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Investigating the effect of Exchange rate changes on Banks performance. A case study of HFC Bank, Ghana

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DECLARATION

I hereby declare that this submission is my own work towards the degree of Master of Science (Economics) 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 acknowledgement has been made in the text.

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DEDICATION

I dedicate this work to my loving family, for all their sacrifices, understanding, love and support throughout the academic period

Table of Content

Content **Page**

LIST OF TABLES

Table **Page**

LIST OF FIGURES

Figure **Page**

ABSTRACT

Ghana since the 1983 has operated under the flexible exchange rate regime (Aryeetey, 2000; Bordo, 1993). Since 2012, the exchange rate in Ghana has been volatile. Business enterprises conduct their business transactions via the services of banks. The study therefore sought to investigate the impact of exchange rate fluctuations on the performance of banks in Ghana. Using quarterly data on exchange rate (ER) as a macroeconomic determinant, and bank specific factors of capital adequacy ratio (CAD), Credit Risk (CdtRSK), Liquidity (Ldty), and Operating Efficiency (OpEff). HFC bank performance was evaluated following the camel-model profit indicators of return on asset (ROA), return on equity (ROE) and netinterest-margin (NIM). In addition, Commissions earned on international Trade (COT) ratio was also used as a profit indicator. Data from period of January 2008 to June 2015 was used in estimation followed a restricted vector auto-regression methodology, so as to capture short run and long-run dynamics, as the series were found to be stationary after first differencing and the Johansen Cointegration test showed that the series were Cointegrated.

ER was significant and positively related with ROE, NIM and COT in the long-run, but negative and significant with ROA. The study found ER to have a significant short-run causality with ROE and COT. The study therefore concludes that HFC management was efficient in managing its equity, net interest margin and commission on trade. The study recommends that Bank management should adopt efficient and effective practices so that banks do not make losses from exchange rate fluctuations with regards to its asset management. Also minimization of operation cost by banks should be encouraged.

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

In the 1960s government maintained a fixed nominal exchange rate, thereby reducing Ghana's export competitiveness (Herbst, 2014; Meng, 2004). Ghana's exchange rate policies teetered between controls and liberalization for period since independence. The policy of fixed exchange rates was maintained in Ghana until the second half of the 1980 (CK Dordunoo, 1994; Aryeetey, 2000). The economy, faced severe struggle in the world-wide markets for its home produce in the 80's, coupled with political instability resulted in a dislocated balance-of-payments position, widened current account deficit before the arrival of the economic recovery program (Ghartey, 1987). In response to the unrelenting adverse trade balance and disequilibrium in the balance of payments, the then government of Ghana accepted stringent IMF and World Bank loan conditions under the Structural Adjustment Programme (Tsikata, 1999; Danquah, 2008).

As part of Ghana's reform process, some policies implemented includes stringent fiscal discipline, devaluation of the cedi currency and the liberalization of Ghana's trade and financial markets. Ghana's SAP experience was revered by most developed and developing world and generally regarded by the IMF as a success story (Agbola, 2004 and Sanusi, 2012).

Yet, according to CNN (2014), Ghana government turns to IMF for help as currency crisis deepens. Volatility in exchange rate affects domestic business and bank performance via exchange rate movements. Understanding how such volatility from exchange rate fluctuations is crucial to financial institutions, so as to minimize losses from such exposure.

The Ghana cedi fluctuated steadily around 3.2 from October to January 2015. It then started rising gradually to 4.4 by the end of July 2015 and had a sharp decline to 3.2 in mid July 2015. Indeed, since 2012, the exchange rate (ER) in Ghana has been volatile, and this does not only affect the macro economy but individual businesses and households. This in turn affects banks deposit, revenue generation avenues, service charge and profit performance (Quartey and Afful-Mensah, 2014).

Exchange rate fluctuations affects banks in their cash flows, real domestic currency value of assets, liabilities and operating incomes to unanticipated changes in exchange rates. Commercial banks engage in trade and commerce, give out credit, performs transaction obligations on behalf of clients, etc. A bank loan to an exporter for instance, can be affected by exchange rate deterioration, as it affects the ability of the deficit credit unit to repay the loan and the interest. This affects banks credit risk, bad loans and hence profit.

In addition, banks perform transaction and hold contractual cash flows stated in foreign currencies. These transactions could be the purchase or sale of goods or services, mergers and acquisitions, money lending / borrowing, etc. When such transactions are of fixed-price contracts stated in foreign currency denomination, the profitability of such transaction are at risk as the bank may gain or make losses from exchange rate movements.

1.2 Statement of Problem

Most reviewed literature on determinants of banks profitability examined bank specific factors and non-bank / macro-economic factors as potential drivers that affects profitability of banks. With regards to macroeconomics factors, studies such as Li (2000), Kosmidou (2008), focused on output (GDP) and inflation, but with differing outcome.

Fluctuations in the exchange rate movements is a crucial as it is a significant source of risk for banking institutions, with which large losses from exchange rate movement could lead to bank failures. As a result of this implications, financial institutions, managers and academia have taken evaluation of banks profit exposure to exchange rate movement. Taiwo et al., (2013) and Isaac (2015), investigated the impact of unsteady exchange rate on performance of Nigerian banks. Similarly, He *et al*., (2014) examined the impact of foreign exchange movements on U.S. banks. Their conclusions suggest that, the impact of exchange rate on bank performance is sensitive to the type of proxy used to capture bank performance.

Addae, Nyarko-Baasi and Tetteh (2014) examined the effect of exchange rate fluctuations on Ghanaian banks. The study established banks that were studied engaged in forex trading. It was further found that apart from Ghana Commercial Bank and Standard Chartered Bank who were exposed to foreign exchange risk - pound sterling, the rest were not. Also, the model was estimated without considering the dynamic interaction of variables, as they are inter-dependent. However, in the review of relevant literature, it was found that no study has investigated exchange rate (considering US$ and the GH¢) fluctuations on the performance of a banks, in Ghana. Therefore, there is a knowledge gap and this study purpose is to fill this gap.

1.3 Research Objectives

The major objective of this study is to investigate the impact of exchange rate fluctuations on the performance of HFC bank. The following specific objectives will be followed:

- To analyse trends in exchange rate fluctuations on HFC bank's profit.
- To examine the impact of exchange rate fluctuations on HFC banks performance.

- To examine the impact of bank specific factors of capital adequacy, liquidity, management / operating efficiency and asset quality / credit risk on HFC bank's performance.

1.4 Research questions

This study seeks to address the following empirical questions:

- Is there any long run relationship between ER and HFC's profit?
- Which HFC's bank specific factor have long run relationship with profit?
- Which of HFC bank profit indicators are affected by exchange rate volatility?

1.5 Significance of the Study

Ernest Aryeetey et al. (2000) used data from 1959-76 and found that the Marshall-Lerner conditions held for Ghana. This study will employ data up to recent to evaluate whether the condition still holds for Ghana. The study will not only add to already existing knowledge, but may confirm or reprove the condition for the current state of the economy. Also, the study will highlight the important need for Banks and its stake holders to come to knowledge of the nature of the issue on trades, as a portion of its clients are traders, so as to have knowledge about the ongoing situation to be incorporated into banks actions of optimization policies such as profits.

1.6 Organization of the study

The study has five chapters. Chapter One is the Introduction and comprises background to the study, statement of problem, research objectives, methodology and significance of the

study. Chapter Two reviews related theoretical and empirical literature. Chapter Three presents the methodology of the study. Chapter Four estimates and analyses the collected data for the study. Chapter Five is the conclusion of the study, it summarises the findings and suggests policy recommendations.

1.7 Limitations of the study

This study foresees that geographical, time and finance will be a greater constraint, and hence limits the study to HFC bank in Ghana. The study therefore calls for same research to be done on other Banks in the Country.

CHAPTER TWO
LITERATURE REVIEW

2.0 Introduction

The chapter is concerned with a review of literature on commercial banks profit performance. It consists of two sections. The first section explores theories on banks profitability performance, and the second section discusses some empirical works on banks performance Indicators.

2.1 Brief review of exchange rate theories

Exchange rate is the price of one country's currency in relation to another country. It is the required amount of units of a currency that can buy another amount of units of another currency. This section gives a brief overview of exchange rate theories/regimes.

2.1.1 Exchange rate regime

There are two main exchange rate regimes namely, the flexible/floating exchange rate regime and the fixed / pegged exchange rate regime.

(i) Floating exchange rate regime

In this regime, the value of a country's currency is determined by the forces of demand and supply of foreign currencies. The domestic currency's value fluctuates in harmony with variations in demand and supply of the currency. When the demand for domestic currency rises relatively to its supply, the value of the domestic currency appreciates. On the other

hand, if the demand for foreign currency rises relatively to its supply, the value of domestic currency is said to have depreciated.

(ii) Fixed exchange regime

In the fixed exchange rate regime, government intervenes in foreign exchange markets. Here, the exchange rates are set, maintained and controlled directly by government action/decisions. Here, the government obligates itself to sustaining that fixed rate by stepping in to support the set exchange rate via the central bank. The fixed exchange rate is also referred to as the par value of the currency.

2.1.2 Exchange rate theories

This section is about some few theories on exchange rates. These include money supply and demand in exchange rate models and Dornbusch's sticky-price monetary model of exchange.

(i) Money Supply and Demand in Exchange Rate Models

Since the start of flexible exchange rate system in the 1970's, the monetary approach emerged as the dominant exchange rate determination model. The Meese and Rogoff (1983) research, as well as most of the succeeding empirical studies of exchange rate determination, used monetary models in estimating and forecasting exchange rates. Here, monetary models use the bilateral exchange rate (which is defined as the relative price ratio of two (2) currencies), as influenced by the supply and demand for money of those two nations. This was therefore one of the main building blocks of the exchange rate models in the monetary equilibrium in each economy as:

$$m_t - p_t = \alpha_1 y_t - \alpha_2 i_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

where m, p, y and ***i*** are the logarithms of the money supply, price level, output and level of the opportunity cost (user cost) of holding money respectively.

(ii) Dornbusch's Sticky-Price monetary model of exchange

Dornbusch's sticky price monetary model of exchange rate represents a major contribution to exchange rate theory in the sense that this model can be explained even in large and prolonged departure of the exchange rate from purchasing power parity. The basis underlying the model is that prices in the goods market and wages in the labour market are determined in the sticky price markets and they only tend to change slowly over time in response to various shocks such as unanticipated change in money supply. However, the exchange rate is determined in a flex-price market and can instantaneously appreciate or depreciate in reaction to new developments and shocks. In such situation exchange rate changes are not harmonized by corresponding price movement and there can be persistent and prolonged departures from purchasing power parity.

2.2 A review of Exchange rates in Ghana

Ghana's exchange rate policies teetered between controls and liberalization for period since independence. An economic reform programme was agreed upon with the Bretton Woods institutions in 1966 in response to a balance of payments crisis, and was implemented between 1967 and 1971 but was suspended in 1972 (Bordo, 1993; Garber, 1993). The abortion of the reforms was largely due to the emergence of fiscal imbalances and balance of payments difficulties, the failure to prevent the real exchange rate from appreciating and the susceptibility of the Ghanaian economy to fluctuations in cocoa prices. Since 1972

Ghana's exchange rate and balance of payments policies fell into distinct regimes: that from 1972 - 83 and the other from the period of 1983 onwards (Aryeetey , 2000).

In Ghana, the fixed exchange rates policy was maintained till the second (2^{nd}) half of 1980. This regime was identified by four main landscapes: extremely overvalued exchange rate regime; a vigorous parallel market in foreign exchange; capital controls; and a sharing out of foreign exchange based on import licences that is issued by the Import Programming and Monitoring Committee. Here, authorising was preferential to industrial inputs over agricultural inputs and consumption goods (CK Dordunoo, 1994; Aryeetey, 2000).

The Ghanaian economy, with its enduring tradition in international trade, has witnessed severe stress in its past thirty (30) years and has experienced some major macroeconomic and trade policy reforms. In the early 1980s, Ghana was faced with severe struggle in worldwide markets for domestically produced primary goods. Coupled with this was political instability. Before the arrival of the economic recovery program (ERP), Ghana's exchange rate policy only involved the maintenance of a fixed exchange rate regime with some occasional devaluation as well as exchange rationing (Ghartey, 1987). In a climate of declining export values and rising imports, the balance-of-payments position was dislocated, resulting in the widening of the current account deficit.

The period 1983 to 1993 marked another distinct point in Ghana's exchange rate policy. By 1983, options available to policy-makers were highly limited. Any more adjustment of the exchange rate would lead to a severe deflation in the economy which was to be avoided. Deflation of the economy would have been a suicidal choice since the then real GDP and real per capital incomes had shrunk drastically over the past eight years since 1975 (Garber, 1993). In response to the unrelenting adverse trade balance and disequilibrium in the balance

of payments, the then government of Ghana accepted stringent IMF and World Bank loan conditions under the Structural Adjustment Programme launched in 1983 (Tsikata, 1999; Danquah, 2008).

As part of Ghana's reform process, some policies implemented included stringent fiscal discipline, devaluation of the cedi currency and the liberalization of Ghana's trade and financial markets. The Government of Ghana and the World Bank have argued that, there has been considerable upswing in macroeconomic indicators, such as the comparatively considerable annual growth rate, reduction in inflation rate and the improvement in services resulting from the structural adjustment policies. In the early 1990s, Ghana's economic recovery was export geared rather than towards the domestic market (Besley *et al.*, 2007). GDP rose by an average of 5% per year since 1984, inflation decreased to about 20%, and export earnings reached US$1,000 million. Ghana's SAP experience was revered by most developed and developing world and generally regarded by the IMF as a success story (Agbola, 2004 and Sanusi, 2012).

2.3 A review of the Ghanaian banking sector

The early stages of the modern banking system in Ghana were in the period of the late 19th century. The Post Office Savings Bank commenced operations in 1888 via post offices in the country. Later, the British Bank of West Africa, which became the Standard Chartered Bank now called Societe Generale Ghana (SGSSB), was established in the then Gold Coast in 1896, followed by Barclays Bank DCO, now called Barclays Bank Ghana Ltd (BBG) in 1917. These banks were abroad subsidiaries of banks incorporated in the United Kingdom (UK). Their operations were predominated by financing trade within the Gold Coast and with the UK.

In the 1912s, the British administration established the West African Currency Board to issue currency of several denominations in the then West African British colonies (Gold Coast, Nigeria, Gambia, Sierra Leone) as well as to redeem British currency. Ghana left the West African Currency Board upon liberation, and separate the then Bank of Gold Coast into two namely the Bank of Ghana and Ghana Commercial Bank. Central banking undertakings were diverted to the newly instituted Bank of Ghana, while the Ghana Commercial Bank assumed commercial banking undertakings.

The Ghanaian banking industry has undergone many transformations. For instance, in 2003, the three-pillar banking models of development, merchant and commercial banking, has been replaced by the Universal Banking Act (BOG, 2011). Universal banking entails that individual banks have the legality to operate in all spheres of banking activities from commercial banking, merchant banking, development banking, development banking, mortgage banking, etc., (Incoom, 2010; BOG, 2011).

Since banks in Ghana now undertake a wide range of financial services without restrictions, the Ghanaian banking sector since then, has witnessed competing keenly in the limited market share for customers with assorted banking products and services. According to Ghana Investment and Promotion Centre (GIPC), the sum of financial institutions established in the financial industry of Ghana existing in various categories as at December 2012 were 593 with Banks (26), Rural and Community Banks (133), Non-Bank Financial Institutions (52),

Forex Bureaux (273), Insurance Companies (18), Re-insurance Companies (2), Insurance Brokers (35), GSE Listed Companies (36) and GSE Licensed Stockbrokers (18).

2.4 HFC BANK

HFC bank which is the acronym for Home Finance Company bank, is a licensed commercial bank in Ghana. It was established in 1990 as it operated as a shell company within Merchant Bank Ghana. HFC became a publicly traded company enlisted in Ghana Stock Exchange in 1995. Having its headquarters situated in Accra, HFC as at ending 2015 can boast of 42 branches across Ghana. It is one of the leading Universal Banking Institutions in the country.

2.5 Theories on banks profitability

This section discusses some theories and models that seeks to explain banks' profits. The study therefore discusses some of these models such as the Structure Conduct Performance theory, the Efficiency Hypothesis theory and the Expense-Preference Behavior hypothesis.

2.5.3 The Structure Conduct Performance (SCP) Model

The Structure Conduct Performance (SCP) model is one of the earliest frameworks used to examine the factors that determine the profitability of Banks (Grygorenko, 2009). According to Baye (2010), the structure of an industry refers to the factors such as technology, concentration, and market conditions. Conduct refers to how individual firms behave in the market; it involves pricing decisions (such as interest rate, commission and fees), advertising decisions, and decisions to invest in research and development, among other factors. Here, performance was referred to the resulting profits and social welfare that arise in the market.

Mason (1939) and Bain (1951) were the earliest to suggest that profit of firms is determined by concentration level of the market. They demonstrated that profits of firms operating in highly concentrated industries are significantly higher than that of firms operating in

industries with lower concentration. The Structure Conduct Performance (SCP) paradigm presupposes that a higher banking industry concentration permits the collusion of banks to set higher prices and consequently gain substantial profits (Mason, 1939; Bain, 1951; Pilloff *et al.*, 2002; Alzaidanin, 2003; Farooq, 2003).

2.5.4 Efficiency Hypothesis

A theoretical effort to offer an alternative explanation on the market Structure Conduct Performance relationship was first made by Demsetz (1973). He also proposed the Efficiency hypothesis and stated that higher profits of banks are not necessarily due to their conniving behaviour but because of high efficiency level, which leads to larger market shares being possessed by banks. Thus, profitability of bank is determined not by the market concentration but by bank efficiency (Grygorenko, 2009).

This hypothesis asserts that a bank which operates less inefficiently than its rivalry gets higher profits resulting from low operational costs. Consequently, dissimilarities at the level of efficiency create an unequal distribution of positions within the market and an intense concentration (Mensi *et al.*, 2010).

2.5.5 Expense-Preference Behaviour

It is worth mentioning that profitability or bank returns, is not the only measure of performance as used in the theories discussed so far. There are nonetheless other theories such as the Expense-Preference Behavior hypothesis which builds on utility instead of profits as a performance measure. In the expense-preference behavior theory, it is argued

that, the main goal managers pursue is to maximize own utility or utility of the firm and not profit, and this is generally achieved via increasing salaries or other staff expenses (Williamson, 1963).

2.6 Some empirical literature on impact of exchange rate on output/growth

A review of some studies on the impact of exchange rate on output (measured by economic growth) has yielded conflicting results. For instance, Edwards and Levy Yeyati (2003) found proof that economies with more flexible exchange-rate regimes grows faster. Rodrik (2009) claimed that real undervaluation encourages economic growth, raises the profitability of the tradable sector, and results in an expansion of the share of tradable in domestic value added. Higher profitability stimulates investment in the tradable sector, which then grows and promotes economic growth.

Barkoulas et al (2002) studied the impact of exchange rate volatility on trade volume and trade flows. The study concluded that, exchange rate volatility daunts expansion of the volume of trade thereby dampening its benefits. Eichengreen and Leblang (2003) studied twelve (12) countries over a historical of 120 years. Their result showed that exchange rate stability and growth were a strongly negatively related. They however concluded that, the results of such estimations strongly contingent on the time period and sample.

Ogun (2006) studied on the impacts of real exchange rate on growth of non-oil export in Nigeria by considering the effects of real exchange rate misalignment and volatility on the growth of non-oil exports. He used a standard trade theory model on the determinants of export growth for Nigeria. His result came that real exchange misalignment and volatility both unfavourably affected growth of Nigerian non-oil exports. Eme and Johson (2012) studied the effect of exchange rate on real output growth in Nigeria for the 1986 to 2010

period. The study found no evidence of a direct relationship between exchange rate variations and growth in output.

2.7 Empirical Literature on banks profitability

There have been a number of research studied (Demirgüç-Kunt and Huizinga, 1999; Davis and Zhu, 2005; Bennaceur, 2003; Uhomoibhi, 2008; Devinaga Rasiah, 2010) on determinants of profitability of commercial banks. Some of the research papers focused on single country and others too concentrated on panel of countries. But the underlining fact of these papers is that the profit measurements which also serve as the dependent variable in the profitability model are in the form of ratios. Most studies split the determinants banks profit performance into those that are internal and those that are the external factors.

Flamini *et al.*, (2009) studied the determinants of commercial banks profitability in the SubSaharan African by analysing a sample of 389 banks, operating in 41 economies between 1998 to 2006. The results showed that apart from credit risk, higher returns on assets are related with larger bank size, activity diversification, as well as private ownership. Bank returns were influenced by macroeconomic variables and this suggested that macroeconomic policies that promote low inflation and stable output growth can help credit expansion. The results also indicate moderate persistence in profitability.

Kosmidou (2008) examined the determinants of banks performance during EU financial integration period of 1990 to 2002, using an unbalanced pooled time series data of 23 Greek banks. The results signalled that high Return on Average Assets were associated with wellcapitalized banks and lower cost-income-ratio. gross domestic product (GDP) growth

was significant and had positive impact on Return on Average Assets, whiles that of inflation was significantly negative.

Li (2000) investigated the impact of bank-specific factors and external factors on bank profitability in the United Kingdom banking industry for the period 1999 to 2006 to establish the strength of risk management in banks. The study found a negative correlation between loan loss reserves and profitability and this was statistically significant. This means that, higher credit risk is associated with lower profits. Finally, he observed that macroeconomic variables such as inflation, interest rate and GDP growth had insignificant impact on performance.

Vong *et al.,* (2009) investigated the impact of bank factors and macroeconomic-financial variables on Macao banking industry performance. They came out that capital-strength of bank is of paramount importance in affecting its profitability. This result was similar to that of Al-Shubiri (2010) and Li (2000). On the contrary, asset quality (measured by the loanloss provisions) had a negative impacted on banks performance. In terms of macroeconomic factors, only inflation rate had a significant relationship with banks' performance, this was contrary to the results of Li (2000) who came out that inflation did not have any significant impact on banks profitability.

El Biesi (2010) studied the profitability of foreign banks in nine economies of the Middle East and Northern African economies for the period of 2002 to 2007 in a panel dataset of 71 foreign banks to examine the impact of some selected macroeconomic, financial market and bank-specific determinants on the profitability of foreign banks. The study came out that capital, total assets and liquidity ratios at bank level, stock market capitalization, level of income per capita growth and trade volume were significant factors affecting foreign banks'

profitability in the selected nine Middle East and Northern African economies. The study showed that, variables such as concentration ratio, stock market trading volumes were insignificant factors.

Kosmidou *et al.,* (2005) examined the impact of bank-factors, macroeconomic conditions and financial market structure on bank profits using indicators of Net Interest Margin and Return on Average Assets for commercial banks in the United Kingdom banking industry for 1995-2002 period. The findings of the study showed cost-to-income ratio to be statistically negatively significant. Liquidity was found to be negatively related to Net Interest Margin (NIM) but positively Return on Average Assets and significant. Loan loss reserves had a significant positive impact on NIM, which means that greater risks result in higher margins. Considering the macroeconomic variables observed, the study showed that inflation and GDP growth had a significant positive impact on performance for both profit measures used.

Adetayo (2013) examined management of foreign exchange risks in a selected commercial bank, in a selected commercial bank, in Nigeria. The study sought to determine how the risk involved in foreign exchange can be effectively managed, by determining the following specific objectives: to determine the various exchange risks which the treasurer of the selected bank is exposed to in its foreign exchange transaction; to investigate how these risks can be effectively managed and to identify risk and exposure management techniques required for treasury management. Spot transaction technique was founded to be effective in minimizing foreign exchange risk.

Adam (2012) examined exchange rate options for South Sudan. The study compares the strengths and weaknesses of fixed exchange rate regimes, including the special cases of a

currency-board and full dollarization, with a floating regime. It argues that the exchange rate regime currently sits uncomfortably between two regimes. The first is a fixed exchange rate anchored by a set of 'currency board' rules. Though broadly effective in a macroeconomic sense, this regime has been plagued by quite serious problems of rent- seeking and corruption more or less since its inception in July 2011. As pressures on the balance of payments increase, this arrangement appears to be giving way to a less robust 'conventional' fixed exchange rate regime that relies for its stability on a level of fiscal control that is becoming increasingly hard for the authorities to deliver and as such the parallel market premium is beginning to increase. The severity of the impending economic crisis for South Sudan makes it likely that this fixed regime would disintegrate, inflation would spike and, with some likelihood, the economy would revert to a de facto dollarization

Ambunya (2012) examined the relationship between exchange rate movement and stock market returns volatility at the Nairobi Securities Exchange. The study adopted a quantitative design. The target population for this study included 56 companies quoted at the NSE as of December 2011. Since the population was small and the study is using secondary data, the study conducted a census. The study used secondary data collected from the Nairobi Securities Exchange and the Central bank of Kenya for the period 2007- 2011. The study regressed stock market returns volatility against exchange rate movement. Study concludes that there is a strong relationship between exchange rate movement and stock market returns volatility. This is especially carried through the information content of exchange rate movement on the security's business. The study concludes that exchange rate movement also affects the stock market performance greatly through its spiral effects. Through over macroeconomic variables, exchange rate movement indicates the state of the economy hence the likely future state of the economy. These variables would include things

like interest rate and the money supply in the economy which has great impact on the activity level of the security's performance.

Owoeye and Ogunmakin (2013), using two proxies for bank performance (loan loss to total advances ratio and capital deposit ratio), have examined the impact of unstable exchange rate on bank performance in Nigeria. Their specified models suggest that the impact of exchange rate on bank performance is sensitive to the type of proxy used to capture bank performance. Loan loss to total advance ratio shows that fluctuating exchange rate may affect the ability of lenders to manage loans resulting in high levels of bad loans while capital deposit ratio does not have significant relationship with exchange rate.

Addae, Nyarko-Baasi and Tetteh (2014) examined the effect of exchange rate fluctuations on Ghanaian banks. It looked at the exchange rate sensitivity of some listed banks on the Ghana Stock Exchange (GSE) between 2005 and 2010. It adopted both quantitative and qualitative approaches. Econometric models were employed to deal with both the exchange rate sensitivities and to ascertain the exchange rate exposure of the Banks. The study established that all the banks studied engaged in forex trading and made gains/profits from such activities. It was further found that apart from Ghana Commercial Bank and Standard Chartered Bank who were exposed to foreign exchange risk - pound sterling, the rest of the banks had no exposure to any of the currency risk. All the banks on the other hand had risk management structures in place to mitigate any risks that arise as a result of their operations.

2.8 Conclusion

The chapter has presented a review of literature on commercial banks profit performance. It explored some theories on banks profitability performance, reviews exchange regimes in

Ghana as well as a brief overview of the Ghanaian banking industry. It finally presented some empirical works on banks performance Indicators.

CHAPTER THREE
METHODOLOGY

3.0 Introduction

This chapter discusses the way this study was conducted. It talks about the types and sources of data, variables under the study, model specification, justification of the explanatory variables, priori expectations on the signs of the coefficients to be estimated as well as the model estimation technique.

3.1 Types and sources of data

This study uses secondary data. They are quarterly data on bank specific indicators and Macroeconomic indicators from January 2008 to June 2015. The bank specific indicators variables are capital adequacy, asset quality or credit risk (non-performing loans), liquidity, Operating Efficiency, net-interest margin, Return on Asset, Return on Equity and commission earned on trade ratio. These banks specific variables were obtained from HFC Ghana banks' records archive. The macroeconomic /non-bank specific indicator used in this study was the exchange rate (GHC to US$) which was obtained from Bank of Ghana publications.

3.2 Definition of Variables and their expected signs

This section discusses the dependent and independent variables, their definitions and measurement, and their expected signs.

3.2.1 Dependent variable:

In research papers relating to banks profitability, profitable are commonly measured in ratios. According to Devinaga Rasiah (2010), profitability ratios are not influence by changes in price levels and hence said to be the most appropriate way of measuring profitability when employing time series analysis, because the real value of profits are unaffected by variations in inflation rates. It is more useful to employ Return On Assets (ROA) and Return On Equity (ROE), and Net Interest Margin (NIM) in accessing banks profitability (Bourke, 1989; Molyneux and Thornton, 1992). Hence, a profit models considering ROA, ROE, NIM and Commissions earned on international Trade (COT) is estimated in this study.

Return on Assets (ROA) signifies efficiency in asset utilization. It shows how much net income is generated out of the bank's assets. It is therefore, the income earned on each unit of asset expressed in percentage. It points out the ability of management to generate returns by utilizing available banks assets. It is measured by the ratio of net profit from operations to total asset as follows:

$$\text{Return on assets (ROA)} = \frac{\text{Net income from operations}}{\text{Average assets}}$$

Return on Equity **(ROE)** as an alternative measure of profitability shows the rate of return that is received from equity invested in banks. It therefore measures the income earned on each unit of shareholder's capital. It also signifies profitability by disclosing the profit generated with shareholder's monies that have been invested (Shigjerji, 2013; Ahmed and Bashir, 2013; Makri et al., 2014). It is measured by the ratio of net profit to equity as follows:

$$\text{Return on equity (ROE)} = \frac{\text{Net income}}{\text{shareholder equity}}$$

Net Interest Margin **(NIM)** is the difference between the interest income generated by banks and the amount of interest paid out to their lenders (for example, deposits) relative to the amount of their (interest earning) assets. It is generally computed as a percentage of what the banks earn on loans less the interest paid on borrowed funds, and this result is divided by the average amount of the assets on which income was earned in that time period (Gul et al., 2011) as;

$$\text{Net Interest Margin } (\mathbf{NIM}) = \frac{\text{Net Interest Income}}{\text{total earnings assets}}$$

Commissions earned on international Trade (COT) ratio: Banks sell products such as letters of credit, documentary collections, advance payments, etc., to their customers to facilitate international trade. Indeed, they charge fees or commissions which may vary in line with the associated risk in handling the documents and the risk profile of the destination country. According to Niepmann (2014), for the reason that part of the fee is fixed (covering document handling, screening and monitoring costs), the profitability of these payment forms rises with the size of export transaction. Commissions earned on international Trade

(COT) will therefore be an explanatory variable as a profit indicator in this study for the fourth profit model to be estimated.

3.2.2 Explanatory variables:

According to Al-Tamimi (2010) and Aburime (2005), the performance of banks can be affected by both internal and external factors. In the light of these, this study investigates factors that affect the profit performance of HFC bank using both internal and external factors to inform management profit-decision.

3.2.3 Bank-specific / Internal Factors

Bank-specific factors are variables which are within the scope of the bank to be controlled. These variables can be influenced by the banks management decisions and/or policy objectives and are discussed as follows:

(i) Operating Efficiency

Expense to Income ratio is mostly used as proxy for operating efficiency (Kwast and Rose, 1982; Javaid et. al., 2011). The Expense-to-Income ratio is defined as the ratio of operating costs to total generated revenues. The key elements of operating cost are staff salaries and administrative cost. This is used to measure the impact of efficiency on bank profitability.

A negative correlation is anticipated between the operating-cost and profitability. This implies that greater operating cost is associated with lower profit and vice-versa. (Ali, Akhtar and Ahmed, 2011; Bourke, 1989; Jiang et al., 2003). However, this may not be the case as higher amounts of operating cost could also reflect higher volume of banking activities.

Molyneux and Thornton (1992), (Naceur, 2003) and Malaysian study (Guru et al., 2002), argue that high profits earned by banking firms in a regulated industry may be appropriate in the form of higher salary and wage expenditures.

(ii) Capital Adequacy

The ratio of Equity to total Asset is employed as a measure for bank Capital Adequacy. This measures the percentage of the total asset that is financed with equity capital. Capital adequacy therefore describes the sufficiency of the amount of equity that can absorb shocks that banks may experience. It is expected that the higher the Equity to Asset ratio, the lower the need for external funding and therefore the higher the profitability of the bank (Kosmidou, 2008). On the contrary, thinking in line with the conventional Risk-Return Hypothesis, one will anticipate an inverse relationship between capital adequacy and profitability. Considering the fact that capital adequacy may have an ambiguous effect on profitability, theoretical expectation of capital adequacy remains a puzzle to be answered by empirical investigation.

(iii) Liquidity

Liquidity measures the ability of banks to meet short-term obligation or commitments when they fall due. Traditionally, banks take deposit from customers and give out loans. For this reason, the ratio of bank's advances to customer deposits is used as proxy for liquidity.

Indeed, Molyneux et al., (1992) and Guru et al. (1999) discovered that negative correlation exists between the level of liquidity and profitability. However, Bourke (1989), and Kosmidou et al. (2005) found a significant positive relationship between liquidity and bank

profits. Thus, conclusion on the impact of liquidity and bank profitability is indeterminate and may require further empirical work.

(iv) Asset Quality / Credit risk

The ratio of provision for bad debt to advances is adopted as proxy for asset quality. This measure reflects changes in the health of the bank loan portfolio and credit quality. Thus, it is also an indication of credit risk of banks.

Although according to Kithinji (2010) the profits of commercial banks are not influenced by the amount of credit and nonperforming loans. Gremi (2013), Garcia-Herrero (2006), Macit (2011) revealed that non-performing loans has significant negative relation with banks profitability. It is therefore expected to be negatively related to profit performance.

3.2.4 Non-Bank-specific / External Factors

The environment with which banks operates in, can influence their performance and as well as have some level of impact on decision strategies. These external factors are outcomes outside the influence of the bank. Theses includes legal, political, economic and social environment with which banks operate. These factors are regarded as external since banks have no control/influence over them. Banks can in some way, anticipate changes in the external spheres and strategically position themselves to take good advantage of it. The study considers only macroeconomic determinants as they reflect the general macroeconomic and market conditions in the country.

(i) Exchange rate

Obadan (2006) argued that, the exchange rate plays a crucial role in connecting the differences of price system in countries, as a result, enabling traders can compare price directly using the rates of currency exchange. Fluctuations in exchange rate have a commanding effect on imports and exports of concerned economies via the effect on their relative goods prices. This can in turn, affect trade activities and thus affects bank transactions, and hence banks' profits.

Regardless of the numerous studies on exchange rate such as :Nyamute (1998), Kisaka (1999), Nyamwange (2009), Opati (2009) , and Maina (2010). They did not examine the influence of exchange rates fluctuations on the profit performance of banks. Albert (2014), examined the exchange rate sensitivity of some listed banks on the Ghana Stock Exchange (GSE) from 2005 and 2010 looking at market portfolio return, which is not among the profitability indicator of this study. Thus it suffices to conclude that, there was no found studies on the influence of exchange rates on the profit performance of commercial banks Ghana considering the profit indicators widely used in most literatures, thus its sign is unknown. This is the gap that this study seeks to bridge.

3.3 Model Specification

This study uses the input-output framework to connect HFC's output (measured by profit indicators) to the relevant inputs. The study followed the approach by Afriyie & Akotey (2013) with their model specified as:

$$X_t = \beta_0 + \beta_1 \text{NPL}_t + \beta_2 \text{CAR}_t + \mu_t$$

Where;

X_t = ROE (Return on equity) is profit after tax divided by equity of bank i at time t.

NPL = Non- Performing Loan

CAR = Capital Adequacy Ratio

This study extended Afriyie & Akotey (2013) model as follows. The explanatory variable (profit indicators) for this study are proxied from the Camel Model profit indicators using ROA, ROE, NIM and the study adds commission earned on trade (CIT). Thus, there are four profit models/equations to be estimated in this study.

Also, the study uses four out of the set five areas from the camel model which are capital adequacy, asset quality, liquidity and management (operating efficiency) as those was available. Furthermore, variables such as credit risk (ratio of non-performing-loans to total loans granted) will be considered as bank specific indicators.

In addition, the study adds exchange rate (GHC to US$, GHC to Pounds) as macroeconomic factor. Though there are other macroeconomic indicators such as inflation, treasury bill rate, money supply, GDP, etc., the available time series data span is not enough, thus including more explanatory variables, will weaken the sample period, weaken degrees of freedom, and weaken the estimation as the study cannot gain any more periods data/information. Thus, the study limits itself to relevant variables of interest, which is the exchange rate variable, as the only macroeconomic determinants in the profit model.

Another modification that the study will apply to the employed model is that, whereas Afriyie & Akotey (2013) estimates profit performance using explanatory variables all in the same time period (t), this study realises that, current profit of a bank does not necessarily

depend on current decisions alone, but depends much on past decisions involving past loans granted, past profit performance, past management efficiencies etc. Thus, some degree of past explanatory variables (*t-i*) will be used in estimating current profit performance of HFC bank. Thus, the study uses the technique of autoregressive (AR) method of estimation.

In a multivariate time-series model, the interaction between several variables is used to estimate each of the individual variable in the system. Hence, the estimation of a variable Y at time t, is said to be a function of the past values of Y itself, and a function of past values of all other variables in the system under study. Thus, all the variables are assumed endogenous. The simplest multivariate time series model is the first order autoregressive model (Craig and Charles, 1984).

Christopher Sims (1980), recommends Vector Autoregression (VAR) techniques as an alternative to the traditional structural modelling (which restricts the relationships between differing variables using economic theories). Sims warned that, such theoretical restrictions are arbitrary, and he further argues that, they are imposed-piecemeal with specific relationship in mind for the economic theorist. Structural models may therefore interfere with the various interactions that should exist among different variables in the model. VAR on the other hand imposes no restrictions and allows the data to speak for itself.

Thus the model in its specific form is as follows:

$$ROA_t = \alpha_0 + \alpha_1 ROA_{t-i} + \alpha_2 CAD_{t-i} + \alpha_3 CdtRsk_{t-i} + \alpha_4 Ldty_{t-i} + \alpha_5 OppEff_{t-i} + \alpha_6 ER + \alpha_1 ECT_{t-i} + \varepsilon_{1t} \quad ...(1)$$

$$ROE_t = \alpha_0 + \alpha_1 ROE_{t-i} + \alpha_2 CAD_{t-i} + \alpha_3 Cdt\ skR_{t-i} + \alpha_4 Ldty_{t-i} + \alpha_5 OppEff_{t-i} + \alpha_6 ER + \alpha_2 ECT_{t-i} + \varepsilon_{2t} \quad ...(2)$$

$\Delta NIM_t = \alpha_0 + \alpha_1 \Delta NIM_{t-i} + \alpha_2 \Delta CAD_{t-i} + \alpha_3 \Delta CdtRsk_{t-i} + \alpha_4 \Delta Ldty_{t-i} + \alpha_5 \Delta OppEff_{t-i} + \alpha_6 \Delta ER + \gamma_3 ECT_{t-i} + \varepsilon_{3t}$

.....(3) $\Delta COT_t = \alpha_0 + \alpha_1 \Delta COT_{t-i} + \alpha_2 \Delta CAD_{t-i} + \alpha_3 \Delta CdtRsk_{t-i} + \alpha_4 \Delta Ldty_{t-i} + \alpha_5 \Delta OppEff_{t-i} + \alpha_6 \Delta ER + \gamma_4 ECT_{t-i} + \varepsilon_{4t}$

.....(4) Where; , , and are short-run coefficients to be estimated.

Δ is the first lag difference,

γ (the error correction term) is the speed of adjustment to long-run equilibrium, and will only exist if johansen test comes out with a significant long-run relationship.

ε_1 to ε_5 are the white noise.

3.3.5 Number of past values to be included

In a VAR (p) process, all variables are treated as endogenous in the system, and are estimated incorporating past variables of all the endogenous variables in the system. Thus, the issue that needs to be addressed is the number of lags (past values) that need to be included in the system. Using more lags would use more relevant information which increases explanatory power, but can have possible consequence such as multicollinearity. Using too few lags would throw away such relevant information in estimations and would lead to the possible consequence of misspecification. Thus the study, uses the Akaike information criterion (AIC) as that is mostly used by some researchers.

Akaike information criterion (AIC) provides a comparative estimate of the lost information from the use of a given model. In the process, AIC deals with the trade-off among the goodness of fit of the model and the complexity of the model. The lowest estimated value

that is reported is used as a justification for the lag order selected, as that is the lowest estimated trade-off that would be incurred.

3.4 Stationarity condition

If one regress a time-series of variable **Y,** which is not stationary and therefore has unit root, on regressors that are also non-stationary (have unit roots), the estimated regressions will give a statistically significant relationship/coefficients, even if that is not the case. When such happens, it is termed as spurious regression.

To avoid spurious regression shortfalls, the study therefore conducts unit root test on the variables using Augmented Dickey Fuller (ADF) unit root test. With the ADF test, the null hypothesis is that 'the series has unit root' as against the alternate hypothesis that 'the individual series has no unit root, and it therefore stationary'. The study will first test the series on the levels, if the ADF test statistic is less than its 5% Critical level, the decision is 'do not reject the null statement'. On the other hand, if the ADF test statistic exceeds its respective 5% Critical, reject the null statement, but do not reject the alternate statement.

If a series is found to be non-stationary, one possible solution is to take the first difference of the series. Thus, the study tested for stationarity on the first difference should it be nonstationary at the levels. If a series is stationary after first differencing, then the series is said to be I(1) which means integrated of order one. If the series are found to be I(1), then there is the need to test for the existence of long-run relationship that might exist among the series.

The study therefore performed a cointegration analysis as discussed on the next sub-section.

3.5 Cointegration analysis

If two or more data series are individually not stationary, but a linear combination of the series becomes stationary, then the series is said to be cointegrated. This test is done to examine the existence of any long-run relationship between the non-stationary series.

The study uses the Johansen test procedure since it provides a more robust method of estimation and is found to be used in most literature that was reviewed.

The Johansen procedure produces two test statistics using Johansen Maximum Likelihood (ML) procedure. They are the Trace test and maximal Eigenvalue test. Both can be used to determine the number of cointegrating vectors present, although they don't always indicate the same number of cointegrating vectors. Should there be a case where both test gives deferring conclusions, the study follows Lutkephol's (2004) 'Pantula principle'. This explains that, one should apply the 'Pantula principle' when one of them (Trace or Max Eigenvalue) does not reject the null hypothesis. So, one keeps on rejecting the null statement until either one of the two (Trace or Max) fails to reject the null hypothesis. It is there that the process stops, by accepting the null that was not rejected by either of trace or max eigenvalue.

At first, one carries out the test on the null hypothesis that there is no cointegrating equations against the alternative hypothesis that is at least one co-integrating equation. If the test statistic is less than its 5% critical, do not reject the null meaning that there is no cointegration and tests is done. If on the other hand, one does not reject the alternative hypothesis of 'at least one cointegrating equations', then there might be more cointegrating vectors.

Thus the study proceeded to the second step to test the null that, there is one cointegrating equations against the alternate hypothesis of at least two. And so on until the null hypothesis cannot be rejected.

Based on the outcome of the Johansen test, the study would have used an Unrestricted Vector Autoregression (VAR) if no cointegrating equations was concluded from the test, otherwise the study further the analysis using an Error Correction Model (restricted VAR) also called Vector Error Correction Model (VECM).

3.6 Diagnostic Testing:

Before an estimated OLS regression can be used for hypothesis testing, it must first meet the normality assumption about the error term. This means that, the error term should be normally distributed, there should be no autocorrelation in the error term, and finally, the error term should not be heteroscedastic. This tests were necessary because, if any of the above assumption does not hold, OLS would give misleading results and hence misleading conclusions from hypothesis testing. The following discusses how the study performs these test.

3.6.1 Normally test:

The study follows the usual Jarque-Bera (1982, 1987) to examine if the errors of each estimated regression model is normally distributed.

The Jarque-Bera (JB) test is used to evaluate the null hypothesis that "the error term is normally distributed" as against "the error term is not normally distributed." The JB test statistic is computed as follows;

$$JB = n\_ ((\text{skew})_2 + (\_\_\_\_\_ \text{kurt})^2)$$
$$6 \qquad 4$$

where n= sample size

The p-value is computed using a table of distribution quantiles. If the p-value exceeds 5% critical, one does not reject the null, otherwise reject the null if p-value < 0.05 critical.

3.6.2 Test for autocorrelation:

If time series residuals from Ordinary Least Squares (OLS) regression, are serially correlated with its residual lagged values, this means that OLS is no longer an efficient linear estimator as the standard errors are incorrect and generally overstated. Thus OLS estimates becomes biased and inconsistent. Breusch-Godfrey Test for serial correlation can go beyond the first order autocorrelation, and is valid in the presence of lagged dependent variables.

The null hypothesis of the Breusch-Godfrey Test is that "there is no serial correlation up to the specified number of lags" as against the alternate hypothesis that "there is serial correlation up to the specified number of lags".

The Breusch-Godfrey test is an auxiliary regression of the residuals on the original regressors and lagged residuals up to a specified lag order, and one obtains the estimated R^2. The sample size 'n' times the estimated R^2 becomes the Breusch-Godfrey Test statistic. This is then compared to a chi-square 5% critical for rejection of H_0 if test statistic exceeds the 5% critical

or not rejecting the null if otherwise. This test is easily done using the Eviews software (Breusch, 1978; Godfrey, 1978).

3.6.3 Test for heteroscedasticity:

Heteroscedasticity is when the variance of the error term is no longer constant. If the homoscedasticity assumption in OLS get violated, it is still unbiased, but not efficient and hence, no longer BLUE. The variances and co-variance of the OLS estimators becomes biased and the usual OLS t-statistic are no longer valid for hypothesis testing or inference.

Here, the Breusch-Godfrey test is employed in evaluating the null hypothesis that "the variance of the error term is constant (no heteroscedasticity)" against the alternate hypothesis that "variance of the error term varies." The test statistic is similar to that of the autocorrelation test, except that, in the case of this auxiliary regression, the squared residuals are regressed on the original regressors and lagged residuals up to the specified lag order to obtains estimated R^2. The sample size 'n' times the estimated R^2 is the Breusch-Godfrey Test statistic. This is then compared to a chi-square 5% critical for rejection of H_0 if test statistic exceeds the 5% critical or not rejecting the null if otherwise. This test is easily done using the Eviews software (Breusch, 1978; Godfrey, 1978).

3.7 Granger Causality Test

Granger shows that causality can furthermore be separated into long-run and short-run causality. The Long-run causality is determined by the error correction term, if found significant, then this indicates evidence of significant long-run causality from the regressors to the explained variable (HFC banks profit indicators).

Short-run causality test can be determined on the joint significance of the lagged explanatory variables, using an F-test or Wald test. This study uses the Wald test approach for short-run causality test running from combined lags of one explanatory variable to the explained variable in the profit model.

Should there be evidence of cointegration from the Johansen test, then that cointegration implies a significant error correction term. Cointegration can therefore be viewed as an indirect test of long-run causality.

3.8 Conclusion

This chapter gave an insight into the way this study was conducted. It deliberated on the types and sources of data used for the study. It presented the model specification as well as discussions of variables used for the model, priori expectations on the signs of the coefficients to be estimated.

CHAPTER FOUR

DATA PRESENTATION AND DISCUSSION

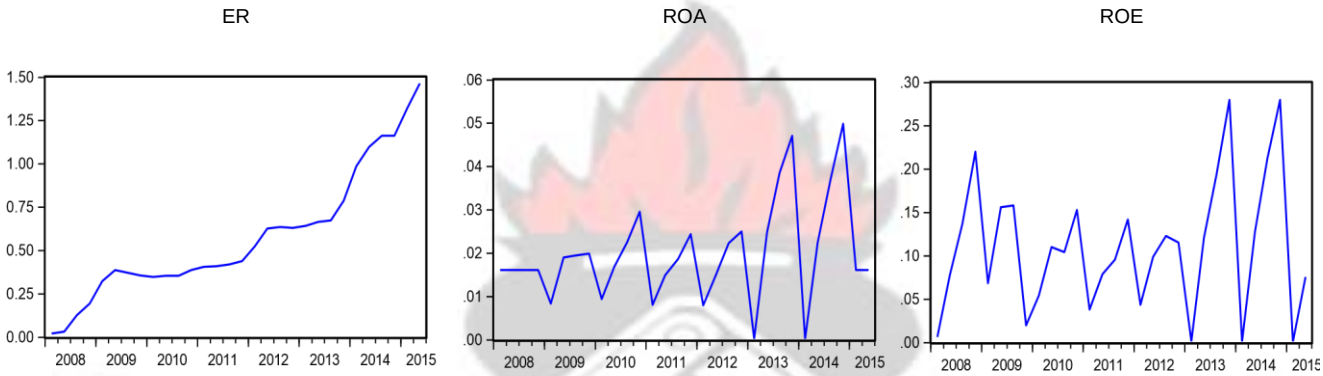
4.0 Introduction

This chapter presents the data collected and the discussions.

4.1 Trend in HFC's profit performance

This section presents a quick over view of movements in exchange rates with HFC's profit performance measured by return on asset (ROA) and return on equity (ROE) as shown in the diagram in figure 4.1 below.

Figure 4.1: Trends in exchange rate fluctuations and HFC bank's profit.



From the diagram above, it can be seen that, Ghana's cedi-dollar exchange rate from 2009 was of a relatively stable till the year 2012, afterwards, the it started rising up steeply. HFC profit proxied by ROA and ROE experience considerable volatility from 2008 to 2012, where exchange rate was considerable stable. After 2012, profit performance experience larger volatilities than the periods before 2012. A glance at figure 4.1 shows that, HFC's profit exposure to exchange rate movement is risky during periods of unstable domestic currency value on international market. Thus, fluctuations in exchange rates have a considerable degree of risk, on banks profit.

4.2 Analysis of stationarity test

To examine the relationship between HFC banks' profits and exchange rate fluctuations in Ghana, this study first test if each individual series is stationary using Augmented

DickeyFuller (ADF) unit root test, to avoid spurious estimated regression results. The ADF test for unit roots in the individual series is presented in Table 4.1:

Table 4.1: Stationarity result of level data

Series (in Natural log)	Deterministic part	ADF test statistic	5% level Critical	**Stationarity Conclusion**
ROA	Intercept	-2.1054	-2.9810	**Not Stationary**
ROE	Intercept	-1.7693	-2.9810	**Not Stationary**
NIM	Intercept	-3.1553	-2.9810	**Yes Stationary**
COT	Intercept	-2.0061	-3.0048	**Not Stationary**
CAD	Intercept	-6.9232	-2.9677	**Yes Stationary**
CdtRsk	Trend, Intercept	-0.7110	-3.6328	**Not Stationary**
Ldty	Trend, Intercept	-3.3310	-3.5742	**Not Stationary**
OpEff	Intercept	-5.6078	-2.9677	**Yes Stationary**
ER	Trend, Intercept	0.0540	-3.5875	**Not Stationary**

To test if each series is stationary, the study tests the null hypothesis that, there is unit root in each time series data. If the null hypothesis is not rejected at 5% critical level, it means that series is not stationary. The results from Table 1 above indicates that for the levels of NIM, CAD and OpEff series, the hypothesis that each has unit root rejected at 5% level. The absolute values of the ADF test statistics for NIM (|-3.1553|), CAD (|-6.9232|), and OpEff (|-5.3078 |) series exceeded their respective critical values of |-2.9810| , |-2.9677| and |2.9677|. Thus one rejects the statement that, each of the series (NIM, CAD and OpEff) has unit roots. Hence, the study concludes that NIM, CAD and OpEff are stationary in their log levels.

On the other hand, the study found ROA, ROE, COT, CdtRsk, Ldty and ER series to be nonstationary. As the ADF statistics of ROA (-2.1054), ROE (-1.7693), COT (-2.0061), CdtRsk (-0.7110), Ldty (-3.3310) and ER (0.054) did not exceed their respective 5% critical values of |-2.9810|, |-2.9810|, |-3.0048|, |-3.6328|, |-3.5742| and |-3.5875| respectively, the study did not reject the null hypothesis of the existence of unit roots in the individual series. Hence, ROA, ROE, COT, CdtRsk, Ldty and ER were not stationary in their log levels.

Since some of the series were not stationary at the levels, the study proceeded by finding the first difference in the series, and tested for stationarity on the first differenced data as presented in Table 4.2 below;

Table 4.2: Stationarity results for first differenced data

Series **(in Natural log)**	Deterministic part	ADF test statistic	5% level Critical	**Stationarity Conclusion**
D(ROA)	Intercept	-9.9416	-2.9810	**Yes Stationary**
D(ROE)	Intercept	-12.834	-2.9810	**Yes Stationary**
D(NIM)	Intercept	-3.6813	-2.9862	**Yes Stationary**
D(COT)	Intercept	-14.152	-2.9810	**Yes Stationary**
D(CAD)	Intercept	-11.920	-2.9718	**Yes Stationary**
D(CdtRsk)	Trend, Intercept	-4.2293	-3.6328	**Yes Stationary**
D(Ldty)	Trend, Intercept	-6.9718	-3.5875	**Yes Stationary**
D(OpEff)	Intercept	-9.3110	-2.9718	**Yes Stationary**
D(ER)	Trend, Intercept	-3.6327	-3.5875	**Yes Stationary**

The presence of unit roots in the series means that, using OLS would yield spurious regression estimations. Since some of the level (natural log) values were non-stationary, the study used the first differencing technique as solution to stationary. From table 4.2 above, the study found that, the first difference the series became stationary at 5% critical. The first

difference of ROA, ROE, NIM, COT, CAD, CdtRsk, Ldty, OpEff and ER series ADF unit root test gave an ADF statistic of -9.9416, -12.834, -3.6813, -14.152, -11.920, -4.2293, 6.9718, -9.3110 and -3.6327, which exceeds their respective 5% critical levels of -2.9810, 2.9810, -2.9862, -2.9810, -2.9718, -3.6328, -3.5875, -2.9718 and -3.5875 in absolute values. Thus, the hypothesis that each series has unit root was rejected at 5% critical. In summary, the Augmented Dickey-Fuller test for stationarity in the first differenced series showed that, they are stationary, and thus the series are integrated of order one, i.e., I (1).

Since the series is first differenced to become stationary, they are I(1). This therefore suggest the possibility of there being co-integrating relationship among the variables. Hence, the study test for Cointegration in the series using Johansen Cointegration test.

4.2.1 Analysis of Co-Integration Result

Running a regression using the first differencing could leave out possible necessary information which may cause problems in the estimation as one can miss-out on the possible long run relationship among the variables which are peculiar situation with the time series that are non-stationary. As a result, to still make good estimation that will maintain this possible long-run relationship, the study then uses the Johansen Cointegration test (Johansen and Juselius, 1990). The Johansen Cointegration test was done separately for the four (4) models. The Cointegration result for each profit indicator system is presented in the Tables below:

Table 4.3: Cointegration result for ROA model

	Trace	Max-Eigen

Null Hypothesis	Trace Statistic	5% Critical Value	Prob.	Max-Eigen Statistic	5% Critical Value	Prob.
None *	149.8059	95.75366	0.0000	73.36768	40.07757	0.0000
At most 1 *	76.43821	69.81889	0.0134	30.79366	33.87687	0.1117
At most 2	45.64455	47.85613	0.0795	23.27791	27.58434	0.1619

Note: * = rejection of the null hypothesis at 5% significant level

Table 4.3 shows the Cointegration results for the variables in the ROA model. To investigate the possibility of the series of the ROA model having any long run relationship, the Johansen Cointegration test was conducted on the null hypothesis that 'there is no Cointegration among the ROA model series'. Both the trace statistics (149.81) and maximum eigenvalue (73.37) far exceeds their respective 5% critical values of 95.75 and 40.07757. Hence the null hypothesis of no-Cointegration in the ROA model is rejected at 5% critical decision. The study therefore test for the possible number of Cointegration equation.

Thus the null hypothesis of 'at most 1 Cointegration equations' was tested against the alternate hypothesis of 'more than 1 Cointegration equations'. Here, the Trace test Statistic of 76.44 exceeds the 5% critical of 69.82. Thus, the null hypothesis was rejected. However, the Max-Eigen Statistic of 30.79366 was less than its 5% critical of 33.87687. Thus, both statistics gives differing conclusive results. However, Helmut Lutkephol (2004) explains that, one should apply the 'Pantula principle' when one of them (Trace or Max Eigenvalue) does not reject the null hypothesis. So, one keeps on rejecting the null statement until either one of the two, fails to reject the null hypothesis. Since the Max-Eigen value does not reject the null hypothesis of 'at most 1' Cointegration, the study therefore concludes that, there is a long-run relationship between the variables and ROA. Thus, the ROA-VAR model will be estimated as a Restricted VAR with one co-integration.

Table 4.4: Cointegration result for ROE model

	Trace			Max-Eigen		
Null Hypothesis	Trace Statistic	5% Critical Value	Prob.	Max-Eigen Statistic	5% Critical Value	Prob.
None* At most 1*	245.7039 87.47101	95.75366 69.81889	0.000 0.001	158.2329 39.75375	40.07757 33.87687	0.0001 0.0089
At most 2	47.71727	47.85613	0.0515	24.578	27.58434	0.1158
At most 3	23.13926	29.79707	0.2393	9.690643	21.13162	0.7731

Note: * = rejection of the null hypothesis at 5% significant level

Testing for the possibility of the ROE model series having any long run relationship, with results presented in Table 4.4, the Johansen Cointegration test was conducted on the null hypothesis that 'there is no Cointegration among the series in the ROE model. Both the trace statistics (245.7039) and maximum eigenvalue (158.2329) are greater than critical 5% values of 95.75 and 40.07757. Hence the null hypothesis of no-Cointegration in the ROE model is rejected at 5% critical decision, and this statistically establishes that, there is a long-run relationship among the variables in the ROE model. The study therefore test for the possible number of Cointegration equation, as was done in the ROA model.

The study proceeds by testing the null hypothesis of 'maximum of 1 Cointegration equations' as against 'more than 1 Cointegration equations'. The Trace test Statistic of 87.47101, as well as the maximum eigenvalue (39.75375) exceeds the 5% critical of 69.82 and 33.87687 respectively. Thus, the null hypothesis was rejected by both test Statistic. This proposes that, there could be more than 1 cointegrating equations.

The study then tests the null hypothesis that 'the maximum Cointegration equations are two

(2)' as against 'more than 2 Cointegration equations'. Here, The Trace test Statistic of 47.71727 and the maximum eigenvalue of 24.578 lies within the 'do not reject H_0 region' as they are less than their respective critical 5% values of 47.85613 and 27.58434. Unlike in the case of ROA model, the study will estimate the restricted VAR for ROE incorporating the restriction that, there are two cointegrating equations present.

Table 4.5: Cointegration result for NIM model

	Trace			Max-Eigen		
Null Hypothesis	Trace Statistic	5% Critical Value	Prob.	Max-Eigen Statistic	5% Critical Value	Prob.
None *	256.9218	95.75366	0.000	125.6073	40.07757	0.000
At most 1 *	131.3144	69.81889	0.000	76.28467	33.87687	0.000
At most 2	55.02976	47.85613	0.0092	26.91431	27.58434	0.0607
At most 3	28.11545	29.79707	0.0772	14.19427	21.13162	0.3493

Note: * = rejection of the null hypothesis at 5% significant level

The results for possible long-run relationship among the variables in the NIM Model is displayed in Table 4.5. Here, the Johansen Cointegration test was conducted on the null hypothesis that 'there is no Cointegration among the series in the NIM model. Just like the two previous models, both the trace statistics (256.9218) and maximum eigenvalue (125.6073) are greater than critical 5% values of 95.75 and 40.07757. Hence the null hypothesis of no-Cointegration in the NIM model is rejected at 5% critical decision, and this statistically establishes that, there is a long-run relationship among the variables in the NIM model. The study therefore test for the possible number of Cointegration equation, as was done in the previous model.

In testing the null hypothesis of 'One (1) maximum number of Cointegration equations' as against 'more than 1 Cointegration equations', the Trace Test Statistic (131.3144), as well as the maximum eigenvalue (76.28467) are larger than their respective 5% critical of 69.82 and 33.87687. The study therefore rejects this null hypothesis, thus, the number of cointegrating equations being more than one (1) could be two (2).

The study goes on to tests that 'the maximum Cointegration equations is two (2)' as against 'more than 2 Cointegration equations'. Here, whereas the Trace Test Statistic (55.02976) exceeds its' 5% critical value (47.85613), the maximum eigenvalue of 26.9143 is less than its' critical 5% values of 27.58434. Just like in the ROA model, the study applies the 'Pantula principle' in the NIM model. Thus, the test stops here since the maximum eigenvalue does not reject H_0, and the study concludes that, there are two (2) Cointegrating equations in the NIM model.

TABLE 4.6: Cointegration result for COT-Ratio model

	Trace			Max-Eigen		
Null Hypothesis	Trace Statistic	5% Critical Value	Prob.	Max-Eigen Statistic	5% Critical Value	Prob.
None *	180.6066	95.75366	0.000	83.90795	40.07757	0.000
At most 1 *	96.69864	69.81889	0.0001	51.09248	33.87687	0.0002
At most 2	45.60616	47.85613	0.0801	19.24375	27.58434	0.3959
At most 3	26.36241	29.79707	0.1182	13.24286	21.13162	0.4301

Note: * = rejection of the null hypothesis at 5% significant level.

The Cointegration results for the variables in the COT model is exhibited in Table 4.6. As usual, the Johansen Cointegration test was conducted on the null hypothesis that 'there is no Cointegration among the variables in the COT model series'. Here, the trace statistics

(180.6066) and maximum eigenvalue (83.90795) surpasses their respective 5% critical values of 95.75 and 40.07757. Hence the null hypothesis that 'there is no Cointegration among the variables in the COT model series' is rejected at 5% critical decision. The study therefore test if there is one (1) possible number of cointegrating equation.

In testing the null hypothesis of 'One (1) maximum number of Cointegration equations' as against 'more than 1 Cointegration equations', the Trace test Statistic (96.69864), as well as the maximum eigenvalue (51.09248) all surpasses their respective 5% critical values of 69.82 and 33.87687. The study therefore rejects this null hypothesis that 'the maximum number of Cointegration equations is one (1). This means that, the number of cointegrating equations could be two (2) or more.

The study proceeds to test if there are two cointegrating equations present in the COT model. The null hypothesis says that 'the maximum Cointegration equations is two (2)', and the alternate hypothesis says that 'there are more than two Cointegration equations'. Both the Trace test Statistic (45.60616) and the Max-Eigen Statistic (19.24375) are less than their respective 5% critical of 47.85613 and 27.58434. Thus, one does not reject H_0, and the study concludes that, there are two (2) Cointegrating equations in the COT model. Before estimating the VAR model, it is necessary to know how many past values of the endogenous variables, will be sufficient enough for each model estimation. The study addresses this issue on the next sub-section.

4.3 Lag order selection

In a VAR (p) process, all variables are treated as endogenous in the system, and are estimated incorporating past variables of all the endogenous variables in the system. Thus, the issue

that needs to be addressed is the number of lags (past values) that need to be included in the system. Using more lags would use more relevant information which increases explanatory power, but can have possible consequence such as multicollinearity. Using too few lags could lose such relevant information in estimations and would lead to the possible consequence of misspecification. Thus the study, uses the Akaike information criterion (AIC) as that is mostly used by some researchers. The results for sufficient lag selection for the VAR process for each model is displayed in Table 4.7 below; Table 4.7 AIC Lag order selection result.

	AIC statistic			
Lag	ROA Model	ROE Model	NIM Model	COT Model
0	3.8014	4.2077	1.1554	2.2159
1	0.0670	0.6476	-2.6435	-2.0515
2*	-1.0297*	-1.2820*	-4.4486*	-3.2492*

* indicates lag order selected by the AIC criterion

From the AIC lag length selection results displayed in Table 4.7, it can be seen that, the AIC result for the ROA VAR model is 3.8014, 0.0670, and -1.0297 for lag 0, 1 and 2 respectively. Thus the minimum returned AIC statistic for ROA model is that of lag order two (2). Hence, the ROA VECM Model will be estimated with two (2) lags.

The AIC statistic for ROE Model was 4.2077 for lag 0, 0.6476 for lag 1 and -1.2820 for lag two (2). Thus, the AIC model indicates a lag order selection of two (2) since that was the min returned statics. Just like ROA model, the ROE model will also be estimated with two (2) lags.

On the NIM profit indicator model, The AIC statistic came out as 1.1554, -2.6435 and 4.4486 for lag 0, 1 and 2 respectively. Here too, the lowest being -4.4486 was for lag order selection of two (2). Hence, the NIM VECM Model will also be estimated with two (2) lags.

The AIC lag length test result for the COT Model came out with conclusions that were no different from the previous models. The AIC statistic for the COT Model was 2.2159, -2.0515 and -3.2492 for lag 0, 1 and 2 respectively.

In summary, all the ROA, ROE, NIM and COT models lag length test using AIC came out with two lag length selection. Thus the study will estimate each restricted VAR incorporating two lag lengths. The study now discusses the estimated long run relationships for the profit indicators of ROA, ROE, NIM and COT models.

Before the study presents the estimated long-run and short-run dynamics among the variables, the study first presents findings for evaluating if the estimated model are each BLUE. This is done by testing the normality assumptions about the error terms in the model to see if the no serial autocorrelation assumption, constant variance assumption, and normal distribution properties of the error terms does hold in each estimated profit model.

4.4 Diagnostic analysis

The study performs diagnostic analysis in the estimated relationship so as to ascertain if, it provides BLUE coefficients for which hypothesis testing will not be misleading. The study test for the null hypothesis that, the errors are normally distributed for each combined system. The normality assumption test is shown in Table A1, B1, C1 and D1 at Appendix.

Here, the study conducts the test on the null hypothesis that the system is normally distributed as against the alternate hypothesis that the system is not normally distributed. This test was conducted using the Jarque-Berra test statistic. It can be seen that the test of normality in the ROA (17.87), ROE (10.51), NIM (13.55) and COT (9.72) systems of equations came out with p-values of 0.1196, 0.5705, 0.3306 and 0.6408 respectively. Thus, one cannot reject the null hypothesis that, the distribution in the individual profit systems are normal.

Also, the further testing of normality in each profit indicator equation from the system itself was also tested if it has a normal distribution property. From Appendix, Figure A1, B1, C1 and D1 shows the histogram and the Jarque-Berra test statistic for ROA, ROE, NIM and COT estimated single equation respectively. The Jarque-Berra test statistic test statistic reported was 0.4065 (with p-value of 0.816) for ROA, 0.147 (with p-value of 0.928) for ROE, 3.391(with p-value of 0.183) for NIM, and 0.597(with p-value of 0.742) for COT. This means that, if one estimates the single equation (profit indicator dependent variable) from the system, the estimated single equation is also normally distributed.

One other problem of OLS estimation is the issue of serial correlation in the error term. To find if this problem was present in each profit indicator single estimated equation, the study run a regression of the residual on the explanatory variables, performed by the BreuschPagan-Godfrey serial correlation LM test procedure. Here, the test null hypothesis is 'there is no autocorrelation in the estimated single profit model' against the alternate hypothesis that there is serial correlation in the error term. The Pagan-Godfrey serial correlation LM test statistic for ROA, ROE, NIM and COT is shown in Table A2, B2, C2

and D2 at the appendix column. The probability chi-square value for ROA came out as 0.3502; that of

ROE was estimated at 0.4410; that of NIM stood at 0.0976 and lastly, COT was given as

0.5681. It can be seen that, all the estimated p(chi-square) values for ROA, ROE, NIM and COT far exceeds 5%. Thus the null hypothesis that, there is no autocorrelation in each profit indicator single equation model cannot be rejected at 0.05 critical level.

In addition, OLS may provide inconsistent estimates if the variance of the error terms varies. The test is conducted on the null hypothesis that, there is no heteroscedasticity in the estimated profit single equation model. The test for heteroscedasticity was conducted using Breusch-Pagan-Godfrey test. Here the square of the residuals from the profit estimated equations was regressed on the variables in the system. The Breusch-Pagan-Godfrey heteroscedasticity test result is shown on Table A3, B3, C3 and D3 for ROA, ROE, NIM and COT respectively on the Appendix page. Each of the test came out with Probability (chisquare) of 0.9054 for ROA, 0.6422 for ROE, 0.5681 for NIM and 0.6119 for COT. All the estimated p(chi-square) values far exceed 0.05 critical decision. Therefore, the null hypothesis that there is no heteroscedasticity cannot be rejected. Thus, the assumption of constant variance holds for each estimated HFC profit model.

From the diagnosis test, the study can conclude that each estimated profit (ROA, ROE, NIM and COT) indicator single estimated model is normally distributed, has no autocorrelation problem, and exhibits the constant variance assumptions, each model is therefore correctly specified. The study now presents the estimated long-run and short-run dynamics.

4.5 Analysis of Long-run result

The very first test (stationarity test), showed that all the variables ROA, ROE, NIM, COT, CAD, CdtRsk, Ldty, OpEff and ER were not stationary in their levels (variables are in Log form), but all became stationary after being first differenced. This indicated that, the variables in this study are said to be differenced stationary process, which means that, they are integrated of order one, I(1). The empirical Long-run Co-integrating Regression model is shown in Table 4.8 below. Since the variables are natural logs, they are therefore interpreted as elasticities.

Table 4.8: Estimated long-run Cointegration model

Dependent Variable : ROA					
regressor	CAD(-1)	CdtRsk(-1)	Ldty(-1)	OpEff(-1)	ER(-1)
Coefficient	1.1987**	1.5656***	1.3021	1.3370***	-1.4551***
t-value	[2.42]	[6.30]	[1.63]	[3.36]	[-5.45]
Dependent Variable : ROE					
regressor	CAD(-1)	CdtRsk(-1)	Ldty(-1)	OpEff(-1)	ER(-1)
Coefficient	1.78 $x10^{-15}$	-22.698***	17.948***	-4.0410	26.822***
t-value		[-6.70]	[2.79]	[-1.02]	[6.80]
Dependent Variable : NIM					
regressor	CAD(-1)	CdtRsk(-1)	Ldty(-1)	OpEff(-1)	ER(-1)
Coefficient	-1.11 $x10^{-16}$	-0.5072***	0.0967	0.1216***	0.6738***
t-value		[-17.20]	[1.651]	[3.245]	[17.29]
Dependent Variable : COT					
regressor	CAD(-1)	CdtRsk(-1)	Ldty(-1)	OpEff(-1)	ER(-1)
Coefficient	-2.22 $x10^{-16}$	-1.3300***	2.5973***	-0.0314	1.2716***
t-value		[-5.828]	[5.166]	[-0.101]	[3.734]

Note: *** = significant at 1%, ** = significant at 5% and * = significant at 10%.

Capital Adequacy Ratio (CAD)

Capital Adequacy Ratio (CAD) which is defined as the ratio of Equity to total Asset. It measures the percentage of the total asset that is financed with equity capital. Capital adequacy therefore describes the sufficiency of the amount of equity that can absorb shocks that banks may experience.

It is expected that the higher the Equity to Asset ratio, the lower the need for external funding and therefore the higher the profitability of the bank. In addition, well-capitalised banks face a lower cost of going bankrupt which reduces their cost of funding (Kosmidou, 2008).

From the Table 4.8 above, Capital Adequacy Ratio (CAD) enters the ROA and ROE model with a positive sign. This means that, HFC bank efficiently utilizes / manages its capital and its equity. This finds were not different from the findings of Hassan *et al*., (2003). This was contrary to the negative coefficient found in Aremu *et. al*., (2013) with their study explained that, banks in Nigeria does not utilize their capital efficiently.

On the contrary, CAD enters the NIM models with a negative sign. This was similar to the findings of Dumičić & Ridzak (2012) that efficiency gains leads to a drop in net interest margin. Just like NIM, the variable CAD also enters the COT models as negative.

Credit Risk (CdtRsk)

Credit Risk which is defined in this study as, the ratio of bad debt to total loan advances, is used to measure the health of the bank loan portfolio and hence, credit quality. It is observed that CdtRsk enters the ROA model as positive and significant at 1% critical level. This can be explained from the Risk-Return Hypothesis implying that high risk should be associated with high profitability indicating a positive relationship.

On the contrary, Credit Risk enters the ROE, NIM, and COT model as negative and significant as 1% critical level. This is contrary to the Risk-Return Hypothesis. This result was same as Gremi (2013) study on Internal Factors Affecting Albanian Banking Profitability which came out that non-performing loans (credit risk) has significant negative relation with banks profitability.

Garcia-Herrero (2006), Ramlall (2009), Macit (2011), Davydenko (2010) and Sarpong *et. al.,* (2011) also found results that were no different.Thus, the findings of this study confirms Bowman's (1980) "risk-return paradox." As he obtained the baffling outcome of 'risk' having a negative relationship with 'return', which was at odds with the usual.

Bessis (2002) explains that credit risk (the risk that an asset or a loan turns out to be irretrievable in the case of immediate default, or having the risk of delay in the servicing of the loan) can have rippling effect thus leading to bankruptcy. The higher the bad debt to loan advances ratio, the higher the credit risk and the higher the accumulation of unpaid loan and interest. Additionally, present value of the asset declines, thereby undermining the solvency of a bank.

Liquidity (Ldty)

As explained in the third chapter of this study, Liquidity measures the ability of banks to meet short-term obligation or commitments when they fall due. The study used loan advances to deposits ratios to proxy liquidity. Though high values for this variable represents low liquidity, which is associated with lower profitability.

It is observed that, from Table 4.8, liquidity enters all each of the four models as positive but was only significant in the ROE and NIM model. Thus there was no significant long-run relationship between Ldty and ROA and NIM, but at 1% critical level Ldty has a long-run significant relationship with ROE and COT. The findings of this study is said to be disagree with the argument of Molyneux et al., (1992) as well as Guru et al., (1999) that holding assets in a highly liquid form tends to reduce profits.

The positive coefficient for Ldty found in this study is similar to that of the findings of Bourke (1989), and Kosmidou et al. (2005) as they established in their study that liquidity is positively correlated with profitability. This can be explained that, loan advances from commercial banks money deposit creation activities, gain interest which becomes their profit, more loans imply more interest revenue to be received. Since banks gives out loans only to clients who have passed the loan process (which is to effectively reduce loan loss), having a negative correlation could be a possible indicator of poor management in loan evaluation decision process of the bank. Thus, the positive sign for Ldty in all the four profit models for HFC banks indicates that, HFC bank has less inefficient loan management in the long-run, and that, it has not passed its threshold point.

Operating Efficiency (OpEff)

Operating Efficiency which is measured as Expense to Income ratio is used to proxy operating efficiency in this study. Operating efficiency (OpEff) therefore serves as an indicator to how HFC bank manages their cost so as to boost up profit, as shown in the longrun model in Table 4.8 above. The variable OpEff enters ROA and NIM with a significant positive sign, this was in line with the findings of Naceur (2003) and Guru et al.,

(2002). This indicates that for the period of 2008 Q1 to 2015 Q2, HFC bank have managed their expense patterns really well. This may come from the fact that, higher levels of operating cost reflect higher volume of banking activities. However, the findings may not necessarily support the efficiency wage theory as confirmed by Molyneux and Thornton (1992), which states that the productivity of employees increases with the wage rate, as higher expenditures are in the form of higher salary and wage expenditures, as it did not disaggregate the expenditures to those from wage and non-wage expenditures. Though OpEff enters the ROE and COT models with a negative sign, it was not significant.

Exchange rate (ER)

It can be seen from Table 4.8 that, the variable ER enters the ROA model as negative and significant at 1%. Thus means that, as the nation's currency appreciates, ROA falls. On the contrary, ER enters the ROE, NIM, and the COT model with a positive sign. With each being individually significant at 1% critical level. Therefore, there is a significant long-run relationship between ER and ROE, NIM and COT for HFC bank from 2008 Q1 to 2015 Q2. Thus as the value ER rise (which means Ghana Cedi depreciates to the US$), ROE, NIM and COT profit indicators for HFC bank increases. The short-run dynamics are discussed in the next sub-section.

4.6 Analysis of Short-run result

The empirical regression results for the short-run dynamics in the profit indicators of ROA, ROE, NIM and COT model for HFC bank is presented in Table 4.9 below.

Table 4.9: Short-run VECM coefficients estimated

Variable	**Equation 1** D(LnROA)	**Equation 2** D(LnROE)	**Equation 3** D(LnNIM)	**Equation 4** D(LnCOT)
Π $_{1}$	-2.645***	-4.349***	-0.269	-1.249***
	(-6.723)	(-7.065)	(-0.307)	(-4.604)
Π $_{2}$		-9.666***	3.949***	1.195**
		(-7.325)	(4.900)	(2.471)
D(LnPft) $_{-1}$	1.435***	2.560***	-0.556	0.338
	(4.137)	(5.741)	(-1.001)	(1.058)
D(LnPft) $_{-2}$	0.398**	1.185***	-0.170	0.388
	(2.313)	(5.437)	(-0.541)	(1.642)
D(LnCAD) $_{-1}$	-2.976**	5.330***	-3.245***	-0.507
	(-2.240)	(2.873)	(-3.644)	(-0.728)
D(LnCAD) $_{-2}$	-1.075*	1.453	-1.292***	0.638**
	(-1.688)	(1.676)	(-3.085)	(3.118)
D(Ln CdtRsk**)** $_{-1}$	1.958***	0.1568	1.600***	-0.214
	(3.626)	(0.222)	(3.010)	(-0.927)
D(Ln CdtRsk**)** $_{-2}$	2.224***	0.951	0.725**	0.0006
	(3.635)	(1.304)	(2.625)	(0.003)
D(Ln Ldty**)** $_{-1}$	-2.897	7.958***	-4.945***	2.866***
	(-1.131)	(3.136)	(-4.192)	(3.317)
D(Ln Ldty**)** $_{-2}$	-5.889**	-1.406	-2.671***	2.651***
	(-2.349)	(-0.539)	(-3.481)	(3.449)
D(LnOpEff) $_{-1}$	1.664**	3.554***	-1.417***	-0.054
	(2.477)	(4.777)	(-3.371)	(-0.218)
D(LnOpEff) $_{-2}$	1.059	1.119	-0.464*	0.291
	(1.597)	(1.581)	(-2.022)	(1.501)
D(LnER) $_{-1}$	-3.019	9.545	2.524	4.846**
	(-0.494)	(1.357)	(1.374)	(2.420)
D(LnER) $_{-2}$	-4.990	9.368	-1.431	-1.868
	(-0.856)	(1.215)	(-0.619)	(-1.179)
Constant	0.108	-0.559	-0.214	0.0375
	(0.351)	(-1.575)	(-1.702)	(0.388)

R-squared	0.8887	0.9409	0.9651	0.8741
Adj. R-squared	0.7773	0.8719	0.9244	0.7271
F-statistic	7.98***	13.65***	23.72***	5.95***

Note: *** = significant at 1%, ** = significant at 5% and * = significant at 10%.

As seen above, the explanatory power for the estimated relationship for the study is very high. This is indicated by a strong R^2 and the adjusted R^2 for ROA standing at 88.87% and 77.74% respectively, ROE standing at 94.09% and 87.19% respectively, NIM given by 96.51% and 92.44% respectively, and COT having 87.41% and 72.71% respectively. In addition, the overall F-statistic of each for profit model is highly significant at 1% critical level.

As discussed in previously, the presence of long-run equilibrium relationship among the variables can be well represented in an Error-Correction Model. From Table 4.9 above, the coefficient of the error correction term (Π) in the ROE model is negative and statistically significant at 1%.

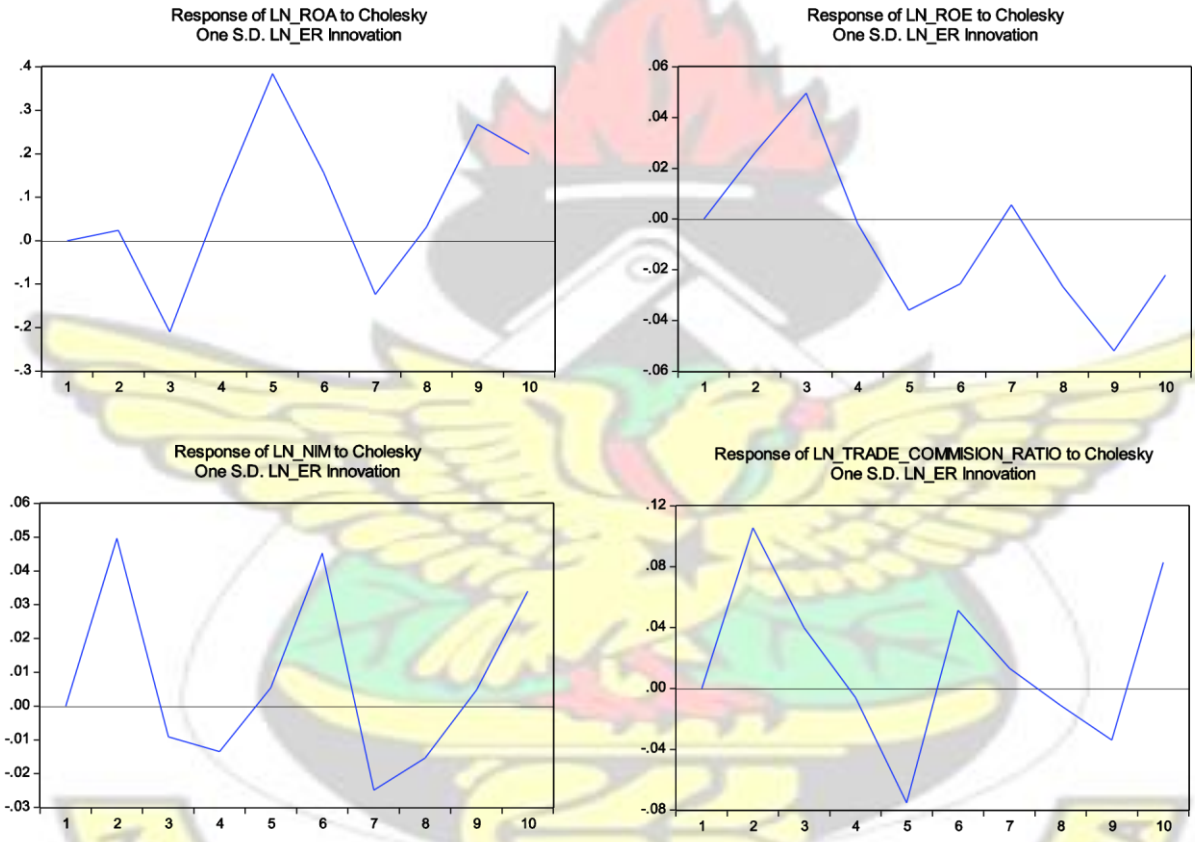
This empirically indicates an equilibrium long-run relationship between ROA and the variables in the system. Although all the four profit indicator models have a negative coefficient in their error correction terms, all were statistically significant except NIM though it was negative, it was not significant at 1%, 5% or even at 10%.

The negative sign of the error correction term of equation 2 (ROE), means that the system eventually restores to equilibrium. Thus the ROE approaches its equilibrium at a rate of 264.469% quarterly.

4.7 Impulse response result

From the diagnostic analysis, it can be said that the model is well specified and hence, the VECM model is therefore not mean reverting. The Figure below is a plot of how HFC profits measured by ROA, ROE, NIM and COT response to a one standard deviation shock in ER.

Figure 4.2: Response of ROA, ROE, NIM & COT to one standard deviation shock in ER.



Here, there are two possible outcomes that is generally employed in explaining the diagram.

From figure 2, the top left is the impulse response of Return on Assets (ROA) to exchange rate, the response of return on assets has recognizable fluctuations. It can be seen that a shock in exchange rate affects ROA positively after the 1st quarter, then negatively after the 2nd quarter, positive in the 4th to 6th quarter, negative for the 7th quarter and the positive

afterwards. Here the highest positive happens on the 5th quarter, and the lowest negative effect is on the 2nd Quarter.

On the top right is the impulse response of Return on equity (ROE)to exchange rate, just like ROA, the response of return on equity also has noticeable fluctuations. Here, a shock coming from exchange rate affects ROE positively after the 1st quarter, negatively after the 4th quarter, and continues dwindling downwards.

At the bottom left is the impulse response of Net Interest Margin (NIM) to exchange rate. Here also, does not have smooth fluctuations as with ROA and ROE. A shock in exchange rate affects NIM positively in the 1st quarter, peaks at 2nd Quarter, goes negative after the 3rd quarter, becomes positive in the 5th quarter, and the cycle restarts.

On the down right of figure 2 is the impulse response of Commissions earned on international Trade (COT) ratio to exchange rate. Shocks coming from exchange rate in the economy affects COT to rise after 1st quarter, attains a peak at the 2nd quarter, then fall gradually (though still positive) till the 4th quarter, after which it become negative, attains the lowest negative at the 5th quarter, diminishes toward 0 by the 6th quarter where it becomes positive. It then goes negative at the 8th and 9th quarter, and becomes positive by the 10th quarter. It is observable that COT undergoes some considerable upswings and downswings due to shocks in the exchange rate.

Since shocks from exchange rate to ROA, ROE, NIM and COT does not die out over time, these shocks are therefore said to be permanent shocks, and not temporal.

4.8 Granger Causality

To assess that, in the short-run, exchange rate fluctuations help predict current profits of HFC bank, the study performs causality test on the significance of the joint lagged exchange rate variables, using the Wald test. Table 4.10 below shoes the short-run causality test result.

Table 4.10 Short-run Granger Causality Results

Null Hypothesis	Chi-square	Degrees of freedom	Prob.
ER does not Granger Cause ROA	2.481	2	0.2892
ER does not Granger Cause ROE	7.388**	2	0.0249
ER does not Granger Cause NIM	1.973	2	0.3727
ER does not Granger Cause COT	6.003**	2	0.0497

Note: ** = rejection of null hypothesis at 5%

From Table 4.10 above, the null hypothesis that exchange rate variable does not Granger Cause HFC profit measured by ROA in the short-run is not rejected at 5% since the probability value 0.2892 is extremely higher than the 5% critical decision probability. Thus, in the short-run, exchange rate does not help predict current ROA profit of HFC bank.

Profit indicator of ROE does have a statistical significance with the exchange rate variable in the short-run. As the estimated probability of the chi-square statistic for the null hypothesis that, exchange rate does not Granger cause ROE in the short-run is 0.0249, this is less than 0.05 critical. Hence, the null statement is rejected. This means that, in the short-

run, exchange rate fluctuations have significant causality on HFC banks profit measured by ROE.

Testing the null hypothesis that, exchange rate variable does not Granger Cause Net-interestmargins for HFC banks, the reported chi-square probability was 0.3727. This is more than 5%, thus one cannot reject this null statement. In short, the test shows that, exchange rate fluctuations do not help predict net-interest-margins of HFC bank, in the short run.

To examine that, exchange rate (ER) variability does help explain HFC current Commissions earned on international Trade (COT) ratio, the study test for the joint significance of past values of exchange rate in the COT model using the Wald Test. The reported probability of the chi-square statistic was 0.0497. Although very close to 5%, it is still less than the 0.05 critical. Hence, the study rejects the null hypothesis that ER does not Granger Cause COT ratio. This means that, current COT ratio values of HFC banks are significantly explained by past exchange rate values of Ghana, in the short run.

4.9 Conclusion

This chapter examined the determinants of HFC Bank (Ghana) profit performance, using internal and external factors, the study followed the model used by Afriyie & Akotey (2013) but extended it using four indicators out of the five camel profit indicators for HFC. The study found the series to be first differenced stationary with each of the profit ROA, ROE, NIM and COT model having a significant long-run relationship. This suggested a restricted VAR model which was then presented. The short-run and long-run relationships were also discussed.

CHAPTER FIVE

SUMMARY OF MAJOR FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter gives the conclusion to the study. It presents a summary of the main findings, offers recommendations based on the regression results obtained. Further studies are also suggested.

5.1 Summary of major findings

The study investigated the impact of Exchange rate fluctuations on HFC Bank (Ghana) performance. Performance was evaluated using profit indicators of return on asset (ROA), return on equity (ROE), net-interest-margin (NIM) and Commissions earned on international Trade (COT) ratio. Thus, the study estimated four profit models with one for each profit indicator.

The study identified that, there are internal factors that can affect banks performance, as well as external factors. The internal factors were bank-specific variables that were within the control of bank management. The study identified four bank specific determinants which consist of capital adequacy ratio (CAD), Credit Risk (CdtRSK), Liquidity (Ldty), and Operating Efficiency (OpEff). The external variables were factors that were outside banks management control. Though external factors could range from sociological, political to economical fields, the study focused on the economic aspect of external factors. On the issue of external factors, there could be numerous ranging from inflation, money supply, monetary policy rule, exchange rate and so on. Since adding possible relevant variables seems good,

dealing with time series especially with banks data, are limited in time space, thus to conserve on degrees of freedom, the study only includes the variable of interest which is exchange rate (ER) variability into the profit indicator model.

Before estimating the exchange rate fluctuations and banks profit dynamics, the study tested if the time series data were stationary so as to avoid spurious regression results, using unit root test. The study found NIM, CAD and OpEff to be stationary at their log levels except ROA, ROE, COT, CdtRsk, Ldty and ER as they were not stationary in their log levels. Since some of the series were not stationary at the levels, the study proceeded by finding the first difference in the series. The series were found to be stationary after first differencing and were hence I(1) which further suggest the possibility of there being co-integrating relationship among the variables. Hence, the study test for Cointegration in the series using Johansen Cointegration test.

The Johansen Cointegration test was done for each profit indicator model. The result came out that each of the profit ROA, ROE, NIM and COT model had significant long-run relationship. This suggest that, the study's VAR model will be a restricted VAR or Vector Error Correction model. The study then tested for the number of significant lags of the explanatory variables to be included in the AR(p) process using The AIC test statistic, the study found lag order selection of two (2) was okay.

The study estimated each profit indicator model incorporating the relevant cointegrating restrictions for each of systems of equations modelling. The study found that, the individual profit equation from each system was BLUE, that is, the assumption of homoscedasticity, no autocorrelation, and normality assumptions were holding.

The results of the estimated profit indicator model dynamics showed that, bank specific indicators such as Capital Adequacy Ratio (CAD) is positively related to ROA and ROE in the long run in the long run. Thus, HFC bank management utilises their assets and equities efficiently.

It was evident that, Credit Risk (CdtRsk) is significant and positively related with ROA in the long-run. This re-asserts the Risk-Return Hypothesis (RRH) which emphasizes that high risk should be associated with high profitability and hence positive relationship. On the other hand, Credit Risk was found to have negative impact on profit indicators of ROE, NIM, and COT in the long-run. This contradicts the "risk-return-paradox.". This was possible owing to the fact that, credit risk which is the risk that an asset or a loan becomes irrecoverable in the case of immediately default, or the risk of delay in the servicing of the loan, can have rippling effect on banks which can lead to its collapse. The higher the bad debt-to-loan advance ratio, the higher the credit risk and the higher the accumulation of unpaid loan and interest, resulting in decline in real value of assets, thereby undermining the creditworthiness and wealth of a bank.

The results also showed a significant positive long-run relationship between Liquidity (Ldty) and profit indicators of ROE and COT, but there was no significant long-run relationship between Ldty and ROA and NIM.

Operating Efficiency which is Expense-to-Income ratio used as an indicator on how HFC bank manages their cost so as to boost up profit. It had a significant positive long-run relationship with ROA and NIM profit indicators. This indicates that HFC bank have managed their expense patterns really well. But the study does not make empirical evidence whether this was owing to higher operating cost reflect higher volume of banking activities

or it supporting the efficiency wage theory as established by Molyneux and Thornton (1992), which argues that the productivity of employees grows with the wage rate, as greater expenditures are in the form of higher salary and wage expenditures.

Turning to the variable of interest for the study, exchange rate variable had a significant long-run relationship with ROE, NIM and COT profit indicator variables, but has negative and significant with ROA.

On the short-run dynamics, the study found that, exchange rate does Granger cause ROE in the short-run. Similarly, the study found that exchange rate does also Granger Cause COT in the short run.

5.2 Conclusion

The study examined HFC profit macro and bank specific determinants. The results of the study show that, with the aim of enhancing profit performance of HFC bank in Ghana, the profit indicators of ROA, ROE, NIM and COT had long run relationship with both bank specific indicators (CAD, CdtRsk, Ldty, OpEff) and Macroeconomic indicator (ER).

The positive and significant long-run relationship between ER and HFC's profit indicators of ROE, NIM and COT implies that, HFC management was efficient in managing these profit indicators with regards to exchange rate fluctuations as it makes more returns from exchange rate variations. On the other hand, the found negative and significant long-run relationship with ROA and ER means that, HFC makes less returns in terms of its profit indicator of ROA stemming from fluctuations in the exchange rate.

The study found ER to have a significant short-run causality with ROE and COT. The study recommends that Bank management should adopt efficient and effective practices so that banks do not make losses from exchange rate fluctuations with regards to its asset management. It was found that, management were efficient in utilizing assets, loan undertakings, customer's deposits (Ldty) and income-expenses in their profit (ROA) decisions.

The overall picture given by the macroeconomic condition in Ghana, showed that, HFC banks' profits are affected by exchange rate fluctuations, and that the effect on HFC profits depends on the profit indicator used.

5.3 Recommendations

The study proposes that, if additional more data in terms of time span become available, other possible bank-specific indicators and additional external factors / macroeconomic variables can be added to the model, as the economy is affected not only by exchange rate alone but other variables such as GDP, inflation, Money supply, etc., does affect economic activities and hence income of households, which may then affect their depositary-savings attitudes as well as banking transactions, and hence bank profit. So as to fill the gap of certain other relevant variables in this study.

APPENDIX

Table A1 : ROA VEC Residual Normality Tests

VEC Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Sample: 2008Q1 2015Q2
Included observations: 27

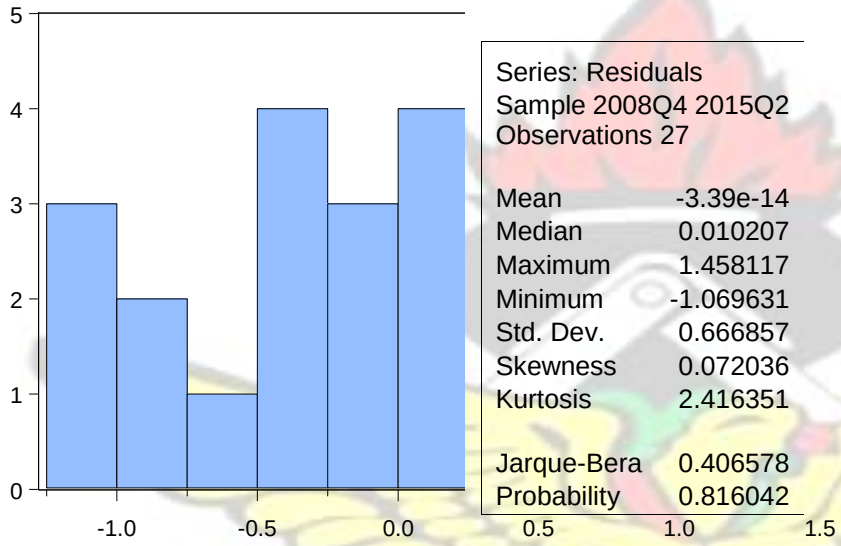
Component	Skewness	Chi-sq	df	Prob.
	0.072036			
1		0.023351	1	0.8785
2	0.694357	2.169592	1	0.1408
3	0.933807	3.923984	1	0.0476
4	-0.385472	0.668649	1	0.4135
5	-0.885404	3.527728	1	0.0604
6	0.895137	3.605716	1	0.0576
Joint		13.91902	6	0.0306

Component	Kurtosis	Chi-sq	df	Prob.
1	2.416351	0.383227	1	0.5359
2	2.974659	0.000722	1	0.9786
3	4.576056	2.794447	1	0.0946
4	3.611094	0.420115	1	0.5169
5	3.393059	0.173807	1	0.6768
6	3.402815	0.182542	1	0.6692
Joint		3.954861	6	0.6828

Component	Jarque-Bera	df	Prob.
1	0.406578	2	0.8160
2	2.170315	2	0.3378
3	6.718431	2	0.0348
4	1.088764	2	0.5802
5	3.701535	2	0.1571
6	3.788258	2	0.1504

Joint	17.87388	12	0.1196

Figure A1: ROA single equation Normality test



F-statistic	0.463587	Prob. F(2,11)	0.6408
Obs*R-squared	2.098879	Prob. Chi-Square(2)	0.3501

Dependent Variable: RESID
Date: 11/11/15 Time: 17:34
Sample: 2008Q4 2015Q2
Included observations: 27
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.076292	0.433732	0.175897	0.8636

Table A2 : ROA Breusch-Godfrey Serial Correlation LM Test:

C(2)	0.003954	0.418743	0.009442	0.9926
C(3)	0.059324	0.195384	0.303627	0.7671
C(4)	0.341146	1.457241	0.234104	0.8192
C(5)	0.060218	0.669788	0.089905	0.9300
C(6)	-0.069990	0.576649	-0.121374	0.9056
C(7)	-0.174199	0.717912	-0.242647	0.8127
C(8)	-0.535783	2.872532	-0.186519	0.8554
C(9)	-0.602084	2.746234	-0.219240	0.8305
C(10)	-0.507649	0.910170	-0.557752	0.5882
C(11)	-0.517176	0.904702	-0.571654	0.5791
C(12)	0.943250	6.473451	0.145711	0.8868
C(13)	0.378601	6.099078	0.062075	0.9516
C(14)	-0.071799	0.331621	-0.216509	0.8326
RESID(-1)	-0.381278	0.479561	-0.795057	0.4434
RESID(-2)	-0.288664	0.490534	-0.588468	0.5681

R-squared	0.077736	Mean dependent var	-3.39 E-14
Adjusted R-squared	-1.179896	S.D. dependent var	0.666857
S.E. of regression	0.984579	Akaike info criterion	3.094038
Sum squared resid	10.66335	Schwarz criterion	3.861941

Log likelihood	-25.76951	Hannan-Quinn criter.	3.322376
F-statistic	0.061812	Durbin-Watson stat	1.981280
Prob(F-statistic)	0.999998		

Table A3 : ROA Heteroscedasticity Test: Breusch-Pagan-Godfrey

	0.293222		
F-statistic		Prob. F(18,8)	0.9854
Obs*R-squared	10.73248	Prob. Chi-Square(18)	0.9054
Scaled explained SS	1.761977	Prob. Chi-Square(18)	1.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Sample: 2008Q4 2015Q2
Included observations: 27

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.661167	6.549718	1.169694	0.2758
LN_ROA(-1)	0.162484	0.240156	0.676577	0.5178
LN_CAD(-1)	1.691218	1.591686	1.062533	0.3190
LN_CDTRSK(-1)	0.274294	0.673626	0.407190	0.6945
LN_LDTY(-1)	2.489876	2.857386	0.871382	0.4089
LN_OP_EFF(-1)	0.951188	1.052876	0.903419	0.3927
LN_ER(-1)	2.683741	6.657874	0.403093	0.6974
LN_ROA(-2)	0.264778	0.251868	1.051256	0.3239
LN_ROA(-3)	0.126901	0.215321	0.589360	0.5719
LN_CAD(-2)	0.162837	2.895096	0.056246	0.9565
LN_CAD(-3)	-0.589828	0.666995	-0.884306	0.4023
LN_CDTRSK(-2)	-0.018647	0.463054	-0.040269	0.9689
LN_CDTRSK(-3)	0.128352	0.738523	0.173796	0.8663
LN_LDTY(-2)	-0.229619	3.069257	-0.074813	0.9422

LN_LDTY(-3)	-0.853128	2.348094	-0.363328	0.7258
LN_OP_EFF(-2)	0.309498	1.055098	0.293335	0.7767
LN_OP_EFF(-3)	-0.263767	0.687168	-0.383846	0.7111
LN_ER(-2)	-3.233295	9.811517	-0.329541	0.7502
LN_ER(-3)	-0.486158	5.816681	-0.083580	0.9354

R-squared	0.397499	Mean dependent var	0.428228
Adjusted R-squared	-0.958128	S.D. dependent var	0.519344
S.E. of regression	0.726735	Akaike info criterion	2.390501
Sum squared resid	4.225144	Schwarz criterion	3.302386
Log likelihood	-13.27176	Hannan-Quinn criter.	2.661652
F-statistic	0.293222	Durbin-Watson stat	2.465906
Prob(F-statistic)	0.985421		

Figure A2: ROA Stability test

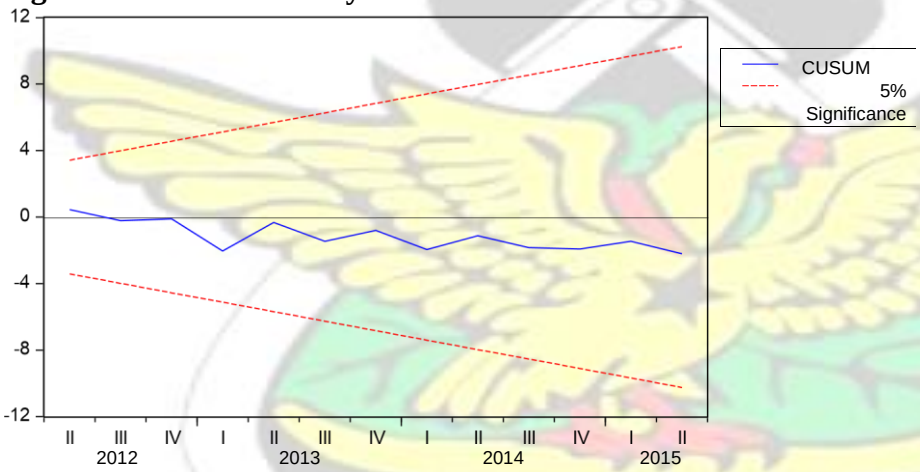


TABLE B1 : ROE VEC Residual Normality Tests

VEC Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Sample: 2008Q1 2015Q2
Included observations: 27

Component	Skewness	Chi-sq	df	Prob.
	-0.180729			
1		0.146983	1	0.7014

2	0.490891	1.084384	1	0.2977
3	-0.026793	0.003230	1	0.9547
4	-0.724614	2.362794	1	0.1243
5	-0.000310	4.31E-07	1	0.9995
6	-0.005197	0.000122	1	0.9912
Joint		3.597514	6	0.7310

Component	Kurtosis	Chi-sq	df	Prob.
1	2.981127	0.000401	1	0.9840
2	2.333658	0.499513	1	0.4797
3	4.092051	1.341647	1	0.2467
4	4.972187	4.375711	1	0.0365
5	2.390256	0.418262	1	0.5178
6	2.495924	0.285855	1	0.5929
Joint		6.921388	6	0.3282

Component	Jarque-Bera	df	Prob.
1	0.147384	2	0.9290
2	1.583897	2	0.4530
3	1.344877	2	0.5105
4	6.738506	2	0.0344
5	0.418262	2	0.8113
6	0.285976	2	0.8668
Joint	10.51890	12	0.5705

FIGURE B1 : ROE single equation Normality test

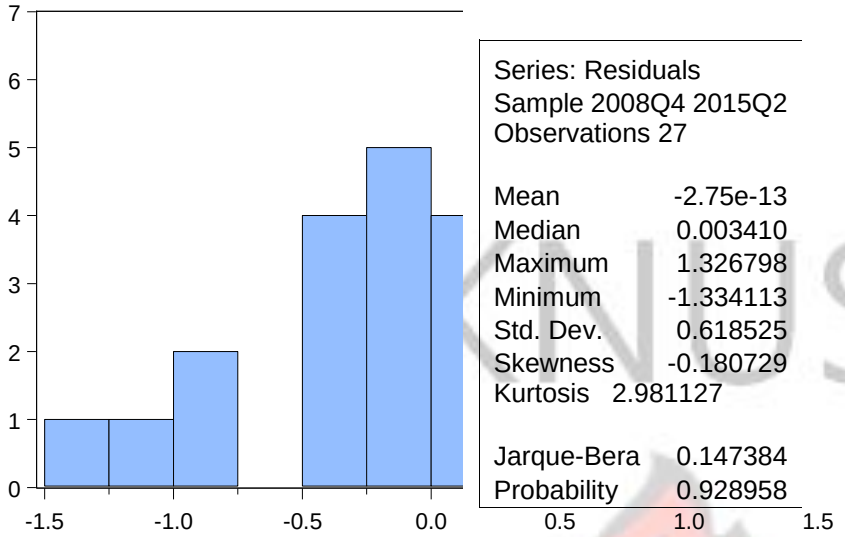


Table B2 : ROE Breusch-Godfrey Serial Correlation LM Test:

Breusch-Godfrey Serial Correlation LM Test:

	0.322788		
F-statistic		Prob. F(2,10)	0.7314
Obs*R-squared	1.637352	Prob. Chi-Square(2)	0.4410

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 11/11/15 Time: 17:40
Sample: 2008Q4 2015Q2
Included observations: 27
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.192623	0.709031	-0.271671	0.7914
C(2)	-0.478039	1.550318	-0.308349	0.7641
C(3)	0.302679	0.611042	0.495349	0.6311
C(4)	0.053802	0.241772	0.222532	0.8284
C(5)	-0.704115	2.174828	-0.323757	0.7528
C(6)	0.538288	1.149487	0.468285	0.6496
C(7)	0.372214	0.879626	0.423150	0.6811
C(8)	0.708861	1.173570	0.604021	0.5593
C(9)	-3.342555	4.957441	-0.674250	0.5154

C(10)	-3.213242	4.909431	-0.654504	0.5276
C(11)	-0.092523	0.803875	-0.115096	0.9106
C(12)	-0.210347	0.802116	-0.262240	0.7985
C(13)	6.407207	11.13845	0.575234	0.5778
C(14)	-3.131869	9.187189	-0.340895	0.7402
C(15)	-0.224859	0.473972	-0.474414	0.6454
RESID(-1)	-0.551648	0.686601	-0.803448	0.4404
RESID(-2)	-0.113079	0.450444	-0.251039	0.8069

R-squared	0.060643	Mean dependent var	-2.75 E-13
Adjusted R-squared	-1.442329	S.D. dependent var	0.618525
S.E. of regression	0.966629	Akaike info criterion	3.036003
Sum squared resid	9.343711	Schwarz criterion	3.851900
Log likelihood	-23.98604	Hannan-Quinn criter.	3.278612
F-statistic	0.040349	Durbin-Watson stat	1.918485
Prob(F-statistic)	1.000000		

Table B3: ROE - Heteroscedasticity Test: Breusch-Pagan-Godfrey

Heteroskedasticity Test: Breusch-Pagan-Godfrey

	0.580012		
F-statistic		Prob. F(18,8)	0.8395
Obs*R-squared	15.28647	Prob. Chi-Square(18)	0.6422
Scaled explained SS	2.991055	Prob. Chi-Square(18)	1.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 11/11/15 Time: 17:41
Sample: 2008Q4 2015Q2
Included observations: 27

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.422389	5.378850	1.008095	0.3429
LN_ROE(-1)	-0.016545	0.195399	-0.084674	0.9346
LN_CDTRSK(-1)	0.158059	0.588970	0.268365	0.7952
LN_LDTY(-1)	2.796455	2.936762	0.952224	0.3689
LN_OP_EFF(-1)	0.611476	0.855219	0.714993	0.4949
LN_ER(-1)	-3.757154	6.263447	-0.599854	0.5652
LN_CAD(-1)	2.691159	1.381691	1.947729	0.0873
LN_ROE(-2)	0.312693	0.226988	1.377576	0.2056
LN_ROE(-3)	0.093641	0.187352	0.499813	0.6307

LN_CAD(-2)	-0.675811	2.343674	-0.288355	0.7804
LN_CAD(-3)	0.083622	0.636642	0.131349	0.8987
LN_CDTRSK(-2)	-0.364393	0.389588	-0.935328	0.3770
LN_CDTRSK(-3)	0.174262	0.641565	0.271620	0.7928
LN_LDTY(-2)	0.900805	2.587175	0.348181	0.7367
LN_LDTY(-3)	-1.152833	2.072668	-0.556207	0.5933
LN_OP_EFF(-2)	0.546187	0.920901	0.593101	0.5695
LN_OP_EFF(-3)	0.447050	0.652830	0.684789	0.5128
LN_ER(-2)	7.699666	10.43602	0.737797	0.4817
LN_ER(-3)	-3.906017	6.102433	-0.640075	0.5400

R-squared	0.566166	Mean dependent var	0.368404
Adjusted R-squared	-0.409962	S.D. dependent var	0.528416
S.E. of regression	0.627451	Akaike info criterion	2.096710
Sum squared resid	3.149558	Schwarz criterion	3.008595
Log likelihood	-9.305581	Hannan-Quinn criter.	2.367861
F-statistic	0.580012	Durbin-Watson stat	2.448371
Prob(F-statistic)	0.839534		

Table C1 : NIM VEC Residual Normality T

VEC Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Date: 11/11/15 Time: 17:42
Sample: 2008Q1 2015Q2
Included observations: 27

Component	Skewness	Chi-sq	df	Prob.
1	0.623676	1.750371	1	0.1858
2	0.952152	4.079672	1	0.0434
3	-0.788563	2.798242	1	0.0944
4	0.132822	0.079387	1	0.7781
5	0.048976	0.010794	1	0.9173
6	-0.709566	2.265675	1	0.1323
Joint		10.98414	6	0.0889

Component	Kurtosis	Chi-sq	df	Prob.
1	4.207682	1.640807	1	0.2002
2	3.528506	0.314233	1	0.5751

3	3.083772	0.007895	1	0.9292
4	2.964662	0.001405	1	0.9701
5	2.501806	0.279222	1	0.5972
6	3.532915	0.319499	1	0.5719
Joint		2.563061	6	0.8613

Component	Jarque-Bera	df	Prob.
1	3.391179	2	0.1835
2	4.393905	2	0.1111
3	2.806137	2	0.2458
4	0.080792	2	0.9604
5	0.290016	2	0.8650
6	2.585174	2	0.2746
Joint	13.54720	12	0.3306

Figure C1 : NIM single equation Normality test

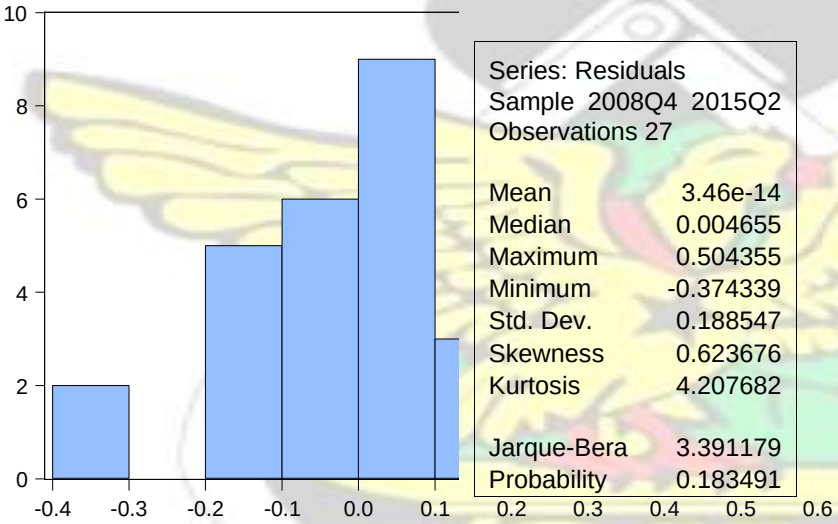


Table C2 : NIM - Breusch-Godfrey Serial Correlation LM Test:

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.041392	Prob. F(2,10)	0.3883
Obs*R-squared	4.654157	Prob. Chi-Square(2)	0.0976

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 11/11/15 Time: 17:43
Sample: 2008Q4 2015Q2
Included observations: 27
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.091508	1.001741	-0.091349	0.9290
C(2)	-0.264099	1.041658	-0.253537	0.8050
C(3)	-0.015358	0.601936	-0.025514	0.9801
C(4)	-0.110454	0.351030	-0.314657	0.7595
C(5)	0.177090	1.065865	0.166147	0.8714
C(6)	0.029528	0.499500	0.059114	0.9540
C(7)	-0.153156	0.599029	-0.255673	0.8034
C(8)	0.057692	0.307611	0.187548	0.8550
C(9)	0.913320	1.402576	0.651173	0.5296
C(10)	0.430486	0.829137	0.519198	0.6149
C(11)	0.158688	0.560113	0.283313	0.7827
C(12)	0.186749	0.278378	0.670848	0.5175
C(13)	0.226677	1.926524	0.117661	0.9087
C(14)	-0.247786	2.381402	-0.104051	0.9192
C(15)	0.010773	0.136240	0.079075	0.9385
RESID(-1)	0.097549	0.544219	0.179246	0.8613
RESID(-2)	-0.724990	0.502506	-1.442750	0.1797

R-squared	0.172376	Mean dependent var	3.46E-14
Adjusted R-squared	-1.151822	S.D. dependent var	0.188547
S.E. of regression	0.276581	Akaike info criterion	0.533380
Sum squared resid	0.764969	Schwarz criterion	1.349277
Log likelihood	9.799371	Hannan-Quinn criter.	0.775989
F-statistic	0.130174	Durbin-Watson stat	1.925849
Prob(F-statistic)	0.999801		

Table C2 : NIM - Heteroscedasticity Test: Breusch-Pagan-Godfrey:

Heteroskedasticity Test: Breusch-Pagan-Godfrey

	0.682408		
F-statistic		Prob. F(18,8)	0.7626

Obs*R-squared	16.35087	Prob. Chi-Square(18)	0.5681
Scaled explained SS	5.180088	Prob. Chi-Square(18)	0.9986

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 11/11/15 Time: 17:43
Sample: 2008Q4 2015Q2
Included observations: 27

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.884615	0.535865	-1.650816	0.1374
LN_NIM(-1)	0.010869	0.123708	0.087861	0.9321
LN_CDTRSK(-1)	-0.015480	0.115409	-0.134135	0.8966
LN_LDTY(-1)	0.023987	0.293143	0.081826	0.9368
LN_OP_EFF(-1)	-0.084585	0.088057	-0.960568	0.3649
LN_ER(-1)	-0.191730	0.545370	-0.351560	0.7342
LN_CAD(-1)	-0.113287	0.154622	-0.732671	0.4847
LN_NIM(-2)	-0.073648	0.095605	-0.770330	0.4632
LN_NIM(-3)	-0.017857	0.085625	-0.208553	0.8400
LN_CAD(-2)	-0.425045	0.255139	-1.665932	0.1343
LN_CAD(-3)	0.024690	0.132431	0.186436	0.8567
LN_CDTRSK(-2)	0.040076	0.093590	0.428211	0.6798
LN_CDTRSK(-3)	0.033965	0.073555	0.461760	0.6566
LN_LDTY(-2)	-0.512399	0.245944	-2.083394	0.0707
LN_LDTY(-3)	-0.206432	0.233428	-0.884350	0.4023
LN_OP_EFF(-2)	-0.066035	0.097518	-0.677158	0.5174
LN_OP_EFF(-3)	-0.069771	0.075232	-0.927417	0.3808
LN_ER(-2)	-0.220007	0.885317	-0.248506	0.8100
LN_ER(-3)	0.543767	0.662032	0.821361	0.4352

R-squared	0.605588	Mean dependent var	0.034233
Adjusted R-squared	-0.281840	S.D. dependent var	0.062480
S.E. of regression	0.070738	Akaike info criterion	-2.268645
Sum squared resid	0.040031	Schwarz criterion	-1.356760
Log likelihood	49.62671	Hannan-Quinn criter.	-1.997494
F-statistic	0.682408	Durbin-Watson stat	3.003532
Prob(F-statistic)	0.762576		

3.6.4 COT Regression results

Table D1 : COT VEC Residual Normality Tests

VEC Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Sample: 2008Q1 2015Q2
Included observations: 27

Component	Skewness	Chi-sq	df	Prob.
	0.359338			
1		0.581058	1	0.4459
2	0.635933	1.819850	1	0.1773
3	-0.812919	2.973766	1	0.0846
4	-0.407923	0.748807	1	0.3869
5	-0.656494	1.939432	1	0.1637
6	0.255775	0.294394	1	0.5874
Joint		8.357307	6	0.2131

Component	Kurtosis	Chi-sq	df	Prob.
1	3.119074	0.015951	1	0.8995
2	3.003506	1.38E-05	1	0.9970
3	3.648140	0.472596	1	0.4918
4	2.307446	0.539585	1	0.4626
5	3.457113	0.235072	1	0.6278
6	3.292260	0.096093	1	0.7566
Joint		1.359310	6	0.9683

Component	Jarque-Bera	df	Prob.
1	0.597008	2	0.7419
2	1.819863	2	0.4026
3	3.446362	2	0.1785
4	1.288392	2	0.5251
5	2.174504	2	0.3371
6	0.390487	2	0.8226
Joint	9.716617	12	0.6408

Figure D1 : COT single equation Normality test

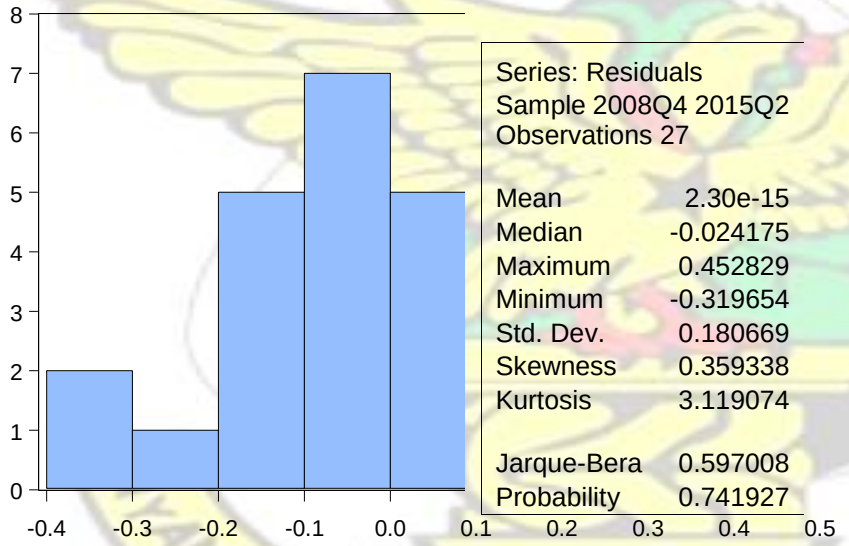


Table D2 : COT - Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.619684	Prob. F(18,8)	0.8103
Obs*R-squared	15.72317	Prob. Chi-Square(18)	0.6119
Scaled explained SS	3.290721	Prob. Chi-Square(18)	0.9999

Heteroskedasticity Test: Breusch-Pagan-Godfrey

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Sample: 2008Q4 2015Q2
Included observations: 27

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.033379	0.411842	0.081047	0.9374
LN_TRADE_COMMISION_RATIO(-1)	-0.024926	0.044566	-0.559320	0.5913
LN_CDTRSK(-1)	0.001494	0.032967	0.045309	0.9650
LN_LDTY(-1)	-0.050509	0.173243	-0.291553	0.7780
LN_OP_EFF(-1)	-0.067736	0.065393	-1.035822	0.3306
LN_ER(-1)	-0.887336	0.458562	-1.935038	0.0890
LN_CAD(-1)	0.002886	0.116866	0.024693	0.9809
LN_TRADE_COMMISION_RATIO(-2)	0.028091	0.073733	0.380987	0.7131
LN_TRADE_COMMISION_RATIO(-3)	0.036050	0.069393	0.519498	0.6175
LN_CAD(-2)	-0.252742	0.179121	-1.411011	0.1959
LN_CAD(-3)	0.065553	0.050016	1.310650	0.2263
LN_CDTRSK(-2)	-0.007134	0.027675	-0.257780	0.8031
LN_CDTRSK(-3)	0.043836	0.040861	1.072819	0.3146
LN_LDTY(-2)	-0.209367	0.185660	-1.127692	0.2921
LN_LDTY(-3)	-0.129440	0.182633	-0.708744	0.4986
LN_OP_EFF(-2)	-0.016359	0.060275	-0.271414	0.7929
LN_OP_EFF(-3)	0.028707	0.054329	0.528389	0.6116

LN_ER(-2)	1.407510	0.720209	1.954308	0.0864
LN_ER(-3)	-0.545349	0.472466	-1.154262	0.2817

R-squared	0.582340	Mean dependent var	0.031433
Adjusted R-squared	-0.357396	S.D. dependent var	0.046628
S.E. of regression	0.054325	Akaike info criterion	-2.796648
Sum squared resid	0.023610	Schwarz criterion	-1.884762
Log likelihood	56.75474	Hannan-Quinn criter.	-2.525496
F-statistic	0.619684	Durbin-Watson stat	2.011853
Prob(F-statistic)	0.810306		

Table C2 : COT Autocorelation Q-stat

Date: 11/11/15 Time: 17:46
Sample: 2008Q1 2015Q2
Included observations: 27

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.301	-0.301	2.7208	0.099
		2	-0.121	-0.232	3.1769	0.204
		3	0.059	-0.064	3.2905	0.349
		4	-0.155	-0.213	4.1081	0.392
		5	0.008	-0.143	4.1103	0.534
		6	-0.013	-0.157	4.1171	0.661
		7	0.171	0.102	5.2557	0.629
		8	-0.101	-0.064	5.6786	0.683
		9	-0.222	-0.305	7.8211	0.552
		10	0.351	0.160	13.489	0.198
		11	-0.086	0.071	13.850	0.241
		12	-0.036	0.029	13.918	0.306

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