment Program (SAP) launched in 1983. As part of the reforms process, some of the policies that were implemented included fiscal contingency, devaluation of Ghanaian cedi and liberalization of trade and financial markets. The Government of Ghana and the World Bank have argued that there have been appreciable upswings in macroeconomics indicators, such as the relatively high annual growth rate and reductions in the level of inflation and improvement in services resulting from the structural adjustment policies. In the early 1990's, Ghana economic recovery was geared toward the export sector rather than the domestic market. Gross Domestic product (GDP) has risen by an average of 5 percent per year since 1984, inflation has been reduced by about 20 percent, and exports earnings reached US$1 billion. In 1990, mineral exports also increased by about 23 percent over the previous year. Ghana's experience of the structural adjustment program (SAP) is admired by most countries in the developed and developing world and generally regarded by the Fund as a story (Ghana, country studies, 2004).

On the international scene, world market prices of our major exports increased. Gold price increased from an annual average of US$271.04 per ounce in 2001 to US$444.74 per ounce in 2005 that is an annual price growth of 13.2 percent. Minerals, specifically diamond and bauxite recorded an average annual price growth of 3.6 percent. These favorable world market prices boosted exports, making the country increase its international reserves from US$640 million in December 2002 to US$1.9 billion in December 2005. However, exports continue to lag behind imports

with the gap widening over the years. In 2001, the trade deficit of ¢10.4 million rose to ¢62.1 million in 2005 (GSS, 2007).

Balance of trade is the difference between the monetary value of exports and imports in an economy over a certain period of time. A positive balance of trade is known as trade surplus and consists of exporting more than importing; and a negative balance of trade is known as a trade deficit or, informally a trade gap. The balance of trade forms part of the current account, which also includes other transactions such as income from the international investment position as well as international aid. The current account balance is subdivided into two; the trade balance, which is the balance between visible exports and imports, and the balance of services or the balance of invisibles. A deficit in the balance of trade may likely affect the position of the current account leading to unfavorable balance of payments.

Balance of trade, also known as net exports, is the sum of the money gained by a given economy by selling exports, minus the cost of buying imports. These form part of the balance of payment, which also includes other transactions such as the international investment position. Factors that can affect the balance of trade include;

- Prices of goods manufactured at home
- Trade agreement or barriers
- Exchange rates movements
- Other tax tariffs and trade measures

Most people do (not) believe that trade deficits are inherently good or bad, some even believe that trade deficits are generally harmful when countries engage in currency

controls, such as fixed or pegged exchange rates. Some economists point out that a large trade deficit (importation of goods) signals that the currency of this country is strong and desirable Milton, 1978. Citizens of such countries also receive the benefit of having the ability to choose between many competing consumables and low prices than they would otherwise experience if the currency was weaker and the country was enjoying a trade surplus. Trade deficit simply means that consumers get to purchase and enjoy more goods at lower prices, conversely, a trade surplus implies that a country's exports that its owns, its citizens do not get to consume and while paying high price for the goods that were consumed (Either 1992).

A review of the factors underpinning the poor performance of the economy suggests that the needed growth to support economic development could be achieved if Ghana develops a strong and vibrant export sector that is efficient, expanded and diversified. Identifying and addressing supply side constraints that impede the development and expansion of the export sector would be a key to achieving this goal. The main challenge is dealing with the lack of competitiveness of the Ghanaian industries and moving away from an export sector based on cocoa beans (CEPA, 2012).

Ghana has two main seaports, one at Tema and the other at Takoradi, which handle most of the country's import and export commodities respectively. Both ports have undergone extension and rehabilitation, which has improved efficiency. The turnaround time for ships at Ghana's ports is now one of the quickest in West Africa and the tonnage handled has also increased significantly.

1.2 Statement of the Research Problem

Export and import is an integral part of international trade in Ghana with many challenges regarding to macroeconomic policy issues in which many past governments have been dealing with since independence. Since 2004, Ghana's exports increased on average by 22.7 percent each year and amounted to US$4 billion in 2008. During these periods, imports increased nearly at the same rate, on average by 22.1 percent each year to US$9.1 billion. The trade balance recorded a deficit of US$5 billion compared to US4.3 billion in 2004. Ghana,s exports were dominated by two products; gold and cocoa beans. Export of gold increased by 24.4 percent in 2008 to reach US$1.8 billion and accounted for 45 percent total exports. Exports of cocoa beans increased by 15 percent and accounted for 25.6 percent of total exported goods. In the same year, machinery and transports equipments accounted for 36.4 percent of the total imported goods (www.akoma-trade.com).

The international trade payments systems in 2006 were characterized by substantial and increased balance of payments surplus and a widening trade deficit driven largely by an appreciating real exchange rate. In spite of the surplus, external reserves accumulation was modest, with gross international reserves in terms of months of imports cover declining. The overall balance of payments recorded a surplus of US$415.1 million in 2005, up from the surplus of US484.3 million in 2006. However, the rate of accumulation was lower than the growth in imports, resulting in imports cover of reserves declining from 3.9 percent in months in 2005 to 3.3 percent in months in 2006. Ghana's total exports receipts increased by 33 percent in 2006 and all components of exports except

Timber and Wood products experienced substantial growth in value terms. The overall growth was led by the two dominant export commodities in the country, which are cocoa beans and gold respectively (Yaw, 2002).

The desire of successive governments in their attempt to improve the country's exports sector and scaling down its imports is still having challenges. There still exist a large gap between exports and imports which needs to be looked at and measures taken to close this gap. Hence the study looks closely at the export and import commodities contributing largely to this trade deficit.

Again, Ghana recorded an external trade deficit of US$1.7 billion in the first nine months of January-September of 2011. According to Bank of Ghana (BOG), the total merchandise exports within the period amounted to US49.8 billion in 2011, representing a growth of about 67 percent over the same period of 2010 whereas total merchandise imports amounted to US$11.5 billion, representing an annual growth of 45.6 percent. This means that Ghana imports more than it exports on the internal market having a shortfall of US$1.7 billion within the period compared to US$2 billion for the corresponding period in 2010. And by the eleventh month it was US$2.6 billion. Again, second quarter of 2012 Ghana trade deficit was U$1,339.50 million according to (BOG, 2012).

In the light of all these macroeconomic indicators, there is the need to analyze the possible effects of export and import commodities on the balance of trade, hence the need for the study.

1.3 Objectives

The objectives for undertaking this study on analyzing the major effects of exports and imports on the balance of foreign trade in Ghana are:

I. To find out which export and import commodities have significant effects on the balance of foreign trade in Ghana.

II. To compare export and import commodities that has effect on balance of foreign trade in Ghana.

1.4 Methodology

We employ Statistical Techniques by first of all using Principal Component Analysis (PCA) to determine which of these major commodities have significant effects on export and import on balance of foreign trade in Ghana. We also use Stepwise Regression Analysis (SRA) procedure to determine the significant independent variables of the regression model. Multiple Linear Regression Analysis was also used to find out the effect of export and import commodities on balance of foreign trade in the country. Analysis of Variance (ANOVA) and graph were both employ to enhance further analysis of the export and import commodities that have major effect on balance of foreign trade in Ghana.

Data is an important aspect of statistics. This stems from the fact that all major conclusions drawn from these data would reflect any mistake, errors or bias been made during the process of collection. It is therefore with a great care that statistical materials should be sought from the right quarters and with the right definition along with accuracy. For the purpose of this study, data were sought from Ghana Statistical Service

Trade Statistics Division (GSSTSD). Data on exports and imports commodities were sought alongside with their value of balance of foreign trade in Ghana from the aforementioned Government department. The study utilized seven years period from 2004 to 2010.

The study made use of soft words; such us SAS and SPSS for the analysis.

1.5 **Justification of the Study**

The effects of export and import commodities on the balance of foreign trade are of significant importance to a country's external trade policy area of macroeconomics in which every growing economy is much concern with. Quite apart from this, many foreign and internal institutions are very much concerned with such macroeconomics area, for instance, the like of International Monetary Fund (IMF), World Bank (WB), World trade organization (WTO), the Bank of Ghana (BOG), Ministry of Trade and Industries (MOTI) and Ministry of Finance and Economic Planning (MOFEP) of Ghana.

Ghana recorded an external trade deficit of US$1.7 billion in the first nine months of January to September of 2011. According to Bank of Ghana (BOG), the total merchandise exports within the period amounted to US49.8 billion in 2011, representing a growth of about 67 percent over the same period of 2010 whereas total merchandise imports amounted to US$11.5 billion, representing an annual growth of 45.6 percent. This means that Ghana imports more than it exports on the international market having a shortfall of US$1.7 billion within the period compared to US$2 billion for the

corresponding period in 2010. And by eleventh month it was U$2.6 billion. Again, second quarter of 2012 Ghana trade deficit was US$1339.50 million according to (BOG, 2012).

In the light of all these macroeconomic indicators, the need for this research to find out which exports and imports commodities have an important major effects on the country balance of trade. We have a purpose for finding out the major effects of export and import commodities in Ghana that have significant effect on its balance of foreign trade position with the rest of the international world. The studies therefore wish to present itself a useful reference or guidance in the area of effects of export and import commodities on the balance of foreign trade in Ghana. It again identified major factors contributing largely to the macroeconomic position of the country. The study also presented major findings by the use of some statistical analysis on the importance to economic improvement of Ghana's external trade policies and eventually contributing extensively to international trade. Finally, the study is useful for academic and for research purposes for all those who will wish to know much about Ghana's macroeconomic position on the area of its export and import and on the balance of foreign trade to the rest of it trading partners across the world.

1.6 **Scope of the study**

Export and import on balance of foreign trade are not only broad but also complex macroeconomic area so far as Ghana's growing economy is concerned. Because of the limited resources, space, and review of related literature, the study is limited to analyzing the effects of major export and import commodities of the balance of foreign trade of the

country for the period 2004 to 2010. Again, the study did not consider the services sector of the macroeconomics, therefore, that sector is excluded from the study.

1.7 Thesis organization

The thesis has been organized in five chapters. The first chapter is an introductory part of the work. The chapter gives a general overview of the study. It is made up of the background to the study, problem statement and the objectives of the study. Methodology, justification of the study as well as the scope of the study, and thesis organization also form part of chapter one. Chapter two outlines the review of literature. The third chapter also discusses the data and modeling. Preliminary analysis is presented at the early stages in this chapter. Chapter four deal's with the discussion of the results and their interpretation. The final chapter presents the conclusions of the study based on the findings.

CHAPTER TWO

LITERATURE REVIEW

2.0 INTRODUCTION

This chapter contains the review of related literature and research work in other fields used in analyzing the effects of export and imports on balance of foreign trade. The applications of some statistical techniques such as principal component analysis and stepwise regression analysis

Laura (2005), from an empirical perspective, two African economies, a developed (South Africa) and a developing country (Ghana) are analyzed. Moreover, sector-heterogeneity is considered. Results show that determinants of trade have a different impact in developed and developing African countries. Geographical and social factors play a key role on trade relationships in South Africa. Moreover, technological innovation in importer countries leads to higher exports from this country. However, Ghana's exports are higher when they are addressed to countries with higher levels of economic freedom. Then, there is a need for contingency plans in the context of multilateral trade negotiations. However, the WTO-compliant unless they aim to free up trade in essentially all sectors on non-discriminatory basis. Moreover, the Economic Community of West African States does not foster exports from Ghana. Trade barriers do not seem to deter significantly trade flows from these African economies, although Ghana has benefited with the current structure of trade imbalance. Ghana imports more than it exports, then freight rates are lower for the shipments transported on the leg of the trip with less traffic

(exports). Finally, geographical distance and technological innovation are the most important determinants of exports from South Africa.

According to a report of Bank of Ghana (2009), while expanding export markets are widely accepted as beneficial, increases in imports can be seen as threatening, replacing domestic production with goods and services from abroad. Therefore, to examine the nature and direction of the relationship between exports and imports using unit root tests and cointegration techniques in a Vector Error Correction Framework were all applied on the study. Therefore, there exists a long-run equilibrium relationship between exports and imports in Ghana. Given the bivariate nature of the study, the Engle-Granger cointegration procedure is employed to test for the presence of co integration between the two time series. The residuals, regressions are tested for stationarity to determine whether or not the two time series are cointegrated by using the following Augmented Dickey Fuller (ADF) unit root tests on the respective residuals. The ultimate convergence towards equilibrium signifies the overall effectiveness of Ghana's past macroeconomic policies in stabilizing trade conditions, which does not exceed the inter-temporal budget constraint. The causality test also indicates absence of causation between exports and imports in the short run but we observe bidirectional causality between them in the long run. The policy implication for Ghana is that trade policy focus should be on reducing imports and raising exports in order to control the trade balance (deficits), at least in the short run.

Konya (2008), investigated the presence of an equilibrium relationship between the logarithms of Indian exports and imports between 1949/50 and 2004/2005, using unit-root, cointegration approach. The results obtained indicate no-cointegration between exports and imports. He therefore concluded that, Indian's macroeconomic policies have been ineffective in bringing exports and imports into long-run equilibrium and that India was in violation of her international budget in terms of trade.

2.1 SOME APPLICATIONS OF PRINCIPAL COMPONENT ANALYSIS

With regard to the applications of principal component analysis on this study, we considered how principal component analysis has been applied in other fields of life.

Brett (2008), worked on modeling the Point Spread Function (PSF) using Principal Component Analysis. An important task in astronomy and cosmology is to determine the shape of objects, including stars and galaxies. Modeling the PSF is highly dependent on the brightness of the nearest star because faint stars are noisier than bright stars and the PSF is affected by noise. Analysis (PCA), which uses the PSF model of each image to create a global model that, describes the overall PSF of all images in a set. The PSF varies between images due to many factors, which may not all be predictable or linked to a known physical source, but if enough images are used, the largest contributing factors can be monitored and a global PSF pattern can be constructed. It is not necessary to attribute each principal component with the cause of its contributing PSF, but can be pursued if desired. PCA works independently of knowing the physical causes that contribute to the global PSF. It also gets around the problem of needing a large number of stars in one image as well as the problem of the PSF changing rapidly between stars.

Edward (2010), also applied Principal Component Analysis of gravitational-wave signals from extreme -mass –ratio source. He used the Laser Interferometer Space Antenna (LISA) to detect the gravitational wave emissions from a wide number of astrophysical sources, but extracting useful information about individual sources or source type is an extremely challenging prospect; the large number of parameters governing the behavior of some sources makes exhaustively searching this parameter space. Principal Component Analysis (PCA) was used to identify redundancy within the parameter space of Extreme Mass Ratio Inspiral (EMRI) sources and to construct a new, smaller parameter space containing only relevant signal information. They then created a simple search method based on how gravitational wave signals project into this new parameter space. Their test case indicates that, a small number of principal components span a space occupied by the majority of EMRI spectrogram. Principal component analysis base shows that the method could be used to provide initial estimates of EMRI coalescence times faster than using it for the first search. It may be that the noise suppression was the only necessary operation, and that whitening does not produce any worthwhile effect. To settle this matter, the searches of the wave form involve without whitening the spectrograms during the search and using the original Eigen spectrograms created from the spectrogram set.

Jip (2010), Principal Component Analysis on Side-Channel Attacks. Differential power analysis is commonly used to obtain information about the secret key used in cryptographic devices. It requires power traces, which usually are highly dimensional, but may leak key information at multiple time instances. In simulated data encryption

standard (DES) encryption there is no simulation of things like the procession of plain text. Also, there is no noise-less trace set, we also considered simulated traces. Principal components were used to capture the variance of the key leakage of the different S-boxes. Since the largest variance is captured in the highest principal components, if there is no noise in the measurements, the information about the key leakages should be in these largest components. They implemented the principal component analysis (PCA) model in such a way that its output contains both the original traces with their noise reduced, all of the PCA and a plot of the eigenvalues in order to evaluate the PCA.

Victor (2001), Principal component analysis with multiresolution. Eigenvalue decomposition and multiresolution are widely used techniques for signal representation. Both techniques divide a signal into an ordered set of components. They considered the first component and considered an approximation of the input signal; and finally subsequent components improve the approximation. PCA is known to be optimal for representation, but suboptimal for classification. They also indicated that PAC- based feature extraction could be improved by adding localization and multiresolution. The combination of localized eigenfeatures and global eigenfaces performed almost perfectly.

Xin (2011), Outlier Detection Approach for Principal Component Base (PCB) Analysis. Capacitive Lead Frame Testing, a widely used approach for printed circuit board testing, is very much effective for open solder detection by applying Principal Component Analysis. However, is affected by mechanical variations during testing and by tolerances of electrical parameters of components, making it difficult to use threshold based

techniques for defect detection. When applied to one window, PCA is able to detect the physical position of potential defects. Combining the basic and enhanced techniques, the effectiveness of outlier detection is more improve with PCA. The PCA is extended to detect and compensate for systematic variation of measurement data caused by tilt or shift of the sense plate. The PAC transformation was specified by first finding the direction that achieves the largest projection variance from the data projection; after finding the direction above, we continue to look for another direction, which is orthogonal to that one and contains as much of the remaining variance from the data projection as possible. Then, they continue to still look for the third one, and so on. In the direction can be considered as the linear combinations of the original data set. In fact, the direction can be considered as the linear combinations of the original data set. The effectiveness of PCA for identifying outliers, we use a series of scatter plots of different combinations of PCs vectors. With first two principal components (PC) vectors s-axis and y-axis respectively, board run number has been plotted.

McAdams et al. (2006) worked on the use of Principal Component Analysis in data reduction for GIS Analysis of water quality data. Environmental analysis is multi-dimensional. When measuring environmental variables such as air pollution, or water quality, one uses multiple measurements. In all this cases of water quality and air pollution, one is particularly concerned with their spatial distribution related to the sources mixing and intensity. These measurements are not mutually exclusive and are often inter- correlated, about the relationship of another. However, it may not be clear how these measurements are spatial connected. When taking multiple samples over

different time periods, the discemment of trends is difficult. The use of statistical analysis such as data set reduction technique such as Principal Component Analysis is indicated in such conditions. The PCA analyses distinguish between different areas of the composition of a lake. The areas correlating strongly with the Polluted variables are areas known for discharge of pollutants such as Phosphorus and Nitrogen due to the entry of pollutants from the streams that were carrying industrial waste. The other section of the lake which is buffered by a wildlife protection area and minimal urbanization were the highest loadings on the good water quality variable were found.

2.2 SOME APPLICATION OF REGRESSION ANALYSIS

We considered how regression analysis has been applied in other fields of life to the research.

Zinvand et al. (2007) applied a random regression model to estimate (co)variances, hertia abilities and additive correlation among average daily gains. The data was a total of 10876 records belonging to 1828 lambs (progenies of 123 sires and 743 dams) born between 1995 and 2001 in a single large size flocks of lori-bakhtiari sheep breed in Iran the model, fixed environment effects of years –season of birth, sex, birth, type, age of dam and random effects of direct and maternal additive genetic and permanent environment were included. Orthogonal polynomial regression (on the Legendre scale) of third order (cubic) was utilized to model the genetic and permanent environment covariance structure throughout the growth trajectory. Direct and maternal heritability estimates of average daily gains ranged from 0.0011 to 0.11 and 0.008 to 0.181,

respectively in which pre –weaning average daily gain (0-3 in months) had the lowest direct and highest maternal heritability estimates among the other age groups. The highest and lowest positive direct additive genetic correlations were found to be 0.993 and 0.118 between ADG (0-9) and ADG (0-12) and between ADG (0.3) and ADG (0-12), respectively. The direct additive genetic correlations between adjacent age groups were more closely than between remote age groups.

Breese (1972), used regression to investigate interaction in two way tables by the regression analysis. Arithmetic and logarithms scales were used in both experiments and the relative's advantages of these are briefly discussed. Significantly high proportion of the interaction between species (row) and associates (column) effects were explained as difference between the linear regressions of individual performance on the associate values. Consequently the performance of the species mean, the regression coefficient (b)and the mean effect of associates(a),which respectively measured the general vigor of the species, its sensitivity to competition and its aggressiveness. These parameters jointly provided estimates of what we have termed the general competitive abilities of species. Specific competitive abilities of particular mixtures are detected as significant deviation from the regression lines. The parameters were used to drive formulae which descriptive and predictive measurement of the competitive advantages of species in particular combination, and of the mixture performance relative to the performance of other mixtures or monocultures. The type of competition phenomena which derive from a situation involving only general competitive abilities were shown to vary greatly and depended on the correlation between the three parameters in the experimental material.

Koul (2009), believed that lack of fit testing of a regression model with Berkson measurement errors has not been discussed in the literature to date. To fill this void, they proposed a class of tests based on minimized integrated square distance between a nonparametric regression function estimators and parametric model being fitted. They proved asymptotic normality of these test statistics under the null hypothesis and that of the corresponding minimum distance estimators under minimal conditions on the model being fitted. They also proved consistency of the proposed tests against a class of fixed alternatives and obtain their asymptotic power against a class of local alternatives orthogonal to the null hypothesis. These latter results are new even when there is no measurement error. A simulation that is included shows very desirable finite sample behavior of the proposed inference procedures.

Mira et al. (1973) embarked on a project titled "regression analysis of the spontaneous spike activity of neurons in snail ganglia'', the activity was carried out with the aim to establish the statistical parameters of this activity under constant experimental conditions and during longer time intervals. The activity of 38 randomly chosen neurons in visceral and parietal ganglia penetrated by microelectrodes and activated either endogenously by pacemaker potentials or by synaptic inputs, was recorded during time intervals lasting from twenty (20) minutes to three (3) hours. The main results of the statistical analyses are presented in the table where the parameters of both cell types are listed. The validity of the regression analysis applied here is discussed from the point of the possibility it offers for carrying on the data processing quickly and without applying complex calculating means the result are also considered regarding the current interest of our research groups.

Mckie et al. (1980) worked on rapid determination of minimum inhibitory concentration of antimicrobial agents by regression analysis of light scattering data. A novel, rapid automated method for determining the minimum inhibitory concentration of antimicrobial drugs within ranges acceptable for therapeutic application is described and validated in this report. By employing a simple modification of the Auto photometer currently in use and in optically clear, modified Mueller-Hinton broth, the method utilizes forward light scattering data measured in the presence of two concentrations of the antimicrobial agent to compute the minimum inhibitory concentrations. Empirically derived regression equations which simultaneously use scattering data from two drug concentrations are employed in this computation, rather than simple breakpoint analysis in which the light scattering measured in the presence of each drug concentration is referred to a threshold level. The minimum inhibitory concentration obtained with this new method were highly reproducible and, as shown by side by side comparisons were excellent agreement with the minimum inhibitory concentrations obtained with the international collaboration study both dilution method.

Krainis et al. (1996) investigate the application of Random Regression Model (RRM) for the genetic analysis of egg production in turkeys. Data collected from a heavy dam line were used to estimate genetic parameters with two (2) RR models, one having second – order Legendre polynomials as regression over (RR2) and another with third-order polynomials (RR3). The second objectives was to benchmark the performance of RR models with more conventional methods, so genetic parameters were re-estimated using a multi trait (MT) and a repeatability model. To assess the model efficiency of predicted missing values, a reduced data set was used, and for each model, the predicted values of

the deleted records were compared with the true values. The RR models were further compared against each other by eliminating the last period and estimating the MS error of the predictions for both models. The repeatability model had the poorest performance in predicting missing values. Heritability estimates from RR2 and MT models were close, whereas the RR3 model estimates were different. Both RR models demonstrate better prediction ability than the MT model .however, when RR models were compared solely, the RR2 model resulted in the smallest MS error. The result indicated that the RR3 model over fitted the data, suggestion that the choice of the appropriate polynomial order requires careful consideration. The present study illustrated that the application of RR models for the genetic analysis off egg production in turkey is not only feasible but offers a high accuracy of prediction.

Yao et al. (1996) analyzed the use of regression models in trading and investment with an application to foreign exchange (FX) forecasting and trading models. It is not intended as a given survey of all potential application of regression methods to the field of quantitative trading and investment, as this would be well beyond the scope of single chapter for instance, time varying parameters models are not covered here as they are focus of another chapter in this book and Neural Network Regression (NNR) models are also covered in yet another chapter. In this section, NNR models are benchmarked against some other traditional regression based and alternative forecasting techniques to ascertain their potential added values as a forecasting and quantitative trading tool. In addition to everlasting the various models using traditional forecasting accuracy measures, such as root mean squared errors, they are also assessed using financial criteria, such as risk adjusted measures of return. Having constructed a synthetic

EUR/USD series for the period up to 4 January 1999, the models were developed using the same in sample data, leaving the remainder for out of sample forecasting, October 1994 to May 2000, May 2000 to July 2001, respectively. The out sample period result were tested in terms of forecasting accuracy, and in terms of trading performance via a simulated trading strategy. Transaction costs are also taken into account. It is concluded that regression models, and in particular NNR models do have the ability to forecast EUR/USD returns for the period investigation, and value an as forecasting and quantitative trading tool.

CHAPTER THREE

METHODOLOGY

3.0 INTRODUCTION

This chapter involves some statistical tools used in analyzing the major effects of exports and imports on balance of foreign trade in Ghana. The statistical tools employed in this research work were, principal component analysis (PCA), stepwise regression analysis and multiple linear regression analysis. They were employed to identify the major components of the commodities that have significant effects on exports and imports. Doing this, all commodities with factor loading greater than or equal to 0.25 in absolute values on the first principal component were retained and therefore considered for further analysis. The firs Principal Component (PC) were considered due to the fact that, it contains the variables with the highest sample variance. The variables so retained were used in stepwise regression analysis to further study their effects on exports and imports on balance of trade to determine better and significant effects.

In dealing with the set of data at this point, the data was transformed by using logarithm transformation procedure because of the non linearity nature of the data in order to be able to perform regression analysis on the data. The fitted regression model was considered base on Stepwise regression (forward selection) at 10% statistical significant level. The statistical software used for the statistical analysis was SAS and SPSS. SAS was basically used for PCA while SPSS was used for the stepwise and multiple regression analysis. Data for the research was sought from (GSS) trade statistics division from the period of 2004 to 2010.

3.1 PRINCIPAL COMPONENT ANALYSIS.

According to Alvin (2002), in Principal Component Analysis, we intend to maximize the variance of a linear combination of the variables. We have not applied Principal component analysis on our data as a whole because in this way we will lose our information. Actually, had we used the PCA on all the variables without grouping them, we would not have been able to identify the proper groups which have a direct bearing on balance of trade. The first PCA is the linear combination with maximal variance in which we are searching for a dimension along which the observation are maximally separated or spread out. The second PC is the linear combination with maximal variance in a direction orthogonal to the first PC, and so on.

We seek a linear combination with maximal variance. The sample variance of $Z = a'y$ is

$a'Sa$

Since $a'Sa$ has no maximum if a is unrestricted, we seek the maximum of

$$\lambda = \frac{a'Sa}{a'a} \qquad (1)$$

By this argument, the maximum value of λ is given by the largest eigenvalue in the expression

$$(S - \lambda I)a = 0 \qquad (2)$$

Hence the characteristic equation

$$|S - \lambda I| = 0 \tag{3}$$

The eigenvector a_1 corresponding to the largest eigenvalue λ_1 is the coefficient vector in $Z_1 = a_1' y$. Therefore, S can be singular, in which case some of the eigenvalues are zero and can be ignored. A singular S would arise, for example, when $n \prec p$ that is when the sample size is less than the number of variables.

3.2.0 LOGARITHM TRANSFORMATION

Koutsoyiannis (1977), theory of econometrics, if the relationship is of the form

$$Y = b_0 X_1^{b_1} X_2^{b_2} \mu \tag{4}$$

Then the error term is multiplication, instead we write the constant relationship in the continent form.

$$Y = b_0 X_1^{b_1} X_2^{b_2} \ell^{\mu} \tag{5}$$

Where $X_i, t(\mu_i) = 0$ the base of the natural logarithms. The appropriate transformation for all estimation of constant variables form is to work with logarithms of the variables to the base e.

$$\log_{\ell} Y = \log_{\ell} b_0 + b_1 \log_{\ell} X_1 + b_2 \log_{\ell} X_2 \tag{6}$$

Setting $Y^* = \log_e Y, X_1^* = \log_e X_1, X_2^* = \log_2 X_2$

We shall apply OLS to the linear transformation.

$$Y^* = b_0^* + b_1 X_1^* + b_2 X_2^* + \mu \qquad (7)$$

The estimate $\hat{b}_1$ and $\hat{b}_2$ are unbiased, however, although $\hat{b}_0$ * Intercept b_0^1 unbiased, the logarithmic transformation yields a biased, but consistent, estimate of the intercept b_0^1.

3.2.1 ASSUMPTION

- The random variables μ has a zero mean value for each X_k (zero mean)
- Homoscedasticity ; the variance of each μ_1 is the same for all the X_1 values

  $E(\mu_i^2) = \sigma_\mu^2$ constant
- (Normality of u) the values of each μ_i are normally distributed. $\mu \square N\left(0, \sigma_{\mu_i}^2\right)$

3.3 STEPWISE REGRESSION ANALYSIS

Bob (2002), these types of regression analysis combines forward selection and backward elimination. At each step, the best remaining variable is added, provided it passes the significant at 5% criterion, then all variables currently in the regression are checked to see if any can be removed, using the greater than 10% significant criterion. The researcher used forward selection which starts with the independent variable that is the best predictors of the dependent variables and check that the coefficient is significant different from zero at the 5% level, then it adds the one that improves the prediction the most, subject to a criteria, usually that the coefficient is significantly different from zero

at 5% level and leave with 10% level of significances. The process continues until no more variables pass the criterion.

3.4 .0 REGRESSION ANALYSIS

Regression analysis is a statistical forecasting model for the investigation of relationship between variables. In regression analysis there is an attempt to establish the mechanism of perdition, or forecasting. There is one particular variable of primary interest and the remaining variables are studied for their possible and in throwing light of this particular variable. The primary variable of interest is assumed to be random housing a probability distribution and the remaining variables are assumed to have fixed values (in repeated sampling).

3.4.1 THE MULTIPLE REGRESSION ANALYSIS (MRA)

(MRA) is a technique that allows additional factors to enter the analysis separately so that the effect of each can be estimate. It is variable for quantifying the impact of various simultaneous influences upon a single dependant variable. Further, because of omitted variables bias with simple regression; multiply models are often essential even the investigator is only interested in the effects of one of the independent variables. The (MRA) is one of the most widely used techniques. The applications of regression are numerous and occur in almost every field including engineering, the physical science, economics management, life and biological science and social science. It is statistical method often used to analysis non-deterministic relationships. In semi-deterministic

relationship, the determination of the parameter of the theoretical relation then becomes a statistical problem which can be tackled regression analysis. The regression analysis enables the investigator to check for the significance of the relationship in relation to the available data.

Peck (1986), the multiple linear regression models employ more than one predictor variables and one response variable. A general additive multiple regression models which relate a dependent variable Y to K predictor variable $X_1 X_2, ..., X_k$ are given by the model equation.

$$Y = a + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_k X_k + \varepsilon \qquad (8)$$

Where $a, \beta_1 \beta_2, ..., \beta_k$ is are the regression coefficient is an independent random variable with mean value zero and variance O^2 and K is number of predictors' variables. If we denote the mean of Y foe given $X_1 X_2, ..., X_k$

By $E(Y)$ then the above model can be expressed as;

$$E(Y) = \alpha + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_k X_k \qquad (9)$$

Then expression $a = \beta_1 X_1 + \beta_2 X_2 + ... + \beta_k X_k$ expresses the mean value of Y as a linear function of the parameters, hence the term linear. Also the expression has multiple number of predictors variable and hence the term multiple. For the purpose of the study therefore the model is given by

$$Y = a + \beta_1 X_1 + \beta_2 X_2 \qquad (10)$$

Where Y is the yearly admission in the hospital, X, is the yearly death recorded in the hospital. Using, the normal equation;

$$\sum Y = \overset{n}{na} + b_1 \sum^{n} X_I \tag{11}$$

$$\sum_{i=1}^{n} Y_i X_{1i} = a\sum_{i=1}^{n} X_{1i} + b_1 \sum_{1=1}^{n} X_{1I}^2 \tag{12}$$

$$\sum_{i=1}^{n} Y_i X_{2i} = a\sum^{n} X_{2i} + b_1 \sum^{n} X_{1i} X_{2i} \tag{13}$$

The least square estimators a and b_1 for a, β_1 and β_2 respectively can be obtained

Based on the above estimators the predicted for given X_1 and X_2

$$Y = a + b_1 + b_2 X_2 \tag{14}$$

3.4.2 ASSUMPTIONS

- The expectation of the error term is zero.
- Homoscedasticity (constant variance), that is at any given values of $X_{1,} X_{2,}, ..., X_k$ the variance in the u-values is the same and equal.
- Normally, at any given value of $X_{1,} X_{2,}, ..., X_k$ the error term is distribution that is $\ell = (0, \sigma^2)$
- Independence; at any given value $X_{1,} X_2, ..., X_k$ of the error term is independence of each other.

3.4.3 SIMPLE LINEAR REGRESSION

Fox (1997), the simple linear regression models is given by a straight line relation between Y and a simple fixed variable X. to be precise, the regression model in this given by;

$$Y = a + \beta_x + \varepsilon \tag{15}$$

Where α and β are the regression coefficients and ε is an independent random variable with mean zero the same variance σ^2 for all Y, .if we denote the mean of Y for given X by μxy ,then the above model can be expressed as

$$\mu y_x = a + \beta_x \tag{16}$$

in equation (16) the variable ε, often referred to as an error term, may be conceived as a random variable representing the fluctuation of Y for given X .Since X is a fixed variable so is $a + \beta_x$, and the Y and ε have the same variable. Suppose that ε is normally distributed with zero mean and variance σ^2 then, this implies that Y is normally with $a + \beta_x$ and variance σ^2. Mean for μ_{yx} any given x lies on a straight line with the slope β and the intercept a.

CHAPTER FOUR

DATA COLLECTION, ANALYSIS AND RESULTS.

4.0 INTRODUCTION

The chapter gives a summary of results on the effects of exports and imports on the balance of foreign trade in Ghana for the period 2004 to 2010. We used principal component analysis for the deduction of the variables which has significant effect on balance of trade in Ghana. The data was divided into three groups before applying the principal components on each of them with regard to export and import of balance of trade in Ghana. Those three groups were food, textile and manufacturing commodities. Principal component was applied to each group to extract variables that contribute significantly to balance of trade. All variables with factor loadings greater than or equal to 0.25 in absolute values were retained for further analysis. Both stepwise and multiple linear regression further analyzed the components of the three groups emanating from the first PC in each group to ascertain the effect on balance of trade. Analysis of variance (ANOVA) was used to test the model adequacy for all the three groups.

The statistical software used for the statistical analysis were SAS and SPSS. SAS was basically used for PCA while SPSS was used for the further analysis base on stepwise regression. Data for the research was sought from (GSS) trade statistics division from the period of 2004 to 2010.

4.1 Principal Component Analysis on Exports and Imports of Food commodities

Principal component analysis is performed on export and import commodities over the period of 2004 to 2010. These commodities under discussion are; Live sheep and goat, live fowl, Fish, Potatoes, Onions, Rice, Maize etc.

Table 4.0: Eigenvalues of the correlation matrix on Exported Food commodities

Principal components	Eigenvalues	Difference	Proportion	Cumulative
1	**7.8400**	2.5862	0.3563	**0.3563**
2	**5.2534**	0.7485	0.2388	**0.5951**
3	**4.5049**	1.2483	0.2048	**0.7999**
4	**3.2567**	2.1113	0.1480	**0.9479**
5	**1.1454**	1.1454	0.0521	1.0000

From table 4.0, the eigenvalues 7.8400, 5.2534, 4.5049, 3.2566 and 1.1454 of the correlation matrix for the exported food commodities shows that only five principal components provide a good summary of the data. These eigenvalues all together accounted for 1.000 of sample variance. The contribution of sample proportion due to the first eigenvalues is 0.3563.

Table 4.1: Eigenvalues of the first five Principal Components of the correlation matrix on Exported food commodities

Commodities	PC1	PC2	PC3	PC4	PC5
Live sheep and goat	-0.1019	0.2736	-.3085	0.1708	0.0386
Live foul	-.01755	0.2144	0.3458	0.1694	0.1202
Fish	-0.1065	-0.1444	0.3532	0.3256	0.0467
Potatoes	-0.1352	0.0155	-0.3388	0.1528	-0.1103
Groundnut oil	**0.3012**	0.2179	-0.1788	0.1985	0.0388
Onions	-0.0155	0.0527	0.1662	0.3355	-0.1933
Millet	-0.1000	0.2973	0.1049	-0.0969	0.0854
Yams	-0.1064	0.3982	0.3531	0.3258	0.0468
Kola nut	-0.1215	0.0154	0.0347	-0.1882	-0.7100
Banana	-0.0736	0.2343	0.3542	-0.1671	0.1061
Plantain	0.0407	-0.2987	-0.1312	-.0534	0.6136
Pineapple	-0.1215	0.4029	-0.0698	-.0080	0.0887
Orange	**0.3437**	-0.0302	-.0327	0.1356	-0.0649
Maize seed	**0.2703**	-.0023	0.1880	0.2863	-0.0304
Cocoa	**0.3556**	0.0313	-0.0001	0.0367	-0.0490
Cashew	**0.3471**	0.0281	0.0220	0.0108	-0.0385
Shea oil	**0.3471**	-0.0215	-0.0257	0.1182	-0.0625
Soya beans	0.0321	0.2064	0.1693	-0.4415	0.0608

Tomatoes	-0.1019	0.2740	-0.3084	0.1701	0.0384
Rice	0.2302	0.3028	0.1466	-0.0353	0.0340
Sorghum	0.1880	0.2144	0.1235	-0.3555	0.0331
Palm oil	**0.3407**	0.0818	0.0598	-0.1078	-0.0284

On table 4.1, the Food commodities with higher factor loadings are, groundnut oil, orange, Maize seed, cocoa, cashew and palm oil. These are the variables that accounted for most of the Exported Food Commodities which has direct effect on exports and imports on balance of trade. Even though all the variables have almost the same factor loadings and may have almost the same effect, the one with the highest factor loading among them is Cocoa having greater effect on balance of trade. All variables with factor loadings greater than or equal to 0.25 in absolute values were considered for further analysis. To enhance the analytical effect of these variables on balance of trade, a Stepwise Regression Analysis is performed on these variables.

Table 4.2: Effect of PC on balance of trade (stepwise regression)

Model	Coefficients	Standard error	P –value
Constant	**287.907**	64.880	0.007
Cocoa	**29.855**	6.879	0.007
Orange	-0.193	-	0.486
Maize	0.184		0.444
Cashew	-0.290	-	0.651
Shea (karite) oil	0.120		0.615

palm oil	0.024	-	0.921
groundnut oil	-0.221		0.648

The above table 4.2, we applied the stepwise regression technique to check for variables with significant effects base on the variables that have higher factor loadings on balance of trade on the Principal components extraction . Among these variables in the model above, Cocoa with (P value 0.007) is significant at 0.1 levels. The principal components on exported food commodities, cocoa is the most significant and have major effect on balance of foreign trade in Ghana. All variables with positive sign have direct effect on balance of trade while negative sign indicates inverse effect. Also included is the intercept (P value 0.007), which reflects the effects of other variables that were not included in the model.

Table 4.3: Analysis of variance (ANOVA)

Model	Sum of squares	DF	Mean squares	F	P value
Regression	4356.882	1	4356.882	18.838	**0.007**
Residual	1156.385	5	231.277		
Total	5513.267	6			

In table 4.3, the fitted model of the explained and unexplained variances is shown above. The variance explained accounted for 4356.882 of total variances, whilst the unexplained proportion accounted for 1156.385. However, the P value 0.007 which is associated with

the regression model suggests that the model as a whole is significant at 0.05. The adjusted $\mathbf{R^2=0.79}$ which tells us that 79% of the variation in the balance of trade with regard to exported food commodities is explain by these variables in the model. Therefore, the variable cocoa has relationship with balance of trade.

Table 4.4: Eigenvalues of Correlation Matrix on Imported food commodities

PC	Eigenvalues	Difference	Proportion	Cumulative
1	**8.6769**	4.1456	0.4132	**04132**
2	**4.5313**	1.3708	0.2158	**0.6290**
3	**3.1605**	0.7697	0.1505	**0.7795**
4	**2.3907**	1.0109	0.1138	**0.8933**
5	**1.3799**	0.5191	0.0657	**0.9590**

On table 4.4 above, the eigenvalues 8.6769, 4.5313, 3.1605, 2.3907 and 1.3799 of the correlation matrix for the imported food commodities shows that only five principal components provide a good summary of the data. These eigenvalues all together accounted for 0.9590 of sample variance. The contribution of sample proportion due to the first eigenvalues alone is 0.4132.

Table 4.5: Eigenvalue of the five PC of the correlation matrix on imported food commodities

Commodities	PC1	PC2	PC3	PC4	PC5
Live sheep and goat	-0.1943	-0.1409	-0.0594	0.4755	0.1489
Live foul	-.01167	-0.01108	-0.0897	0.5502	-0.1834
Fish	**0.2706**	0.1130	-0.1591	-0.0272	0.1657
Groundnut oil	-0.0189	0.1636	0.5190	0.0695	-0.0167
Potatoes	-0.0451	0.3225	0.3746	-0.0988	0.1586
Onions	0.2089	0.2210	-0.1527	-0.1220	-0.3865
Millet	-0.0982	-0.1546	-0.1253	-0.1751	0.5988
Yam	-0.1060	0.0781	0.5149	-0.0928	-0.0137
Rice	**0.3106**	-0.1484	0.0966	0.1052	0.0637
Maize seeds	**0.2915**	-0.1593	0.1991	0.0859	0.3740
Plantain	-0.2332	-0.1159	0.2372	0.1867	0.0569
Pineapple	**0.3017**	-0.1717	0.1036	0.1265	0.3740
Shea oil	**0.2935**	-0.1636	0.1254	0.0489	0.0404
Orange	**0.3004**	0.1802	0.0173	0.1124	-0.1684
Kolanut	0.1029	0.4306	-0.0720	0.0422	0.1622
Cashew	0.1054	-0.2324	-0.2188	-0.2381	0.1841
Banana	**0.3056**	-0.1682	0.1025	0.1002	0.2725

Soya bean oil	**0.3062**	-0.1642	0.1022	0.1037	0.0553
Tomatoes	-0.0408	0.2880	-0.1496	0.4725	0.0608
Palm oil	0.0947	0.4225	-0.1410	0.0502	0.1764
Sorghum	0.2023	0.1995	-0.0313	0.1109	0.1752

The Food commodities on table 4.5 with higher factor loadings are, Fish, Rice, Maize Seed, Pineapple, Shea (kariti) Oil, Orange, Banana and Soyabean oil. These are the variables that accounted for most of the imported food Commodities which has direct effect on imports and imports on balance of trade. Even though all the variables have almost the same factor loadings and may have almost the same effect, the one with the highest factor loading among them is rice is having greater effect on balance of trade. All variables with factor loadings greater than or equal to 0.25 in absolute values were considered for further analysis. To enhance the analytical effect of these variables on balance of trade, a Stepwise Regression Analysis is performed on these.

Table 4.6: Effects of PC on balance of trade (stepwise regression)

Model	Coefficients	Standard error	P value
Constant	**22.046**	0.481	**0.000**
Rice	**-0.333**	0.064	**0.003**
Fish(frozen)	0.056	-	0.846
Pineapple	-0.203	-	0.298
Maize seed	0.349	-	0.270
Shea oil	0.208	-	0.463
Orange	-0.082	-	0.761
Banana	-0.210	-	0.287
Soya bean oil	-0.192	-	0.424

The above table 4.6, we applied the stepwise regression technique to check for variables with significant effects base on the variables that have higher factor loadings on balance of trade on the Principal components extraction. Among these variables in the model above, Rice with (P value 0.003) is significant at 0.1 level. The principal component on imported food commodities, rice is the most significant and has major effect on balance of foreign trade in Ghana inversely. All variables with positive sign have direct effect on balance of trade. Also included is the intercept (P value 0.000), which reflects the effects of other variables that were not included in the model.

Table 4.7: Analysis of variance (ANOVA)

Model	Sum of squares	DF	Mean squares	F	P value
Regression	0.882	1	0.882	26.951	**0.003**
Residual	0.164	5	0.033		
Total	1.046	6			

In table 4.7, the fitted model of the explained and unexplained variances is shown above. The variance explained accounted for 0.882 of total variances, whilst the unexplained proportion accounted for 0.164. However, the (P value 0.003) which is associated with the regression model suggests that the model as a whole is significant at 0.05. The adjusted $\mathbf{R^2=0.84}$ which tells us that 84% of the variation in the balance of trade with regard to imported food commodities is explain by these variables in the model. Therefore, the variable rice has relationship with balance of trade. Hence, rice has indirect effect on balance of trade in Ghana in terms of imports market. The above analysis can be found in appendix A.

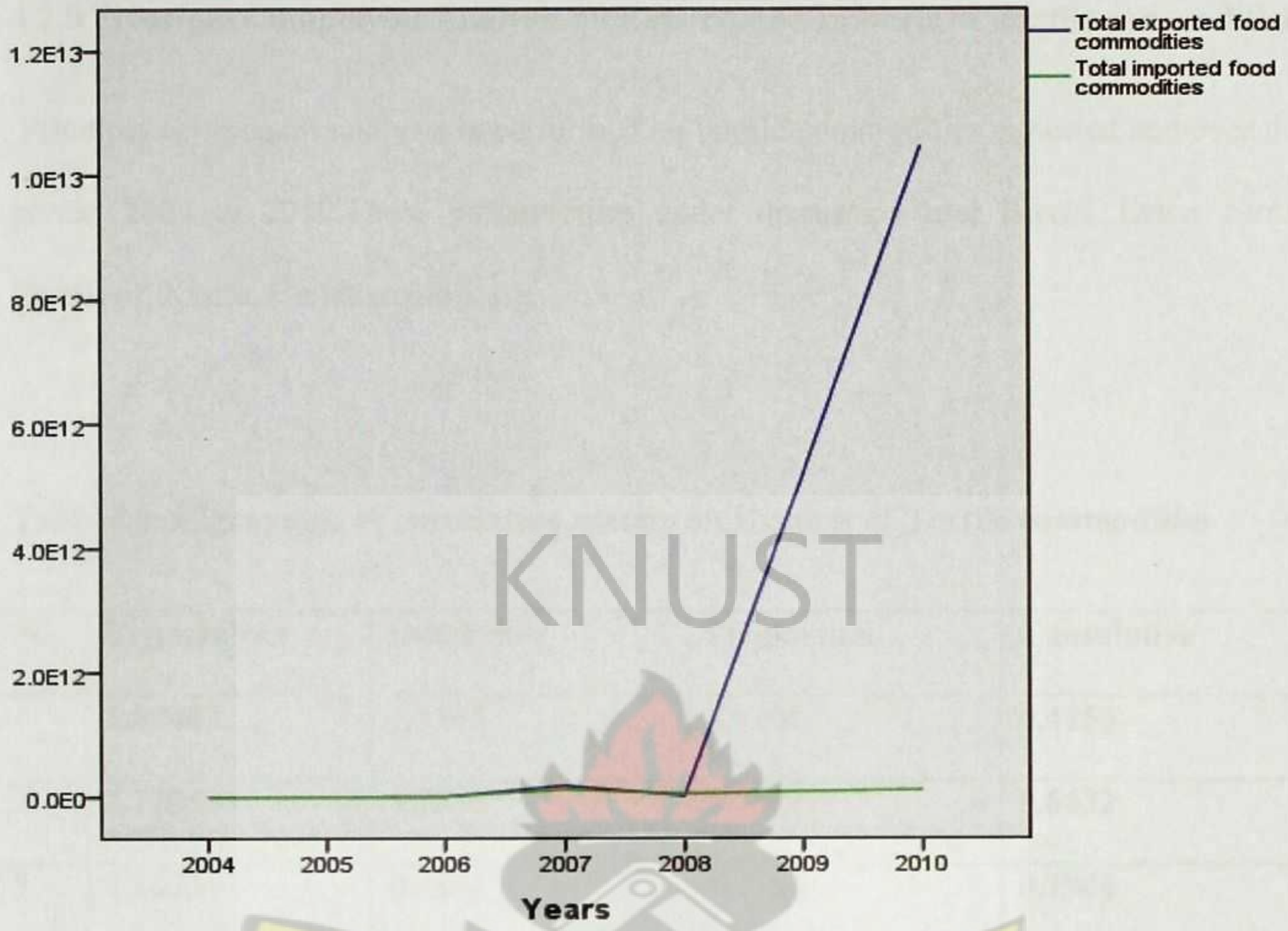

Figure4. 1: Plot of Export and Import on Food Commodities.

The patterns of food exports and imports commodities moved together from 2004 to 2008 and exports departed sharply from 2008 to 2010. Imports remained steadily over the entire period. This is an indication that, Ghana exports market shows that food commodities in general performed relatively well over the period compared to the same period for imports which seem to be stable. It therefore suggests that, Ghana has the potential of improving in the export market of food commodities compare to imports.

4.2.0 Principal Component Analysis on Exports and Imports of Textile commodities

Principal component analysis is performed on textile commodities exported and over the period 2004 to 2010.These commodities under discussion are; Boxes, Letter cards, Envelops, Kente, Handkerchiefs etc.

Table 4.8: Eigenvalue of correlation matrix on Exports of Textile commodities

PC	Eigenvalues	Difference	Proportion	Cumulative
1	**4.5748**	1.8543	0.4159	**0.4159**
2	**2.7205**	1.2530	0.2473	**0.6632**
3	**1.4675**	0.2851	0.1334	**0.7966**
4	**1.1825**	0.3914	0.1075	**0.9041**

The above table 4.8, the eigenvalue 4.5748, 2.7205, 1.4675 and 1.1825 of the correlation matrix for the exported textile commodities shows that only four principal components provide a good summary of the data. These eigenvalues all together accounted for 0.9041 of sample variance. The contribution of sample proportion due to the first eigenvalues is 0.4159.

Table 4.9: Eigenvalue of the four PC of the correlation matrix on exports of Textile commodities

Commodities	PC1	PC2	PC3	PC4
Envelopes	-0.1124	0.0364	-0.7327	0.1825
Letter cards	**0.4286**	-0.1809	0.1206	0.1508
Kente	**0.4293**	0.2035	0.0464	0.1773
Handkerchief	-0.1745	0.1392	0.5073	0.1710
Sanitary towels	**-0.2877**	0.2365	0.3879	0.1646
Exercise books	**0.4279**	0.2086	0.0451	0.1772
Cotton plain weave	0.0806	-0.5817	0.1285	-0.0093
Boxes	**0.4163**	0.2321	0.0030	0.2096
Sewing thread	0.0767	-0.5827	0.1279	-0.0108
Single yearn Polyester	0.0582	0.2645	0.0613	-0.7680
Multiple yearn Polyester	**-0.3660**	0.0632	-0.0052	0.4368

The exported textile commodities on table 4.9 with higher factor loadings are; Letter cards, Kente, Exercise books, Boxes, Multiple yearn polyester and Sanitary towels. These are the variables that accounted for most of the exported textile commodities which has direct effect on exports and imports on balance of trade. Even though all the variables have almost the same factor loadings and may have almost the same effect, the one with

the highest factor loading among them is Kente having greater effect on balance of trade. All variables with factor loadings greater than or equal to 0.25 in absolute values were retained for further analysis. To enhance the analytical effect of these variables on balance of trade, a Stepwise Regression Analysis is performed on them.

Table 4.10: Effects of PC on balance of trade (stepwise regression)

Model	Coefficients	Standard error	P value
Constant	**16.556**	1.469	**0.000**
Kente	**0.555**	0.140	**0.011**
Letter cards	-0.006	-	0.986
Boxes	0.154	-	0.572
Exercise books	-0.545	-	0.159
Sanitary towels	-0.653	-	0.272
Multiple yearn polyester	-0.436	-	0.255

The above table 4.10, we applied the stepwise regression technique to check for variables with significant effects base on the variables that have higher factor loadings on balance of trade on the Principal components extraction. Among these variables in the model above, Kente with (P value 0.011) is significant at 0.1level. The principal component on exported textile commodities, kente is the most significant and has major effect on balance of foreign trade in Ghana directly. All variables with positive sign have direct effect on balance of trade and those with negative sign have inverse effect on balance of

trade. Also included is the intercept (P value 0.000), which reflects the effects of other variables that were not included in the model.

Table 4.11: Analysis of variance (ANOVA)

Model	Sum of squares	DF	Mean squares	F	P value
Regression	16.327	1	16.327	15.721	**0.011**
Residual	5.193	5	1.039		
Total	21.520	6			

In table 4.11, the fitted model of the explained and unexplained variances is shown above. The variance explained accounted for 16.327 of total variances, whilst the unexplained proportion accounted for 5.193. However, the (P value 0.011) which is associated with the regression model suggests that the model as a whole is significant at 0.05. The adjusted $\mathbf{R^2=0.76}$ which tells us that 76% of the variation in the balance of trade with regard to exported textile commodities is explain by these variables in the model. Therefore, the variable kente has relationship with balance of trade. Hence, kente has direct effect on balance of trade in Ghana in terms of the export market.

Table 4.12: Eigenvalue of the correlation matrix on imports of textile commodities

PC	Eigenvalues	Difference	Proportion	Cumulative
1	**7.8246**	5.5699	0.7113	**0.7113**
2	**2.2547**	1.3341	0.2050	**0.9163**

The eigenvalues 7.8246 and 2.2547 in table 4.12 of the correlation matrix for the import food commodities shows that only two principal components provide a good summary of the data. These eigenvalues all together accounted for 0.9163 of sample variance. The contribution of sample proportion due to the first eigenvalues is 0.7113.

Table 4.13: Eigenvalue of the first PC of the correlation matrix on imports of textile commodities

Commodities	PC1	PC2
Envelopes	**0.3436**	0.1809
Letter cards	**0.3573**	0.0078
Boxes	**0.3444**	-0.1778
Handkerchief	**0.3584**	-0.1489
Sanitary towels	**0.3344**	-0.2353
Exercise books	**0.3114**	0-.3272
Cotton plain weave	**0.3379**	0.2150
Kente	-0.0999	-0.0885
Sewing thread	0.0482	-0.1503
Single yearn Polyester	0.1904	0.5619
Multiple yearn Polyester	0.1546	0.5988

The imported textile commodities on table 4.13 with higher factor loadings are; Letter cards, Exercise books, Boxes, Handkerchiefs, Cotton plain weave and Sanitary towels. These are the variables that accounted for most of the imported textile commodities which has direct effect on exports and imports on balance of trade. Even though all the variables have almost the same factor loadings and may have almost the same effect, the one with the highest factor loading among them is Handkerchiefs having greater effect on balance of trade. All variables with factor loadings greater than or equal to 0.25 in absolute values were retained for further analysis. To enhance the analytical effect of these variables on balance of trade, a Stepwise Regression Analysis is performed on them.

Table 4.14: Effects of PC on balance of trade (stepwise regression)

Model	Coefficients	Standard error	P value
Constant	**16.945**	1.732	**0.000**
Boxes	**0.541**	0.173	**0.026**
Envelops	-0.081	-	0.862
Letter cards	0.253	-	0.446
Handkerchiefs	-0.383	-	0.439
Sanitary towels	0.528	-	0.068
Exercise books	0.296	-	0.580

The above table 4.14, we applied the stepwise regression technique to check for variables with significant effects base on the variables that have higher factor loadings on balance

of trade on the Principal components extraction. Among these variables in the model above, Boxes with (P value 0.026) is significant at 0.1level. The principal component on imported textile commodities, Boxes is the most significant and has major effect on balance of foreign trade in Ghana directly. All variables with positive sign have direct effect on balance of trade and those with negative sign have inverse effect on balance of trade. Also included is the intercept (P value 0.000), which reflects the effects of other variables that were not included in the model.

Table 4.15: Analysis of variance (ANOVA)

Model	Sum of squares	DF	Mean squares	F	P value
Regression	14.254	1	14.254	9.794	**0.026**
Residual	7.277	5	1.455		
Total	21.532	6			

In table 4.15, the fitted model of the explained and unexplained variances is shown above. The variance explained accounted for 14.254 of total variances, whilst the unexplained proportion accounted for 7.277. However, the (P value 0.026) which is associated with the regression model suggests that the model as a whole is significant at 0.05. The adjusted $\mathbf{R^2=0.66}$ which tells us that 66% of the variation in the balance of trade with regard to imported textile commodities is explain by these variables in the model. Therefore, the variable Boxes have relationship with balance of trade. Hence,

Boxes has direct effect on balance of trade in Ghana in terms of the export market. Hence this can be found in appendix B.

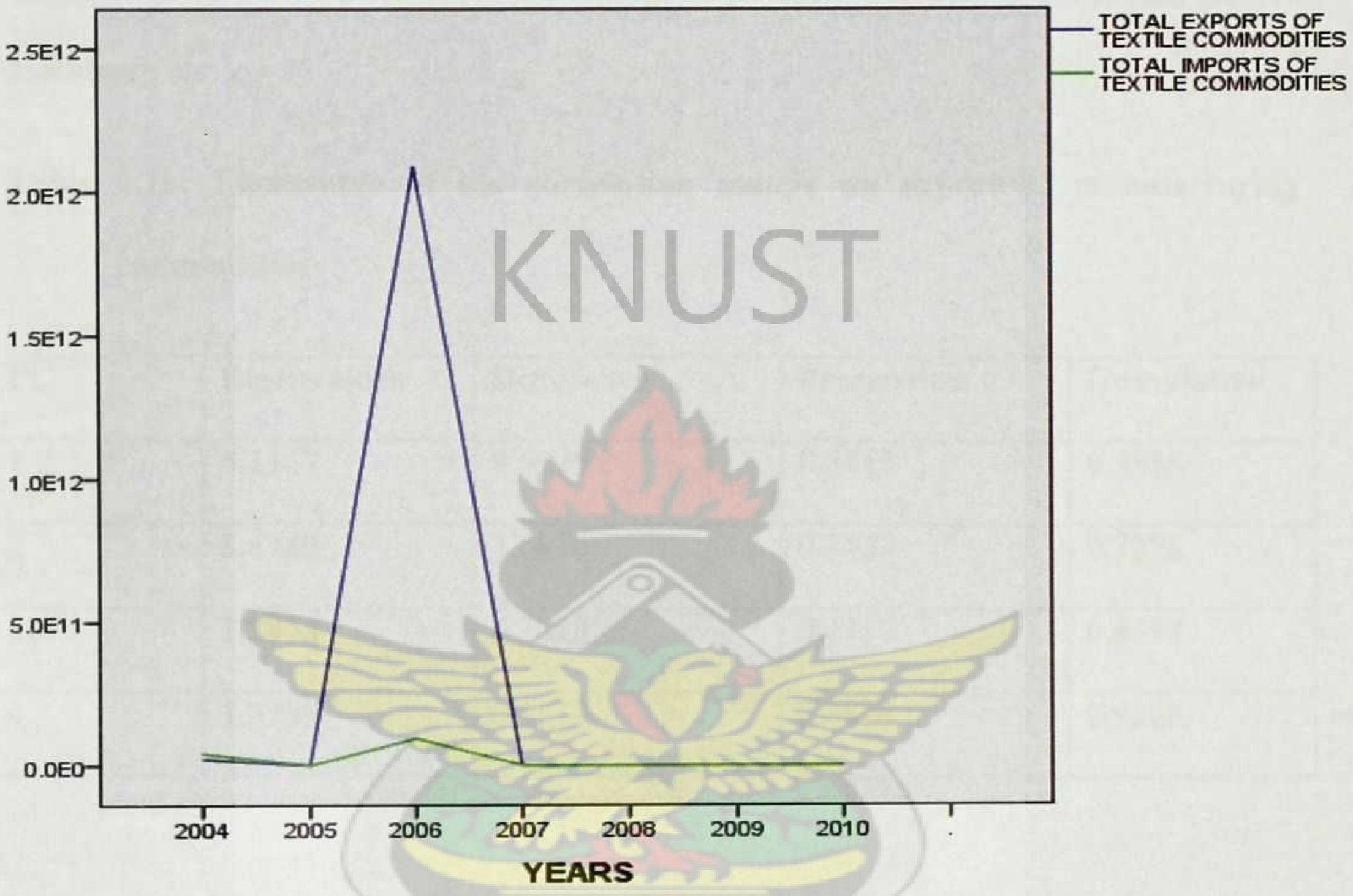

Figure 4.2: Plot of Export and Import on Textile Commodities from 2004-2010.

The patterns of textile export and import commodities moved together for a period of one year and departed from 2005 until 2007. Exports saw a sharp drop in 2007 and became level with import the same year till 2010.

4.3.0: Principal Component Analysis on Exports and Imports of manufacturing commodities

These commodities under discussion includes, ceramic flooring blocks, ceramic roofing tiles, drinking glasses, diamond powder, gold powder, buckets, shovels and grib of machinery etc.

Table 4.16: Eigenvalue of the correlation matrix on export of manufacturing commodities

PC	Eigenvalues	Difference	Proportion	Cumulative
1	**6.1167**	0.6926	0.3855	**0.3855**
2	**5.4749**	3.6876	0.3422	**0.7276**
3	**1.7873**	0.3888	0.1117	**0.8394**
4	**1.3985**	0.5877	0.0874	**0.9268**

From table 4.16, using the eigenvalues greater than 1.0 rule, the results displayed in the table shows that only four principal components are relevant for the analysis. These components are associated with the eigenvalues 6.11675, 5.4749, 1.7873 and 1.3985 which together account for 0.9268 of sample variance of the data.

However, because the focus of the study is to extract the specific commodities that accounted for factor loadings greater than or equal to 0.25 in absolute values on the first principal component.

Table 4.17: Eigenvalue of the first four PC of the correlation matrix on export of manufacturing commodities

Commodities	PC 1	PC2	PC 3	PC4
Ceramic Flooring Blocks	0.0317	0.4185	0.1180	0.0027
Ceramic Roofing Tiles	**0.3870**	-0.1076	-0.0584	0.0606
Drinking Glasses	-0.0179	-0.0841	-0.5652	0.1147
Diamond powder	-0.0102	0.3711	-0.1953	-0.0365
Gold powder	0.1227	-0.1492	0.4532	-0.4366
Buckets, shovels and grib of machine	**0.3554**	0.1952	-0.0078	0.0749
Gold smiths	-0.0983	-0.0983	-0.2700	-0.5693
Iron steel and barbed wires	-0.1541	-0.1439	0.5674	0.1921
Standard wires	0.0354	0.4215	0.0692	0.0323
Accessories for electrical installations	0.0363	0.4216	0.0657	0.0340
Domestic cooking or heating apparatus	**0.3870**	-0.1076	-0.0580	0.0604
Nails	**0.3871**	-0.0108	-0.0540	0.0581
Screws bolts and nuts	0.0353	0.4218	0.0622	0.0254

Copper bars and profiles	-0.1626	-0.1279	-0.0057	0.6372
Monetary gold	**0.3998**	-0.0211	-0.0455	0.0682
Aluminum sheets	**0.3901**	-0.0944	-0.0565	0.0624

The imported textile commodities on table 4.17 with higher factor loadings are; Ceramic Roofing Tiles, Buckets, shovels and grib of machine, domestic cooking or heating apparatus, Nails, Monetary gold, Aluminum sheets. These are the variables that accounted for most of the exported manufacturing commodities which has direct effect on exports and imports on balance of trade. Even though all the variables have almost the same factor loadings and may have almost the same effect, the one with the highest factor loading among them is monetary gold having greater effect on balance of trade. All variables with factor loadings greater than or equal to 0.25 in absolute values were retained for further analysis. To enhance the analytical effect of these variables on balance of trade, a Stepwise Regression Analysis is performed on them.

Table 4.18: Effects of PC on balance of trade (stepwise regression)

Model	Coefficient	Standard Error	P value
Constant	**27.065**	1.070	**0.000**
Monetary gold	**0.214**	0.052	**0.014**
Aluminum sheets	**-0.230**	0.082	**0.049**
Ceramic roofing tiles	-0.112		0.655
Buckets, Shovels and grib of machine	-0.153	-	0.473
Iron, steel and barbed wires	0.512		0.304
Domestic heating or cooking apparatus	0.318	-	0.505

The above table 4.18, we applied the stepwise regression technique to check for variables with significant effects base on the variables that have higher factor loadings on balance of trade on the Principal components extraction. Among these variables in the model above, monetary gold with (P value 0.014) and Aluminum sheets (P value 0.049) is significant at 0.1level. The principal component on exported manufacturing commodities, monetary gold and aluminum sheets are the most significant and have major effect on balance of foreign trade in Ghana directly and inversely respectively. All variables with positive sign have direct effect on balance of trade and those with negative sign have inverse effect on balance of trade. Also included is the intercept (P value 0.000), which reflects the effects of other variables that were not included in the model. The other

variables, including ceramic roofing tiles, buckets, shovels and grib of machine, iron, steel and barbed wires, and domestic heating or cooking apparatus were not significantly associated with balance of trade , hence their standard errors were calculated.

Table 4.19: Analysis of Variance (ANOVA)

Model	Sum of Squares	DF	Mean Squares	F	Sig.
Regression	2.989	2	1.494	13.878	**0.016**
Residual	0.431	4	0.108		
Total	3.419	6			

In table 4.19, the fitted model of the explained and unexplained variances is shown above. The variance explained accounted for 2.898 of total variances, whilst the unexplained proportion accounted for 0.431. However, the (P value 0.016) which is associated with the regression model suggests that the model as a whole is significant at 0.05. The adjusted $\mathbf{R^2=0.87}$ which tells us that 87% of the variation in the balance of trade with regard to exported manufacturing commodities is explain by these variables in the model. Therefore, the variable monetary gold has relationship with balance of trade. Hence, monetary gold has direct effect on balance of trade in Ghana in terms of the export market.

4.4: Eigenvalues of the correlation matrix on imported manufacturing commodities

Also the eigenvalues for the correlation matrix of the imported manufacturing commodities revealed that only two principal components provide a good summary of the data. Thus, the eigenvalues 13.060 and 6.044 are the only values that satisfies Mineigen

criterion, which suggest that eigenvalues greater than or equal to 1.0 corresponds to the number of principal components to be retained.

Table 4.20: Eigenvalue of the first two PC of the correlation matrix on Imported of manufacturing commodities

Commodities	PC 1	PC2
Ceramic Flooring Blocks	0.1526	0.3392
Ceramic Roofing Tiles	**0.2736**	-0.0605
Book binding machinery	**0.2736**	-0.0601
Diamond powder	0.1527	0.3391
Gold powder	-0.0920	-0.0172
Gold smiths and sliver smith	0.2401	-0.2022
Iron steel and barbed wires	**0.2737**	-0.0594
Standard wires	**0.2766**	-0.0065
Drinking glasses	0.2383	-0.2065
Copper bars and profiles	0.2235	-0.2398
Nails	0.2359	-0.2142
Screws, bolts and nuts	0.2048	-0.2734
Domestic cooking or heating apparatus	0.2218	-0.2432
Aluminum sheet	0.2072	0.2694
Compacting machinery	**0.2525**	-0.1661
Buckets, shovels and grib of machine	**0.2610**	0.1346

Seeders, planters and transplanters	0.1993	0.2820
Poultry incubators and broilers	0.1821	0.3061
Accessories for electrical installations	0.2482	0.1796

The imported manufacturing commodities on table 4.20 with higher factor loadings are; Ceramic Roofing Tiles, Book binding machinery, Gold smiths and sliver smith, iron, steel and barbed wires, standard wires, compacting machinery and buckets, shovels and grib of machines.. These are the variables that accounted for most of the exported manufacturing commodities which has direct effect on exports and imports on balance of trade. Even though all the variables have almost the same factor loadings and may have almost the same effect, the one with the highest factor loading among them is standard wires having greater effect on balance of trade. All variables with factor loadings greater than or equal to 0.25 in absolute values were retained for further analysis. To enhance the analytical effect of these variables on balance of trade, a Stepwise Regression Analysis is performed on them.

Table4.21: Effects of PC on balance of trade (stepwise regression).

Model	Coefficients	Standard Error	P value
Constants	**24.469**	0.658	**0.000**
Bucket Shovel grib machinery	**0.195**	0.072	**0.042**
Ceramic roofing titles	-0.227	-	-.280
Book binding machinery	0.126	-	0.862
Iron, steel and barbed wires	-0.489	-	0.076
Standard wires	-0.365	-	0.300
Compacting machinery	-0.297	-	0.516

The above table 4.21, we applied the stepwise regression technique to check for variables with significant effects base on the variables that have higher factor loadings on balance of trade on the Principal components extraction. Among these variables in the model above, Buckets, shovels and grib of machines with (P value 0.042) is significant at 0.1level. The principal component on imported manufacturing commodities Buckets, shovels and grib of machines are the most significant and have major effect on balance of foreign trade in Ghana directly. All variables with positive sign have direct effect on balance of trade and those with negative sign have inverse effect on balance of trade. Also included is the intercept (P value 0.000), which reflects the effects of other variables that were not included in the model.

Table 4.22: Analysis of variance (ANOVA)

Model	Sum of squares	DF	Mean squares	P value
Regression	2.044	1	2.044	**0.042**
Residual	1.376	5	0.275	
Total	3.419	6		

In table 4.22, the fitted model of the explained and unexplained variances is shown above. The variance explained accounted for 2.o44 of total variances, whilst the unexplained proportion accounted for 1.376. However, the (P value 0.042) which is associated with the regression model suggests that the model as a whole is significant at 0.05. The adjusted $\mathbf{R^2=0.60}$ which tells us that 60% of the variation in the balance of trade with regard to imported manufacturing commodities is explain by these variables in the model. Therefore, the variable Buckets, shovels and grib of machines have relationship with balance of trade. Hence, Buckets, shovels and grib of machines has direct effect on balance of trade in Ghana in terms of the import market is concerned. This can be found in appendix C.

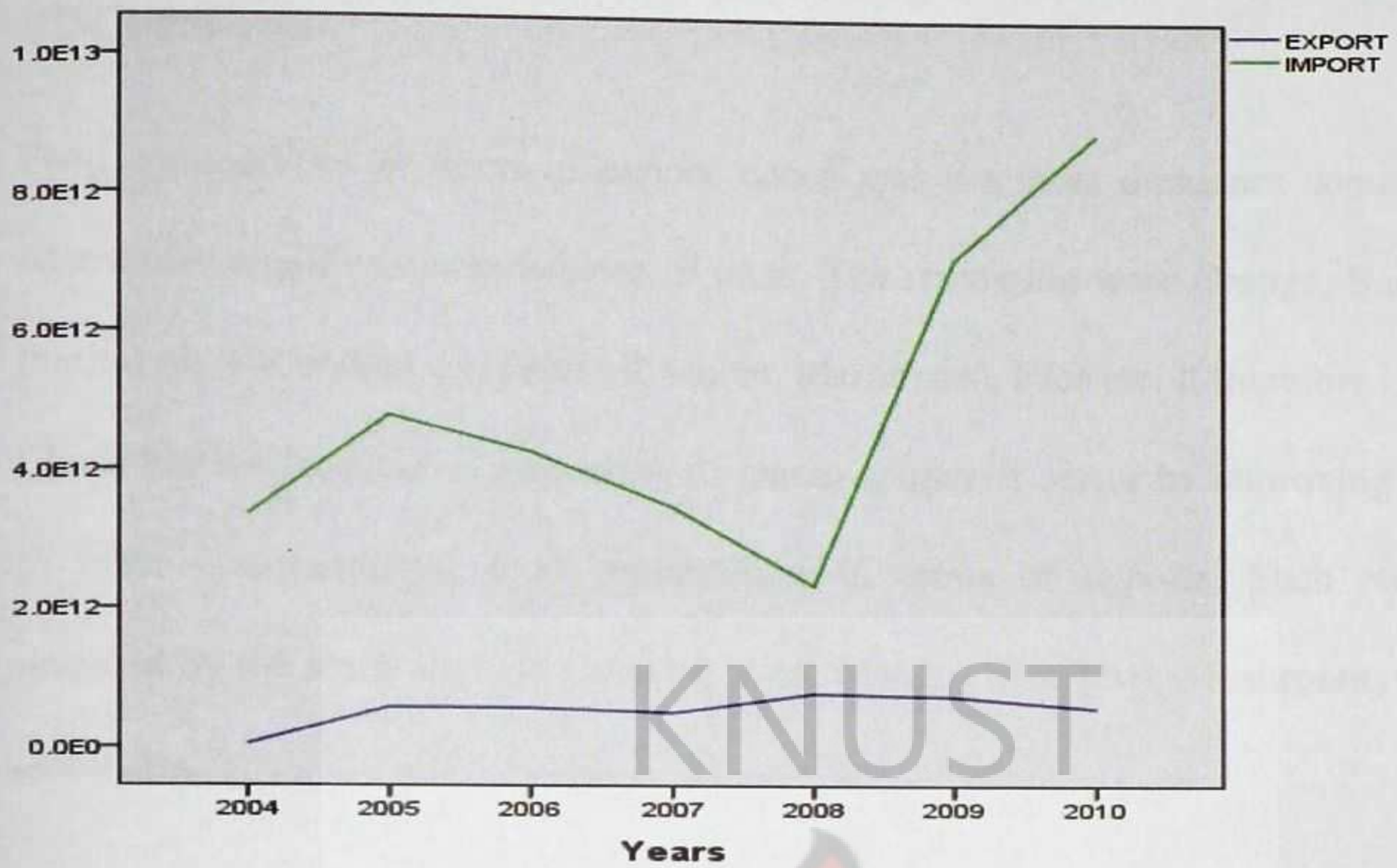

Figure 4.3: Plot of Export and Import on Manufacturing Commodities from 2004 to 2010.

The patterns of manufactured Exports and Imports commodities departed greatly from one another over the period 2004 to 2010. Exports increased from 2004 to 2005 and declined from 2005 to 2008. It increased significantly from 2008 to 2010 whilst that of Imports remained relatively stable over the same period. This means that, the country exported much of its manufacturing commodities from 2004 and 2005 as well as 2008 to 2010 while that of its imports remains almost the same over the entire period.

DISCUSSIONS

Food commodities in terms of export, cocoa was the most dominant commodity that contributed significantly to balance of trade. The remaining were Orange, Banana, Shea (karite) oil, Groundnut oil, Palm oil, Onion, Maize seed, Rice etc. It therefore implies that Ghana has the potential of improving its macro-economic sector by improving in the area of other non-traditional food commodities in terms of exports. Such commodities revealed by the study include Cassava, Yam, Mango, Live fowl, Mushroom, Groundnut (shell) etc.

The contribution of the Textile industry revealed by the study is not encouraging hence the need for policy makers to consider improving on the sector to level-up with the rest of the macroeconomics sectors. The study shows that Kente contributes much to balance of trade, followed by Letter cards, Exercise books etc. Ghana can still improve in this sector by encouraging our craft men and women to go into leader work, basket weaving and others as well as providing support to farmers to go into cotton production.

In the area of manufacturing commodities monetary gold emerges the highest commodity exported in that sector in Ghana. There were other textile commodities that also contributed significantly to balance of trade of Ghana with her trading partners across the world. Such commodities are Aluminum sheets. Ghana has the potentials of exporting other textile commodities that can go a long way to improving the overall balance of trade. These includes Bauxite, Diamond, Salt, Gold smiths, Iron steel etc. Quite apart from Ghana making efforts in exporting most of these commodities, the Country needed to do more in that sector as well.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter focuses on the outcome of the analysis in the last two chapters and considers the extent to which the objectives of the study have been achieved. In this, the items that have been covered include conclusions and recommendations.

5.1 Conclusions

The aimed of the study was to find out which export and import commodities have major effect on the balance of foreign trade in Ghana. The analysis was divided into three groups, which are Food commodities, Textile commodities and Manufacturing commodities. The analysis revealed that, the first group cocoa beans and rice were some of the commodities that had major effect on balance of foreign trade in Ghana, the second group textile, Kente and boxes also had significantly effect of balance of foreign trade and finally, in the manufacturing group, monetary gold, aluminum sheet, buckets, shovels and gribs machines were some of the largest commodities that had effect on balance of foreign trade in Ghana.

Finally, we made comparison on all export and import commodities for the three groups of the study period. Food group, the pattern of export and import moved together from 2004 to 2008 and export departed sharply from 2008 to 2010. On the second group that is textile commodities, the study once again shows that, exports and imports moved together from a period of one year and departed from each other from 2005 to 2007 and

became stable until 2010.The last group which is manufacturing, exports and imports departed greatly from one another over the period of 2004 to 2010. Exports increased from 2004 to 2005 and declined again from 2005 to 2008. It increased significantly from 2008 to 2010 whilst that of imports remained relatively stable over the same period. This means that, the country as a whole exported much of her manufacturing commodities from 2004 to 2005 as well as from 2008 to 2010 whilst that of her imports of the same period is relatively stable.

5.2 Recommendations

Based on the findings of this research work, the following recommendations are made:

I. **Food industry**, improvement should be done in the quality and quantity of the production of the following commodities thereby, helping the export sector base of the market. Such food commodities are; rice, orange, banana, Shea (karite) oil, groundnut (shell), palm oil, onion, maize seed, and live sheep and goat. Since Ghana is somehow an agriculture based economy, it can gives a boost to small and medium scale enterprises, thus benefiting the economy of the country.

II .Textile industry, cotton/ textile industry should be promoted extensively because, Ghana as a country is continues relying on imports from the market. Ghana can still improve in this sector by encouraging our craft men and women to go into leather work, basket weaving and others as well as providing support to farmers to go into large scale

cotton production as the country has potentials of doing well in these areas to help its export market. Again, it can be serving as employment opportunities for the youth.

II. Manufacturing industry, monetary gold and aluminum are helping the exports market, whereas mineral, Buckets, shovels, grib machinery, ceramic roofing tiles, iron, steel, book binding machines, compacting machinery, lubricants are dependent on imports. Machinery, lubricants and minerals are vital industry for any nation and can play a pivotal role in development. These types of industries must be promoted even if it requires the nation pumping much of its resources into it to help enterprises grow and also to expand the job market. Ghana as a country has the potentials of increasing its minerals exports if a critical look is taking at certain minerals such as; diamond, salt and bauxite.

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Appendix A

Table 1.1: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.889[a]	.790	.748	15.20779

Table 1.2: Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	287.907	64.880		4.438	.007
Cocoa	29.855	6.879	.889	4.340	.007

Table 1.3: Excluded Variables[b]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
1	Orange	-.193[a]	-.767	.486	-.358	.725
	Maize	.184[a]	.847	.444	.390	.938
	Cashew	-.290[a]	-.488	.651	-.237	.141
	Shea oil	.120[a]	.544	.615	.262	.999
	Palm oil	.024[a]	.106	.921	.053	.996
	Groundnut oil	-.221[a]	-.493	.648	-.239	.246

Table 1.4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.861[a]	.741	.676	2.00567

Table 1.5: Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	Constant	10.291	3.593		2.864	.046
	Rrice	.985	.291	.861	3.381	.028

Table 1.6: Excluded Variables

Model		Beta In	T	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
1	Pineapple	-.357[a]	-1.584	.211	-.675	.928
	Orange	-.407[a]	-2.279	.107	-.796	.994
	Banana	-.096[a]	-.313	.775	-.178	.889
	Soyabeanoil	.032[a]	.102	.925	.059	.862

Appendix B

Table 2.1: Model Summary (Stepwise regression)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.871[a]	.759	.710	1.01912

Table 2.2: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	Constant	16.556	1.469		11.270	.000
	Kente	.555	.140	.871	3.965	.011

Table 2.3: Excluded Variables[b]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
1	Letter cards	-.006[a]	-.019	.986	-.009	.561
	Boxes	.154[a]	.615	.572	.294	.884
	Exercise books	-.545[a]	-1.727	.159	-.653	.347
	Sanitary towels	-.653[a]	-1.272	.272	-.537	.163
	Multiple yearn polyester	-.436[a]	-1.329	.255	-.554	.389

Table 2.4: Model Summary (Stepwise regression)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.814[a]	.662	.594	1.20642

Table 2.5: Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	Constant	16.945	1.732		9.782	.000
	Boxes	.541	.173	.814	3.130	.026

Table 2.6: Excluded Variables

6Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
1	Envelops	-.081	-.185	.862	-.092	.442
	Letter cards	.253	.844	.446	.389	.800
	Handkerchiefs	-.383	-.859	.439	-.395	.359
	Sanitary towels	.528	2.484	.068	.779	.734

Exercise books	-.296	-.602	.580	-.288	.321
Sewing thread	.051	.084	.937	.042	.230

Appendix C

Table 3.1: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	Constant	24.335	.661		36.825	.000
	Monetary gold	.229	.079	.793	2.913	.033
2	Constant	27.065	1.070		25.300	.000
	Monetary gold	.214	.052	.741	4.152	.014
	Aluminum sheets	-.230	.082	-.498	-2.789	.049

Table 3.2: Excluded Variables[a]

Model		Beta In	T	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
1	Ceramic roofing tiles	.096[b]	.298	.781	.147	.865
	Buckets, shovels and grib of machinery	-.128[b]	-.427	.691	-.209	.981
	Aluminum sheets	-.498[b]	-2.789	.049	-.813	.989
	Iron steel and barbed wires	-.393[b]	-1.372	.242	-.566	.769
	Domestic heating or cooking apparatus	.089[b]	.172	.872	.086	.339
	Ceramic roofing tiles	-.112[c]	-.494	.655	-.274	.750
2	Buckets, shovels and grib of machinery	-.153[c]	-.819	.473	-.428	.979
	Iron steel and barbed wires	.512[c]	1.238	.304	.581	.163

	Domestic heating or cooking apparatus	.318[c]	1.013	.386	.505	.318

Table 3.3: Model summary (Stepwise regression)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.773[a]	.598	.517	.52454

Table 3.4:Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	Constant	24.469	.658		37.205	.000
	Buckets, shovels and grib of machinery	.195	.072	.773	2.725	.042

Table 3.5:Excluded Variables[a]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
1	Ceramic roofing tiles	-.227[b]	-.583	.591	-.280	.614
	Book binding machinery	.126[b]	.186	.862	.093	.218
	Iron, steel and barbed wires	-.489[b]	-2.383	.076	-.766	.985
	Standard wires	-.365[b]	-1.191	.300	-.512	.792
	Compacting machinery	-.297[b]	-.712	.516	-.336	.515