UNIVERSITY OF CAPE COAST

FINANCIAL DEEPENING AND ECONOMIC GROWTH IN GHANA

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BY

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate Signature:…………………….……   Date:…………………

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Supervisors' Declaration

We hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

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ABSTRACT

This study investigated the relationship between economic growth and financial deepening for the case of Ghana using quarterly data from 1983 to 2008. Whereas financial deepening was proxied by credit to private sector/GDP and broad money/GDP, economic growth was measured by real GDP per capita. Other variables included gross fixed capital formation/GDP, interest rate and government spending/GDP. Employing the Johansen cointegration approach, vector error correction, vector autoregressive and Granger causality approaches, the results revealed a positive long run relationship between financial deepening as measured by credit to private sector/GDP and economic growth but no long run relationship when financial deepening was measured by broad money/GDP.

The results of the forecast error variance decomposition indicated that the most important variable for economic growth was capital stock. For financial deepening and capital stock, the most influential variable was economic growth. For real interest rate, financial deepening was the most important variable.

The study found support for the endogenous growth prediction when credit to private sector/GDP proxied financial deepening. However, evidence for the demand–pulling hypothesis was found when financial deepening was proxied by broad money to GDP. The study recommended that the Bank of Ghana could consider enhancing the institutional, legal and regulatory framework to enable financial institutions perform their roles without friction. Government could also consider maintaining and pursuing a consistent development policy as well as ensure a continued implementation of the financial sector reforms.

ACKNOWLEDGEMENTS

DEDICATION

To my lovely Pelpuo family

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LIST OF ACRONYMS

ADF	Augmented Dickey Fuller
AIC	Akaike Information Criterion
ARDL	Autoregressive Distributed Lag
ECOWAS	Economic Community of West African States
ECT	Error Correction Term
ERP	Economic Recovery Program
FINSAP	Financial Sector Adjustment Program me
FINSSIP	Financial Sector Strategic Plan
FMOLS	Fully Modified Ordinary Least Squares
FPE	Final Prediction Error
FS	Financial Savings
FSAP	Financial Sector Assessment Programme
GDP	Gross Domestic Product
GDPG	Gross Domestic Product Growth
GMM	Generalised Method of Moments
IMF	International Monetary Fund
LDCs	Less Developed Countries
LR	Log-likelihood Ratio
MENA	Middle Eastern and North African
M2	Money Stock
ML	Maximum Likelihood
NBFI	Non-Bank Financial Institutions

OMO	Open Market Operations
PP	Phillips-Perron
SACU	Southern African Customs Union
SADC	Southern Africa Development Community
SAP	Structural Adjustment Program
SIC	Schwarz Information Criterion
SSA	Sub-Sahara African
VAR	Vector Autoregressive Model
VECM	Vector Error Correction Model
WDI	World Development Indicators

CHAPTER ONE

INTRODUCTION

Background to the study

A financial System comprises network of financial markets, institutions, businesses, households and governments that participate in that system and regulate its operations. The benefits accruable from a healthy and developed financial system relate to savings mobilisation and efficient financial intermediation roles (Gibson & Tsakalotos, 1994).

The key function of financial systems in the saving-investment-growth nexus is to act as an effective vessel for: channelling funds from surplus to deficit units by mobilising resources and ensuring an efficient transformation of funds into real productive capital; creating sufficient liquidity in the economy by borrowing short-term and lending long-term; reducing information costs, providing risk management services and reducing risks from the system through diversification and techniques of risk sharing and risk pooling; mobilising savings from atomised individuals for investment, thereby solving the problem of indivisibility in financial transactions and mobilising savings that are invested in the most productive ventures irrespective of the source of the savings. This can be achieved either by direct market based financing or by indirect bank-based

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finance (Levine, 2004; Emenuga, 2004; Nowbutsing, Ramsohok & Ramsohok, 2010).

Following the theoretical works of Keynes (1936) who advocated government interference in financial markets, many governments (in the 1960s and 1970s) including those of sub-Sahara Africa of which Ghana is no exception, tried to generate economic growth through financial repressive policies such as the use of fixed interest rates, sectoral credit allocation and inflationary monetary policies. However, in 1973, McKinnon and Shaw argued against such financial repressive policies as they acted as disincentives to savings mobilisation, which inhibited long-run economic growth and sustainable development.

As a result, developing economies in the last few decades have tended to development strategies that focus more on the modernisation and liberalisation of their financial systems. The countries of sub-Saharan Africa are no exception. The 1980s have seen most of these countries undertake policies aimed at lowering the levels of financial repression by generally reducing the extent of governmental intervention in national financial sectors, via the privatisation of banks. These policies were expected to promote growth through financial development and this was to be realised through a higher mobilisation of savings, a rise in domestic and foreign investments or a general improvement in the efficiency of resource allocation (Cobbina, 1999).

The Ghanaian economy prior to 1983 experienced various forms of financial repression and macroeconomic problems. The 1970s was characterised by persistent high inflation of about 122.87 percent, declining exports from 21

percent of GDP to 4 percent of GDP, low productivity, flourishing illegal activities and political instability. A decline in per capita income by 30 percent increased the incidence of absolute poverty accompanied by a worsening of income distribution, growing unemployment and the exodus of skilled professionals. Specifically, the financial system was characterised by officially fixed low interest rates, high rates of inflation, negative real interest rates, fall in rate of savings from 13 percent to about 3 percent, fall in the rate of investment from 14 percent to 2 percent of GDP and dominance of the public sector in the domestic credit market. There were also shallow financial sector, high budget deficit and negative growth of real GDP. The impact of these policies on economic development was found to be depressing. This motivated financial sector reforms (Dordunoo & Nyanteng, 1997; Aryeetey & Harrigan, 2000; Aryeetey & Tarp 2000; Emenuga, 2004).

These reforms which were implemented as components of the Stabilisation and Structural Adjustment Programme (SAP) and the Economic Recovery Programme (ERP) supported by the international community included measures aimed at reversing, restoring and accelerating growth of the economy. Measures targeted at the financial development aimed at interest rate deregulation, elimination of credit ceiling, decontrol of entry and operation in the banking industry, increased regulatory and supervisory powers of the Central bank over the banking system, and gradual introduction of indirect monetary control instruments (Dordunoo & Nyanteng, 1997).

The Ghanaian financial system has been profoundly transformed throughout the adjustment period and recently the joint IMF-World Bank Financial Sector Assessment Programme (FSAP) in 2000 and its update in 2003 but still remains undeveloped (IMF, 2003; Bawumia & Theresa, 2008).

The success of Ghana's ambitious financial sector reforms can be attributed largely to solid "buy-in" from key stakeholders—especially the private sector—and coordinated donor assistance. This success is evident in the following respect: First, economic growth has been positive and has risen to 6.3 percent in 2007 from 4.5 percent in 2002 since the start of the economic adjustment. Second, the ratio of money supply (M2) to GDP, the traditional measure of financial deepening, doubled after 2004, reaching 43 percent of GDP by the end of 2007. Much of the increase was funded by an increase in demand and savings deposits. Third, the banking system has grown rapidly, fuelled by fast credit expansion. Banks now account for about 70 percent of the financial sector. Finally, financial sector vulnerabilities have been reduced. Improved banking supervision now gives priority to capital adequacy, bank risk management, and more on-site supervision (Bawumia & Theresa, 2008).

Statement of the problem

Over the past few decades, the role of financial deepening in economic growth has attracted significant attention from finance and development experts and has been debated extensively. This debate can be characterised into four main theoretical propositions: the supply-leading hypothesis (McKinnon, 1973; Shaw,

1973; Neusser & Kugler, 1998), demand-pulling hypothesis (Robinson, 1952; Patrick, 1966; Ireland, 1994), the endogenous growth theory (Greenwood & Smith, 1997; Blackburn & Hung, 1998) and the Stern-Lucas proposition (Kuznets, 1955; Meir & Seers, 1984; Lucas, 1988; Stern, 1989).

Given these alternative theoretical paradigms, empirical evidence especially time series studies have generally been mixed and inconclusive. Interestingly, specific studies on the finance-growth nexus in sub-Saharan African countries especially Ghana are very few. Some of these studies have used cross-country regression method. This method is saddled with heterogeneity bias. As such, it fails to address the country-specific effects of financial development on economic growth which may lead to inconsistent and misleading estimates (Quah, 1993; Caselli, Esquivel, & LeFort, 1996; Ghirmay, 2004).

In addition, some other studies using time series employed a bivariate VAR framework (Al-Yousif, 2002; Quartey & Prah, 2008). Quartey and Prah (2008) found evidence for both the demand-pulling and independent hypotheses in Ghana when different measures of financial development were used. However, bivariate tests suffer from omitted variables problem and lead to erroneous causal inferences (Loizides & Vamvoukas, 2005). Frimpong and Adam (2010) using a trivariate VAR found evidence for the bi-directional causality proposition in Ghana. However, the introduction of an additional variable in the causality framework may not only alter the direction of causality but also the magnitude of the estimates (Loizides & Vamvoukas, 2005).

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It is against this background that this study seeks to investigate the cointegration and causal relationship between financial deepening and economic growth in Ghana using a quadvariate vector autoregressive (VAR) and vector error correction (VECM) framework. The advantages of this technique are that: First, it is possible to distinguish between the short-run and long-run causality if the variables are cointegrated. Second, endogeneity is less of a problem since it treats all variables as potentially endogenous. Finally, it models relationships among macroeconomic variables in a dynamic manner since it is common for macroeconomic variables to be affected by their own past values. Thus, it enable us study the impact of unanticipated shocks on the endogenous variables (impulse response functions). The relative importance of each variable in explaining the variations in the endogenous variables can also be examined (variance decomposition analysis).

Objectives of the study

The objectives of the study are organised into the broad or general objective and the specific objectives.

The general objective of this study is to investigate the relationship between financial deepening and economic growth using quarterly time series dataset in Ghana from 1983 to 2008.

Specifically the study seeks to;

- Investigate the long-run relationship between financial development and economic growth.

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- Find out whether the direction of causal relationship will change given the proxy used for financial deepening.

- Identify the relative importance of capital stock, financial deepening, interest rate and economic growth variables in explaining variations in economic growth and financial deepening.

- Provide policy recommendations.

Hypotheses

Within the context of financial deepening and economic growth, our main hypotheses are as follows:

H_0: There is no long-run relationship between financial deepening and economic growth.

H_0: The direction of the causal relationship between economic growth and financial deepening does not depend on the proxy used for financial deepening.

H_0: capital stock, financial deepening, interest rate and economic growth are relatively more important in explaining variations in economic growth.

H_0: capital stock, financial deepening, interest rate and economic growth are relatively more important in explaining variations in financial deepening.

Significance of the study

The research results are relevant to policy makers, development planners, finance experts and researchers. Investigating the finance-growth nexus can be of principal interest to government and business planning. It will help stakeholders

formulate policies capable of enhancing the development and effectiveness of the financial system.

Again, the results of the study can serve as a guide to constructing appropriate financial sector reforms and in evaluating the effectiveness of these reforms since countries undertaking reforms hope to achieve a more competitive, healthier, efficient and deeper financial system. In particular, it is expected that through more efficient intermediation (financial deepening), the higher savings would increase the level of investment, resulting in higher real incomes.

There exist few studies using multivariate time-series analysis on the finance-growth relationship especially in the case of Ghana. This study adds to the existing literature. In so doing the study addresses some of the methodological issues inherent in the literature.

Scope of the study

This study examines the relationship between financial deepening and economic growth in Ghana using quarterly data from 1983 to 2008. It utilises Johansen's Cointegration and Granger causality techniques. The study employed the following variables: Economic growth, financial deepening, capital stock, real interest rate and government expenditure. Economic growth is proxied by real gross domestic product (GDP) per capita and financial deepening proxied by ratios of credit to the private sector to GDP and money stock to GDP. The variables such as capital stock, real interest rate and government spending were used to augment the model. Capital stock was proxied by the share of gross fixed

capital formation to GDP and government expenditure by the ratio of government spending to GDP.

Organisation of the study

This study is organised into five chapters. Chapter one, which is the introductory chapter, presents a background to the study, problem statement, objectives of the study, hypotheses, significance and scope of the study as well as organisation of the study. Chapter two presents review of relevant literature, both theoretical and empirical that underpins financial deepening and economic growth. Chapter three presents the methodological framework and techniques employed in conducting the study. Chapter four examines and discusses the results and main findings with reference to the literature. The final chapter presents the summary, conclusions and recommendations of the study.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

Introduction

The broad aim of this chapter is to present the review of relevant literature on the relationship between financial deepening and economic growth. The chapter is organised into two sections. The first section presents an overview of the Ghanaian economy with specific focus on the financial sector and its performance. The rationale is to give a fair view and draw attention to the various developments that characterised the economy. As a result, the section discusses briefly financial policies and macroeconomic performance in Ghana spanning the early 1970s to 2008. The second section presents and discusses the theoretical foundations of this relationship beginning with Patrick's opposing demand and supply hypothesis, McKinnon-Shaw thesis, the endogenous growth perspective and finally the Stern-Lucas proposition.

Following Levine (2004), the empirical literature is categorised around econometric approaches. This is as a result of the fact that many of the strides in empirical studies of finance and growth have been methodological. The categorisation is done into cross-country regressions, time-series, panel data and country-case studies. However, greater attention is devoted to time series studies.

Overview of the Ghanaian Financial Sector

The financial services industry encompasses a broad range of organisations that deal generally with the management of money. In Ghana, the financial services industry is categorised into three main sectors: Banking and Finance (including Non-Bank Financial Services and Forex Bureaux), insurance and Financial market/capital markets.

Ghana has a tiered financial system, with a broad range of financial institutions. The financial system includes commercial banks, rural banks, insurance companies, discount houses, leasing companies, savings and loans associations, credit unions and a stock exchange. Many of these institutions, however, remain underdeveloped, even by the standards of sub-Saharan Africa. The level of financial intermediaries in the economy was judged by the 2003 Financial Sector Adjustment Programme report to be comparatively modest (IMF, 2003).

Financial policy regimes in Ghana

Over the last three decades, the Ghanaian financial sector has gone through the interventionist to a liberalised financial policy regime. The choice of the financial policy has undoubtedly been influenced by changing development thought, economic conditions and general apathy with the system. Clearly, the Ghanaian experience reveals a remarkable attachment to dominant and prevailing development policy as the world's economy evolved. For instance, Ghana adopted the repressionist or interventionist policies in the 1970s when these

policies were rigorously pursued and advocated in the development literature. However, with the emergence and proclamation of the McKinnon-Shaw hypothesis as a new orthodoxy of financial liberalisation throughout the developing world in th1980s, the financial sector became once more, a major tool for policy experimentation (Aryeetey, Nissanke & Steel, 2000). This new orthodoxy view as opposed to interventionist proposition, argue that liberalised real interest rate policy will encourage savings and enhance more productive investment in the real sector leading to economic growth. Such argument has, however, been contested by other prominent scholars and the debate goes on and on.

Financial sector development before the reforms

At the beginning of the 1980s, it was evident that the financial system was incapable of delivering its promises. The financial system, characterised by government dominance had led to a lack of competitive environment, market inefficiencies, and political patronage in the banking system. In addition, since managers of these institutions did not share any risk of loss, they took on additional risk without paying any price for their actions (Ziorklui, 2001). Aside failing to mobilise sufficient financial resources for rapid growth and development, it was also failing in its supportive role to the development of the monetary sector. The failures of the system were best reflected in the way various policies became dysfunctional and were often ignored in the operations of the institutions. First, broad macroeconomic indicators showed that Ghana lagged

behind other African nations in terms of financial deepening. A comparison of the ratio of money supply to GDP (M2Y) ratios for 10 African nations showed that Ghana had earlier ranked third after Ivory Coast and Kenya in 1977. By 1978, it ranked fifth after Kenya, Ivory Coast, Togo and Senegal, sixth in 1979, seventh in 1980, and ninth in 1981. Between 1983 and 1986, Ghana remained at the tail end of the rankings (Aryeetey, Asante & Kyei, 1992).

Indeed, the negative impact of repressive policies on financial sector development was clearly seen in the halving of financial depth, as measured by the ratio of money supply to GDP, from about 19.62 percent in 1979 to only about 9.75 percent in 1984. Between 1979 and 1984, most other indicators of the development of the financial system declined in size; demand deposits fell from 11.6 percent to 4.6 percent, savings and time deposits from 7.1 percent to 2.6 percent, and credit to private sector to GDP from 2.82 percent to 1.54 percent. Second, informalisation of financial markets paralleled the decline of the formal real sectors under pervasive controls, a massively overvalued exchange rate and scarcity of foreign exchange through official channels (Aryeetey & Seini, 1992). Third, the Ghanaian financial system was characterised by excessive borrowing from the banking institutions by the government. As a way of inducing the banking sector to provide loans to the government to solve its budget deficits, commercial banks were allowed to include short-term government Treasury bills as part of the short-term liquid assets that could satisfy their cash reserve requirements (Ziorklui, 2001). As a result, the liability structure of banks was dominated by short-term instruments. For instance, by 1980, about 70 percent of

the banking system's liabilities originated from demand and savings deposits. In general, very few banks achieved adequacy ratio above the minimum of 5 percent before 1984. Assets of the banking system before the reforms were characterised by low lending volumes in very short-term instruments. Prior to the reforms, the loan/deposit ratio averaged 50 percent for the indigenous commercial banks and 45 percent for the expatriate banks. Excess reserves held by banks averaged about 15 percent of total deposit liabilities with about 5 percent in cash reserves and 10 percent in government paper. Finally, the fixed interest rates, credit ceilings on bank lending to the private sector and mandatory guidelines turned out to be ineffective in directing credit (Aryeetey & Seini, 1992).

This low performance was attributed to external and internal factors. The external factors, dubbed exogenous shocks, included the droughts of 1975-77 and 1981-83; worsening of the country's terms of trade; oil shocks of the 1970s; high and increasing rates of interest on external debts following adjustments in the developed market economies to curb inflation; and falling volume of exports as Ghanaian exports as a proportion of world imports declined to 0.05 percent by 1981 compared to 0.15 percent in 1970 .The internal or endogenous shocks were mainly 'inappropriate' domestic policies that distorted relative prices and Ghana's comparative advantage in the production of tradeable and non-tradeable goods, corruption, brain drain among others. These inappropriate policies included financing the ever increasing fiscal deficits by borrowing from the banking system, fixing of the exchange rate for a considerable number of years without regard to the deteriorating economic circumstances leading to a grossly

overvalued exchange rate and directed credit programmes in the form of commodity price and distribution controls (Gockel & Amu, 2003)**.**

Government control of and direct intervention in the financial sector was criticised as a cause of underdeveloped and inefficient financial systems by the financial liberalisation school (McKinnon, 1973; Shaw, 1973; Fry, 1978). The several obstacles and restrictions served to undermine private sector confidence in the system as a whole. It was clear to policy-makers that controls were ineffective and that liberalisation of financial markets was needed. Apart from the state of the financial sector outlined above, financial sector reforms were actually needed to promote the development of the financial market, the deepening of financial intermediation, the creation of new financial instruments for the people to invest in and the establishment of new financial institutions aimed at increasing the competitiveness of the sector and the economy at large. The liberalisation of the system therefore could not have come at a more opportune time (Aryeetey & Seini, 1992; Gockel & Amu, 2003).

Financial sector reforms and performance

Ghana's financial sector has witnessed a remarkable turnaround from the pre-1988 reform period. The comprehensive economic adjustment programme which embodied the financial sector reform started in April 1983. According to Emenuga (2004), the liberalisation of interest rates was gradual and it was not until September 1987 that the prescription of minimum and maximum deposit rates was abolished. The phased transition to market-determined interest rates was

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stepped up in 1988 with the introduction of the Financial Sector Structural Adjustment Programme (FINSAP). As a by-product of the Economic Recovery Programme (ERP), FINSAP, which was implemented between 1988 and 2000 encapsulated several issues. Its specific focus on the financial sector was aimed at: creating a sound, prudential and regulatory framework for banking; strengthening bank supervision, restructuring distressed banks; human resource development in banks; and development of fully liberalised money and capital markets. A follow up programme, Financial Sector Strategic Plan (FINSSIP) which was implemented between 2001 and 2008 was largely home grown. Both sets of reform impacted positively on the banking and financial system in many ways (Bawumia, 2010).

The thrust of FINSAP was therefore to fully deregulate the financial sector through introduction of market-oriented monetary management instruments and at the same time ensuring the protection of the overall health of financial institutions through adequate regulation and supervision.

With FINSAP, government completely deregulated interest rates, eliminated selective credit guidelines and implemented measures to usher in indirect monetary controls. Open Market Operations (OMO) was introduced for liquidity management. Other features of the financial sector reform include, licensing of new private banks, establishment of a stock exchange, granting more supervisory powers to the Central Bank and promulgation of laws to formalise the activities of Non-Bank Financial Institutions (NBFI).

Financial Sector Reforms and Banking System Performance

The outcome of the financial sector reform reflected the pace of its implementation in many ways. The banking sector experienced an increase in the number of banks and non-banks in the financial sector with increased private sector participation. By the end of 1988, the banking sector comprised 10 banks with 405 branches as displayed in Appendix A. In 1998, the number of banks increased to 17 consisting of 9 commercial banks, 5 merchant banks and 3 development banks. Of the seventeen banking institutions at the end of 2001, foreign investors held a majority of the shares in eight commercial banks, and three banks were state-owned; there were nine purely commercial banks, five merchant banks and three development banks (Appendix B). According to Bank of Ghana (as cited in Bawumia, 2010) by 2009, there were 27 banks with foreign investors holding the majority shares in 13 of them. There was also improvement in the banking system balance sheet indicators. The performance of these indicators covering the 1993-2008 period is displayed in Table 1.

Table 1 indicates that there was an increase in the total assets of the banking system from 0.31 percent of GDP in 1993 to 0.44 percent of GDP by 2000 representing a 42 percent increase. However, the ratio dropped to 0.38 percent of GDP in 2001. This was partly attributed to the economic crisis of 2000. Total assets of the banking system steadily rose to 0.66 percent by 2008. This period also witnessed a change in the composition of bank assets as lending to the private sector increased substantially.

Table 1: Banking system balance sheet indicators (1993-2008)

	Loans/Total Assets	Bills/Total Assets	Demand Dep/ T.Dep.	Savings Dep/ T. Dep.	Time Dep/T.Dep	Total Asst./GDP
1993	0.16	0.38	0.48	0.40	0.12	0.31
1994	0.17	0.32	0.57	0.31	0.12	0.33
1995	0.18	0.40	0.63	0.21	0.16	0.25
1996	0.23	0.27	0.65	0.19	0.16	0.25
1997	0.29	0.31	0.61	0.24	0.15	0.26
1998	0.33	0.35	0.59	0.22	0.19	0.27
1999	0.36	0.31	0.61	0.21	0.18	0.35
2000	0.40	0.24	0.67	0.18	0.16	0.44
2001	0.38	0.28	0.62	0.20	0.18	0.38
2002	0.30	0.32	0.64	0.22	0.13	0.40
2003	0.35	0.28	0.61	0.21	0.16	0.41
2004	0.36	0.28	0.61	0.21	0.14	0.39
2005	0.43	0.27	0.61	0.22	0.17	0.38
2006	0.45	0.23	0.59	0.22	0.19	0.45
2007	0.50	0.18	0.57	0.18	0.25	0.56
2008	0.52	0.14	0.58	0.15	0.56	0.66

Note: Dep represents Deposit

 T. Deposit represents Total Deposit

 Ass. represents Assets

Source: Bank of Ghana (as cited in Bawumia, 2010, pp. 210)

It can be observed from Table 1 that the loan/asset ratio rose from 0.16 in 1993 to 0.40 by 2000 while the ratio of holdings of treasury and Bank of Ghana bill/ total assets decreased to 0.24 in 2000 before rising to 0.28 in 2001. Demand and Time deposits as a proportion of total deposits improved with the exception of Savings deposit to Total deposits that declined steadily over the reform period.

Regarding the financial system as a whole, somewhat enviable success was recorded. First, it is worthy to note that in accordance with the scope of liberalisation, there was a gradual increase in the nominal deposit and lending rates from 1984. Observing from Table 2, the average nominal lending rate increased by just 3.7 percent over its level at the start of the programme after barely five years. It rose to as high as 47 percent in 2000 but reduced gradually thereafter to 27.19 percent in 2006. Again, immediately the reform started in 1983, interest rate spread dropped considerably and even became negative in 1993 but later rose above the pre-reform levels and remained positive. Aryeetey and Seini (1992) observed that the higher default risk and its associated cost within the reform period was a major cause of the increasing interest rate spread.

From Table 2, one would observe that there was improvement in the real deposit rate. It increased from -49.97 percent to -17.66 percent in the first year of the reforms (stabilisation cum interest rate liberalisation) representing a 64.7 percent points increase. The negative real interest rate in the 1970s and 1980s was a cumulative effect of government imposition of ceilings on commercial lending/borrowing and deposit rates as well as the double or triple inflation rates. Positive real deposit rates were achieved as the reforms were continued.

Table 2: Performance of selected financial rates, 1979-2008

Year	Lending rate %	Deposit rate %	Interest rate spread %	Real deposit rate %	Savings/ GDP %
1979	19.00	11.50	7.50	-97.99	6.61
1980	19.00	11.50	7.50	-97.82	4.94
1981	19.00	11.50	7.50	-99.05	4.01
1982	19.00	11.50	7.50	-95.21	3.73
1983	19.00	11.50	7.50	-49.97	3.32
1984	21.17	15.00	6.17	-17.66	4.15
1985	21.17	15.75	5.42	4.94	6.64
1986	20.00	17.00	3.00	-6.07	5.80
1987	25.50	17.58	7.92	-15.90	3.91
1988	25.58	16.50	9.08	-11.31	5.42
1989	25.30	8.00	17.30	-13.75	5.61
1990	25.80	17.00	8.80	-14.76	5.47
1991	25.80	21.32	8.50	2.79	7.32
1992	23.00	16.32	6.80	5.69	1.26
1993	31.70	23.63	-2.20	-1.06	6.05
1995	39.20	28.73	10.10	-19.27	11.59
1996	42.10	34.50	11.00	-8.23	13.22
1997	43.10	35.76	11.80	6.16	4.22
1998	37.50	32.05	16.50	15.20	10.2

Table 2: Performance of selected financial rates, 1979-2008 (Continued)

1999	36.50	23.56	20.60	29.55	3.45
2000	47.00	28.60	24.90	34.81	5.55
2001	44.00	30.85	26.80	40.08	7.02
2002	38.50	16.21	22.00	45.34	7.44
2003	37.42	14.32	20.10	50.61	7.01
2004	33.93	13.63	23.79	55.87	7.31
2005	29.46	10.16	19.30	61.14	3.73
2006	27.19	8.89	18.30	66.40	6.10
2007	27.20	8.90	18.30	71.67	3.80
2008	32.09	11.29	20.80	76.93	2.00

Note: Real deposit rate was computed using the formular $[(1+r)/(1+i)]-1$

Source: Computed and compiled from: World Bank, World Development Indicators (2010) and Bank of Ghana

From the beginning of the reform, real deposit rate increased although it remained negative until from 1996 when we had sustained positive increases (Table 2). This resulted mainly from the stabilisation measures which led to lower rates of inflation. The contribution of nominal interest rate growth was, however, marginal.

Second, the rise in real deposit rates did not lead to significant rate of savings as Table 2 clearly depicts. The ratio of gross domestic savings to GDP continuously declined from 1979 to as low as 3.32 percent in the year of reform. This could be due to the fact that high interest rate might result from the stickiness

of deposit rate, high operating costs or the use of unremunerated reserve requirements and lack of competition within the financial sector (Nyawata & Bird, 2004). The poor performance of savings was also attributed to the public loss of confidence in the banking system as a result of the passage of the infamous decree 17 of 1987, which allowed government to access bank accounts owned by individuals without their consent. Many account holders lost trust and withdrew their savings from the system (Aryeetey & Gockel, 1991; Ziorklui, 2001). This had grave consequences on the economy. However, it can be observed again from Table 2 above that savings rose in 1984 to a marginal 4.15 percent and thereafter, gradually improved with the continued implementation of the reform programme especially in the 1990s when real deposit rate became positive.

Financial sector reforms and macroeconomic performance

Overall, the benefits of the reform are widely shown in the increased macroeconomic stability as reflected in the macroeconomic variables during the period. Table 3 displays the performance of selected macroeconomic variables.

Table 3 reveals that there was a fall in the rate of inflation in just one year into the reform from 122.87 percent in1983 to 39.67 percent in 1984 on the average representing a decline by 67.7 percent points. Whereas the highest rate of inflation in the pre-reform period was 122.87 percent, it has been 59.46 percent in 1995 since the full implementation of the reform. In some years it was as low as 10 percent.

Table 3: Performance of Selected Macroeconomic Variables, 1979-2008

Year	M2Y	PRIVY/GDP	GDP growth	GCF growth	Inflation
	%	%	%	%	%
1979	19.62	2.82	-2.51	3.77	54.50
1980	16.21	2.19	0.47	-8.75	50.20
1981	13.76	1.85	-3.50	-8.98	116.40
1982	15.54	1.80	-6.92	-23.10	39.80
1983	9.68	1.54	-4.56	0.00	122.87
1984	9.75	2.21	8.65	14.43	39.67
1985	11.47	3.11	5.09	22.72	10.31
1986	11.32	3.63	5.20	-15.09	24.57
1987	11.73	3.15	4.79	-1.53	39.82
1988	12.41	3.14	5.63	18.83	31.36
1989	13.93	5.84	5.09	21.14	25.22
1990	13.31	4.93	3.33	6.58	37.26
1991	13.38	3.66	5.28	19.80	18.03
1992	17.00	4.94	3.88	-22.99	10.06
1993	17.35	4.84	4.85	2.00	24.96
1996	17.70	6.01	4.60	17.51	46.56
1997	20.19	8.20	4.20	17.78	27.89
1998	21.6	9.36	4.70	4.14	14.62
1999	21.65	12.56	4.40	-2.79	12.41

Table 3: Performance of Selected Macroeconomic Variables, 1979-2008 (Continued)

2000	23.21	13.97	3.70	51.68	25.19
2001	23.27	11.85	4.00	71.98	32.91
2002	25.65	12.05	4.50	23.03	14.82
2003	26.54	11.84	5.20	-20.50	26.67
2004	28.64	13.08	5.60	26.97	12.62
2005	27.6	15.54	5.90	44.50	15.12
2006	29.17	17.78	6.40	13.30	10.92
2007	33.80	24.00	5.70	24.50	10.73
2008	36.90	34.00	7.30	8.60	16.52

Source: World Bank, World Development Indicators, 2010

It is again evident from Table 3 that, the reform period also witnessed improvement in the financial deepening variables. Credit to private sector as a percentage of GDP picked up marginally from 3.1 percent in 1984 to 5.2 percent in 1986 and continued increasing thereafter amid fluctuations to as high as 27.5 percent in 2008. The percentage of money supply to GDP (M2Y) declined continuously from 36.6 percent in 1978 to as low as 9.68 percent in 1983 but picked up marginally from 1984 and reached a height of approximately 13.4 percent in 1991 in the reform period and thereafter increased consistently to 40.9 percent and 45.8 percent in 2007 and 2008 respectively. Essentially, both measures of financial deepening were improved. Figure 1 depicts clearly some selected measures of financial deepening. It can be observed that broad money

supply as a percentage of GDP (M2Y) seems to be mimicking credit to the private sector as a percentage of GDP (PRIVY).
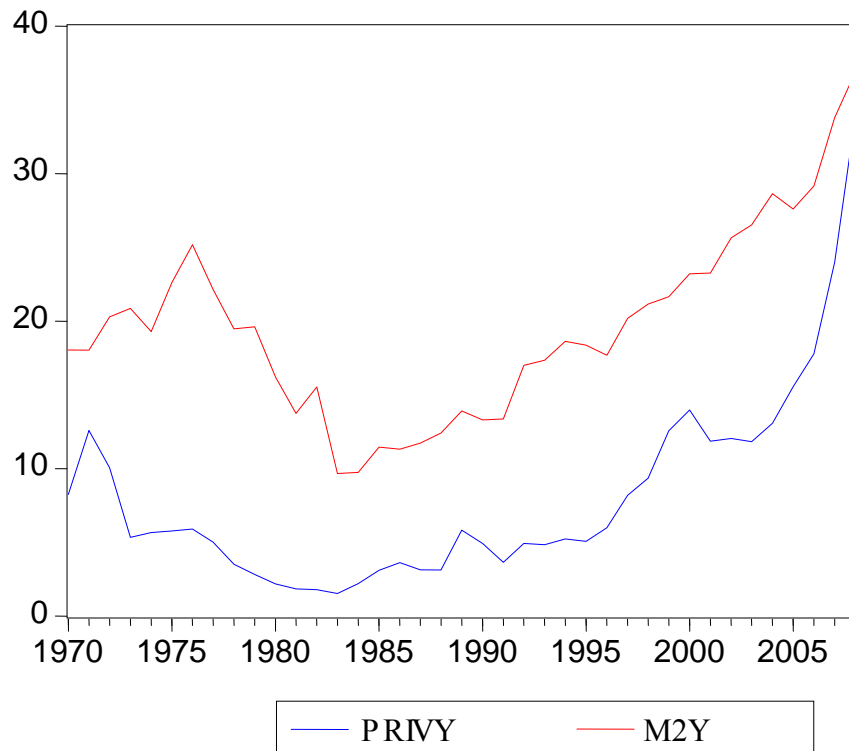
Figure 1: Trends in selected financial deepening variables, 1970 -2008

Source: Generated from WDI (2010) using Eviews 5.0 Package

It would be observed that as discussed, Figure 1 clearly shows that credit to private sector as a percentage of GDP (PRIVY) and broad money supply as a percentage of GDP (M2Y) exhibit a period of decline into the 1980s and thereafter increased steadily during the period of the reforms. The implication of the co-movement of credit to private sector as a percentage of GDP and broad money supply as a percentage of GDP is that estimating these two measures of

financial deepening in a single equation is likely to lead to erroneous inferences due to the possibility of the problem of multicollinearity.

Investigating the growth and improvement in the productive capacity of the economy throughout the reform period, one finds quite an impressive achievement. From Table 3, real GDP growth was negative for four consecutive years preceding the reform but shot up to an impressive 8.65 percent in 1984 during the adjustment Programme and has since ranged between 3.30 percent and 7.3 percent. According to Emenuga (2004), this growth can be linked to the financial sector through increased savings, investment and improved efficiency in financial intermediation. Table 3 reveals an impressive growth in gross capital formation (GCF) from negative or at best zero growth in the pre-reform period to 14.4 percent in 1984 and to as high as 71.98 percent in 2001. This growth has been characterised by frequent fluctuations and therefore not quite impressive though better in recent times. However, among the factors found to influence investment include: the growth of credit to the private sector (which is a measure of financial deepening), macroeconomic stability and fiscal stance all of which have improved since the reform (Asante, 1994).

According to Emenuga (2004), the growth in the economy could be attributed to the increased efficiency in resource allocation arising through larger flows to the private sector. Figure 2 depicts vividly the relationship among financial deepening variables used in this study and some macroeconomic variables.
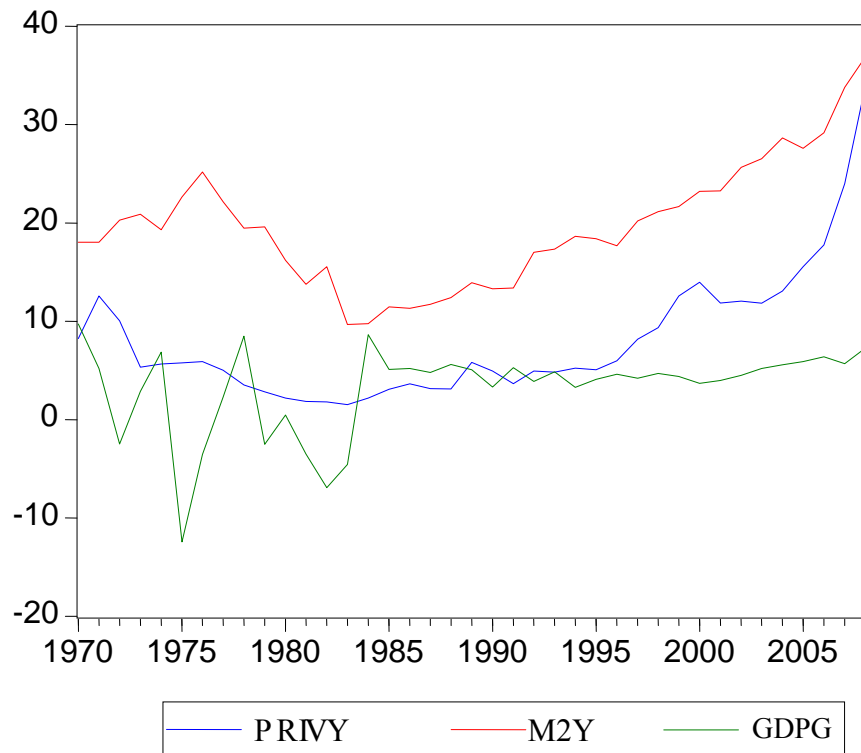
Figure 2: Trends in financial deepening and economic growth, 1970 -2008.

Source: Generated from WDI (2010) using Eviews 5.0 Package

It can be observed from Figure 2 that all the variables are trending upward, implying an improvement within the period under consideration. It is important to note that economic growth as measured by gross domestic product growth rate (GDPG) exhibited frequent fluctuations between 1970 and 1985 and even assumed negative values as shown by Figure 2 and as discussed already. It however, gained stability thereafter and seemed to be marginally trending upward behind the ratios of broad money to GDP (M2Y) and credit to private sector to GDP (PRIVY).

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Theoretical literature review

Development economists have long recognised that the financial system plays a decisive role in the process of economic development. The theoretical foundation of this relationship can be traced to the works of pioneers like Schumpeter (1911), Patrick (1966), McKinnon (1973) and Shaw (1973). Schumpeter argued that the services provided by financial intermediaries are paramount for technical innovation and economic growth. He asserts that well functioning banks spur technological innovation by identifying and funding those entrepreneurs with the best chances of successfully implementing innovative products and production processes. Thus finance influences growth. Hicks (1969) hold the view that the financial system plays a crucial role in the mobilisation of capital for industrialisation. He argued that the financial system played a critical role in igniting industrialisation in England by facilitating the mobilisation of capital for immense works (Levine, 1997).

Patrick (1966) made the first attempt at evaluating the relationship between financial deepening and economic development and proposed the two competing hypotheses: the supply-leading and the demand-pulling or following. He attributed them to specific stages of the development process.

The Gurley and Shaw (1955) hypothesis commonly referred to as the supply-leading hypothesis contends that the expansion of the financial system precedes and induces the demand for its services. That is financial deepening is the engine of real economic growth. Accordingly, the creation and expansion of effective market-oriented financial intermediaries is a vital pre-condition for

genuine and sustained economic development in any country. This hypothesis postulates that well functioning financial institutions can promote overall economic efficiency, create and expand liquidity, mobilise savings, enhance capital accumulation, transfer resources from traditional (non-growth) sectors to the more modern growth inducing sectors, and also promote a competent entrepreneurial response in these modern sectors of the economy (Darrat, 1999).

Patrick (1966) asserted that the direction of causality changes over the course of development. In his view, the supply-leading hypothesis dominates during the early stages of economic development, and subsequently gradually shifts its leading role to the demand-following one. He argued that as the process of real growth occurs, the supply-leading impetus gradually becomes less important, and the demand-following financial response economic development and cultural change becomes dominant. This therefore means that initially causality runs from finance to growth, a scenario that should be expected in developing countries. The demand-following pattern should then be expected to establish a causality that runs from growth to finance at a later stage of development. More advanced economies may accordingly be expected to exhibit this direction of causality (Agu & Chukwu, 2008).

Patrick (1966) suggested three major ways in which a well developed financial system can influence the capital stock for growth purposes. First, financial institutions can encourage a more efficient allocation of a given total amount of tangible wealth (capital) by bringing about changes in its ownership and in its composition, through intermediation among various types of asset-

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holders. Second, financial institutions can encourage a more efficient allocation of new investment (additions to capital stock) from relatively less to relatively more productive uses by intermediation between savers and entrepreneurial investors (credit creation). Third, they can induce an increase in the rate of accumulation of capital by providing increased incentives to save, invest and work. The deliberate establishment and promotion of financial institutions in many less developed countries (LDCs) might reflect this belief in the supply-leading hypothesis. This hypothesis has been advanced by many prominent theorists like McKinnon (1973), Shaw (1973), Fry (1978), DeGregorio and Giudotti (1995) and Neusser and Kugler (1998).

Darrat (1999) argued that many well-known scholars including Robinson (1952) and Patrick (1966) have long rejected this hypothesis on purely theoretical grounds and have argued an alternative view known as the demand-following hypothesis. This hypothesis argues that financial deepening is merely a by-product or an outcome of growth in the real side of the economy. According to this alternative view, any evolution in financial markets is simply a passive response to a growing economy. Therefore, the lack of financial growth is a manifestation of the lack of demand for financial services. As the real side of the economy develops its demands for various new financial services materialise, and these are met rather passively from the financial side. This view is labelled the "demand-following" hypothesis since financial markets develop and progress following the increased demand for their services from the growing real economy. Robinson (1952, p.52) argued, "where enterprise leads, finance follows."

According to this view, economic development creates demand for financial services and the financial system responds automatically to these demands (Levine, 1997).

A position that adopts a different approach but same conclusion with the demand-following hypothesis is that argued by the structuralists. Their model assumes the existence and importance of non-institutional finance in the form of money lending and indigenous banking. It recognises the role of informal financial sector in financial sector development, thus emphasising the fact that financial dualism is a characteristic of financial development process. Structuralists believe that stable macroeconomic policies stimulate growth and development of the financial sector. The main prediction of the model is that economic growth and development determines financial sector development.

The McKinnon-Shaw Model extends the supply-side argument by noting that financial deepening implies not only higher productivity of capital but also a higher savings rate and therefore, a higher volume of investment leading to growth (DeGregorio & Guidotti, 1995). The focus of this model is on the effect of public policy regarding financial markets on savings and investment. They viewed financial development as being characterised by financial restrictions. McKinnon (1973) and Shaw (1973) , taking a neo-liberal position on the role of money in the development process argued that financially repressive policies in the form of nominal interest rate ceilings, controlled credit allocation and high reserve requirements were not only inefficient but also the source of economic instability that reduced the volume of financial savings, the rate of real economic

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growth and the real size of the financial system relative to the non-financial sector in developing countries. Financial repression in this context is defined to entail artificially low deposit and loan rates that give rise to excess demand for loans and to non-price credit rationing (McKinnon, 1973; Shaw, 1973). The McKinnon-Shaw model advocates for financial liberalisation to accelerate economic development and economic growth. They contend that financial liberalisation would improve the rate of economic growth through increased efficiency in financial intermediation subject to financial discipline (Acheampong, 2007). According to this model, interest rate ceilings distort the economy in four ways: Bias in favour of current consumption and against future consumption, hence reducing savings below the socially optimal level; engagement in relatively low-yielding investments; bank borrowers are able to obtain all the funds they want at low interest rates and will choose relatively capital-intensive projects and the pool of potential borrowers contains entrepreneurs with low yielding projects who would not want to borrow at the higher market clearing interest rates (Fry,1978).

McKinnon (1973) and Shaw (1973) attempted to defend their proposition through the complementarity and debt intermediation hypotheses. McKinnon (1973) on complementarity between money balances and physical capital, considers an outside model of money demand (money backed by loans to government). He postulates that due to underdeveloped financial markets in most developing countries, there are limited opportunities for external finance and all firms are confined to self-finance. Given that investment expenditures are lumpier than consumption expenditures, potential investors must first accumulate money

balances prior to undertaking relatively expensive and indivisible investment projects. Shaw (1973) based his 'debt-intermediation' hypothesis on an inside money model. He contends that high interest rates are essential in attracting more saving. With more supply of credit, financial intermediaries promote investment and raise output growth through borrowing and lending. If valid, this McKinnon-Shaw thesis predicts a unidirectional causal relationship from financial deepening to economic growth and it will be prudent to focus attention on the development and promotion of financial intermediation through the establishment of financial institutions in order to promote sustainable economic growth and development.

However, since the 1980s, both the theoretical underpinnings and the empirical validity of the McKinnon-Shaw thesis have been challenged by various scholars. The neo-structuralist led by Wijnbergen (1983) and Taylor (1983) argued that given that financial sector reform leads to increased mobilised savings, it may not facilitate economic growth. Economic activities would be induced if more of the growth in savings is channelled to productive activities. On the contrary, the gains to economic growth through increased credit to the private sector would be sidelined if the increased savings is used to finance public sector deficits (Wijnbergen, 1983).

Again, the implicit assumption that seem to underlie financial liberalisation and for that matter the McKinnon-Shaw hypothesis is that markets will work reasonably well when left alone. A rebuttal from Keynesian economics is the fact that markets are not necessarily self-equilibrating because of, among other things, the role of expectations.

In an extension to this line of thought, Emenuga (2004) argued that increased real interest rate may not necessarily lead to improved private savings. In developing countries, the level of income could be so low that all or more than half of households earnings are spend on basic needs. In such a case, even with high real interest rates, very little if any proportion of income could be saved. This suggests that the McKinnon-Shaw proposition would therefore be more relevant in rich nations.

Recent theoretical work has rekindled the debate and incorporated the role of financial factors in models of endogenous growth in an attempt to formally analyse the interactions between financial markets and long-run economic growth. The endogenous growth-finance theory which follows the Schumpeter's argument, emphasises the role of the financial sector in promoting innovations, income distributions and the speed of technological progress, thus contributing to long-term economic growth (King & Levine, 1993a). Endogenous growth models by Romer (1986), Lucas (1988) and recently Barro (1991), Pagano (1993), Barro and Sala-i-Martin (1994) and Benhabib and Spiegel (2000) are modifications of those of the neoclassical models. They postulate that the financial sector promotes capital accumulation and productivity growth by: facilitating trading; hedging, diversifying, and pooling of risks; mobilising savings; allocating resources to highly productive investment; monitoring managers and exerting corporate control; facilitating exchange of goods and services. The enhanced capital accumulation and productivity growth in turn influences long-run economic growth through two main channels: the volume of investment and the efficiency

of investment. Proponents argue that since capital accumulation may be financed by domestic savings, the financial sector influences long-run economic growth through the channel of increased volume of investment and the economic efficiency of investment captures all other factors such as technology, human capital accumulation and improvement in employment of factor inputs that influence growth (Greenwood & Jovanovic, 1990; King & Levine, 1993).

This model treats both financial deepening and economic growth as endogenous. It assumes a positive two-way causal relationship between financial sector development and long-run economic growth signifying a feedback effect from economic growth to financial deepening. Greenwood and Jovanovic (1990) developed and presented a model in which both financial development and growth are endogenous. They argued in their framework that the role of financial institutions is to collect and analyse information to channel investible funds to investment activities with higher returns. They concluded by demonstrating that the process of growth can stimulate development of financial resources and financial deepening could also stimulate growth. Bencivenga and Smith (1991) presented a model that showed that the development of banks increases economic growth by channelling savings to the activity with high productivity but offering risky and illiquid assets, while allowing individuals to reduce the risk associated with their liquidity needs. Interestingly, they showed that even when aggregate savings are low owing to financial deepening, growth increases. They attribute this to the dominant effect financial deepening has on the efficiency of investment. Bencivenga, Smith and Starr (1995) argued that financial institutions

reduce liquidity risk to which savers are exposed by making financial assets tradable or by enabling depositors to withdraw cash before it is mature (credit). This reduces the disincentive to invest in long-run projects. This also lowers the transaction costs in financial markets.

Endogenous growth theorists argue that the financial sector contributes to economic growth through its effects on the efficiency of investment by: collecting and analysing costly information on entrepreneurs/investment projects; allocating credit to its highest productive use; enabling technological advancement; transforming the composition of savings to suit investment and financing of human capital formation. But economic growth also influences development of the financial sector by creating the demand for financial services, thereby enabling the creation of new financial products and deepening of the financial system. Proponents include: Schumpeter (1911), DeGregorio and Guidotti (1995), King and Levine (1993a), Greenwood and Smith (1997), Greenwood and Jovanovic (1990), Bencivenga and Smith (1991), Bencivenga, Smith and Starr (1995) among others.

Furthermore, the Stern-Lucas hypothesis or the 'independent hypothesis' denies any reliable causal relationship between financial deepening and real economic growth. They maintain that financial deepening is almost totally irrelevant for economic growth. Building on assumptions, Arrow (1964) and Debreu (1959), argued that in a world characterised by a complete set of state-contingent claims, with no information or transaction costs, there is no need for financial intermediation. In such a world, the Modigliani-Miller (1958)

irrelevance hypothesis holds and institutions, particularly financial institutions, do not matter. Stern (1989) completely ignored the role of financial development in the economic growth process. Concluding his survey of important literature in development economics, Stern (1989) listed a number of topics omitted from the survey that are worthy of future research but financial development was not even mentioned in that list. Similarly, Meir and Seers (1984) neglected the role of financial deepening in economic development in their book which is a collection of essays by 'pioneers of development economics.' Robert Lucas, a Nobel Laureate in economics, seems to ascribe to this view. In a study describing the dynamics of economic development, Lucas (1988) argued that economists have generally exaggerated the importance of financial markets in economic development and that these markets at best play only a very minor role in the economic growth process. If valid, this Stern-Lucas proposition denies any reliable causal relationship between financial deepening and real economic growth (Darrat, 1999).

Empirical literature review

Starting with cross-country regression studies, Goldsmith (1969) using data on 35 countries over the period 1860 to 1963 on the value of financial intermediary assets as a share of economic output, showed graphically a positive correlation between financial deepening and the level of economic activity. However, given his unwillingness to draw any causal interpretations from his graphical illustrations, Goldsmith did not take a stand on whether financial

deepening causes growth. This study could be criticised on the basis that it was limited to only 35 countries, did not control for intervening factors and used only one proxy for financial development which may not be an accurate measure (Levine, 2004).

King and Levine (1993a) built on Goldsmith's work by studying 77 countries over the period 1960-1989. They controlled for other factors affecting long-run growth, examined the capital accumulation and productivity growth channels, constructed additional measures of the level of financial development, and analysed whether the level of financial development predicts long-run economic growth, capital accumulation, and productivity growth. They used three proxies for economic growth. The ratio of bank credit to bank credit, central bank domestic credit and the ratio of credit to private sector to GDP were used to proxy financial deepening. Running cross country regressions, they showed that financial depth is a good predictor of growth, capital accumulation and economic efficiency over the next 30 years even after controlling for income, education, and measures of monetary, trade, and fiscal policy. This study did not however deal formally with the issue of causality and simultaneity bias.

Extending King and Levine (1993a) by accurately deflating nominal measures of financial intermediary and assets using consumer price index and incorporating legal origin indicators as instruments for the measures of financial deepening with different conditioning variables, Levine, Loayza and Beck (2000) examined 71 countries on panel data from 1960 to 1995. Using a panel GMM estimator to correct for country specific effects, their results indicate that the

strong link between financial development and growth is not due to simultaneity bias but could be attributed to the effect of the exogenous component of financial intermediary development on growth. The argument is that since finance is based on contracts, legal origins (whether a country's Commercial/Company law derives from British, French, German, or Scandinavian law) that produce laws that protect the rights of external investors and enforce those rights effectively will do a better job at promoting financial development They concluded that financial deepening stimulates economic growth.

Beck, Levine and Loayza (2000) investigated not only the relationship between financial development and economic growth but also the relationship between financial development and the sources of growth in terms of private saving rates, physical capital accumulation, and total factor productivity. Using GMM and IV estimators to correct for possible simultaneity biases, they concluded that higher levels of financial development lead to higher rates of economic growth and total factor productivity.

Bordo and Rousseau (2006) conducted a historical line of research using cross-country analysis with institutional variables. They used data for seventeen countries covering 1880 to 1997 in order to explore the link between finance, growth, legal origin and political environment. Interestingly, they found that political variables such as proportional representation election systems, universal female suffrage, frequent elections and infrequent revolutions or coups seem linked to larger financial sectors and higher conditional rates of economic growth. They, however, contend that most part of the growth-enhancing role of financial

development remains unexplained by institutional fundamentals. The paper concluded that institutions are important for avoidance of financial crises, which can also affect economic growth.

Cross-country regressions, however, have been criticised for ignoring large differences between countries (Arestis & Demetriades, 1997; Neusser & Kugler, 1998). The reliability of their results has also been questioned due to the instability of long time series used (Quah, 1993). Some economists have expressed scepticism about the ability of cross-country regressions to explain the direction of causality. For example, Rousseau and Wachtel (2000) argue that often components, even pre-determined, measuring financial sector development remain correlated with the contemporaneous measures.

As a result a number of other studies have employed the panel methodology. The advantage with the panel methodology is that one has the ability to exploit the time-series and cross-sectional variation in the data, avoid biases associated with cross-country regressions and it permits the use of instrumental variables for all regressors and thereby provides more precise estimates of the finance-growth relationship.

Allen and Ndikumana (2000) using four indicators of financial intermediation and three different panel techniques-simple OLS regressions, regressions including country-specific fixed effects, and regressions including a high-income dummy, they found a positive correlation between financial development and the growth of real per capita GDP for the Southern Africa Development Community (SADC).

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Khan and Senhadji (2000) presented evidence on the finance-growth nexus for a 159 cross-section sample of countries using dataset covering 1960-1999. The study used four alternative proxies for financial deepening and controlled for investment as a share of GDP, the growth rate of population, the growth rate of terms of trade and the log of initial income. Estimating a growth equation using both a pure cross-country sample and five-year-average panels in order to overcome the defects in the cross-section methodology, they found positive effect of financial development on growth. Notable, however, was the fact that the authors found that the size of the effect varied with different indicators of financial development, estimation method, data frequency and the functional form of the relationship.

Lee and Chang (2009) applying recent advances in panel cointegration and panel error correction models for a set of 37 countries using annual data for the period 1970-2002, found convincing evidence of a fairly strong long-run relationship among foreign direct investment, financial development, and economic growth. It was also found that the financial development indicators had a larger effect on economic growth than that of foreign direct investment. This confirms the supply-leading hypothesis. Overall, the findings underscored the potential gains associated with foreign direct investment when coupled with financial development in an increasingly global economy.

Dabós and Gantman (2010) contribute to the literature on the finance-growth link by presenting new findings based on a new, larger dataset that improves over earlier studies in its greater coverage in terms of time periods and

countries, as well as the incorporation of additional control variables like institutional quality and the size of the economy, countries' initial level of economic development, human capital and government spending. They used unbalanced panel dataset for 98 countries covering nine to five-year periods from 1961-1965 to 2001-2005 within the dynamic panels in a GMM framework. Their results demonstrated that financial development does not have a statistically significant effect on economic growth. They also showed that the orientation of a country's political and legal institutions, whether predominantly authoritarian or democratic, is not a relevant factor for economic growth. Most importantly, they found that the economy's size is a statistically significant determinant of growth. Their conclusion casts doubts on the strength of the growth-finance link.

Rioja and Valev (2004) reexamined the finance-growth nexus on a panel of 74 countries using GMM dynamic panel techniques. They found that in the low region with countries of very low levels of financial development, additional improvements in financial markets have an uncertain effect on growth. In the intermediate region, financial development had a large, positive effect on growth and in the high region, the effect was positive, but smaller. This study established that the finance-growth link may vary according to the level of financial development.

Aziakpono (2003) examined for the Southern African Customs Union (SACU) and the Common Monetary Area, whether domestic financial intermediation matters for economic growth in an integrated financial market using highly sophisticated econometric techniques. Employing two indicators of

financial intermediation and the panel methodology, the Zellner seemingly unrelated regression estimation method gave mixed evidence across the countries. He found strong support for the supply-leading hypothesis within the SACU, but a support for the demand-following hypothesis in the case of Botswana and Lesotho. The study concluded that for countries contemplating forming or entering an economic integration, in particular a monetary union, the development of their financial system along with addressing other institutional and structural problems in their economy would be a necessary precondition for them to derive maximum gains from such integration.

Ahlin and Pang (2008) focused on the interaction between corruption control and financial development in order to find out whether they work as complements or substitutes in promoting economic growth. They find out, using dynamic panel analysis on both macro and industry data during 1960-2000 that financial development and low corruption are substitutes. In other words, the growth impact of reducing corruption is higher when the financial system is less developed. Conversely, the growth impact of improving the financial system is higher when corruption is high. They, however, pointed out that there is overlap in the institutions and other ingredients behind financial development and corruption control.

Rousseau and Wachtel (2007) investigated what was happening to the impact of financial deepening on economic growth. Their study included panel data on financial and macroeconomic indicators for 84 countries from 1960 to 2003. They found out that first, excessive financial deepening or too rapid growth

of credit may have led to both inflation and weakened banking systems which in turn gave rise to growth inhibiting financial crises across the countries. Secondly, they found that the increased incidence of financial crisis since the 1990s was primarily responsible for the weakening of the finance-growth link but found no direct evidence that liberalisation played an important supporting role.

DeGregorio and Guidotti (1995) extending the sample of countries used by King and Levine (1993a) to 98, examined the empirical relationship between financial development and economic growth between 1960-1985 with the ratio of bank credit to the private sector to GDP as the only indicator of financial development. They employed both cross-section and panel methodology and found that by and large financial development leads to improved growth particularly. The authors, however, reiterate that the effects vary across countries, over time and levels of income. Furthermore, the study argued that the positive effect of financial intermediation on growth is due mainly to its impact on the efficiency rather than the volume of investment.

A substantial studies employed time-series on the finance-growth relationship using a variety of time-series techniques. These studies frequently used Granger-causality test and vector autoregressive (VAR) procedures. Others employed several measures of financial development and or more powerful and sophisticated econometric techniques or examined individual countries in much greater depth.

In the case of Egypt, Abu-Bader and Abu-Qarn (2008) examined the causal relationship between financial development and economic growth in Egypt

during the period 1960–2001 within a trivariate vector autoregressive (VAR) framework (investment being the additional variable). They employed four different proxies of financial development and apply Granger causality tests using the cointegration and vector error-correction (VECM) methodology. They found strong support for the view that financial development and economic growth are mutually causal, that is, causality is bi-directional. Furthermore, the results revealed that financial development causes economic growth through both increasing resources for investment and enhancing efficiency.

Examining the finance-growth nexus, Darrat (1999) employed multivariate Granger causality tests within a bivariate error correction model (VECM) for three Middle Eastern and North African (MENA) countries over the period 1964-1993. Using the currency and M2Y ratios as alternative measures of financial development, the study found support for the view that financial deepening is a necessary causal factor of economic growth although the strength and consistency of his evidence varied across countries and across the proxies used to measure financial deepening. He showed, however, that the causal relationships are predominately long-term in nature. A major policy implication is that, government policies aimed at promoting financial deepening in these countries must be persistent and sustainable in order to foster economic development.

Abu-Bader and Abu-Qarn (2008) extending and tremendously improving on the methodological shortfalls of earlier studies in MENA, examined the causal relationship between financial deepening and economic growth in five MENA

countries using annual dataset between 1960 to 2004 within a trivariate vector autoregressive (VAR) framework. They employed four different measures of financial deepening with investment as a conditioning variable and real GDP per capita as indicator of growth. Applying Granger causality, cointegration and vector error correction methodology as well as variance decomposition, they found weak support for long-run relationship between financial deepening and economic growth and the supply-leading hypothesis. In cases where cointegration was detected, Granger causality was either bidirectional or it ran from growth to finance. They also demonstrated clearly that causality patterns vary across countries and financial measures.

Demetriades and Hussein (1996) carried out causality tests for 16 developing countries employing the ratio of bank deposit liabilities to nominal GDP and the ratio of bank claims on the private sector to nominal GDP as financial development indicators. In about half the countries examined, they found a feedback relationship between financial development and economic growth. In the other countries, the relationship run from growth to finance (unidirectional), suggesting that it is by no means universal that financial development leads economic growth.

Rousseau and Wachtel (1998) examined the nature of links between the intensity of financial intermediation and economic performance for five countries using time series over the 1870-1929 period. Cointegration test within the vector error correction models (VECM) established long-run relationships among measures of financial intensity and real per capita levels of output. Granger

causality tests then suggest a leading role for financial development in real sector activity, while feedback effects were largely insignificant. The results suggest an important role for intermediation in the rapid industrial transformations of all five countries.

Arestis, Demetriades and Luintel (2001) substantially augmented time-series studies on finance and growth by using measures of both stock market and bank development. They found additional support for the view that finance stimulates growth but raised some caution on the size of the relationship. Using quarterly data and applying time series methods to five developed economies, the study revealed that while both banking sector and stock market development explain subsequent growth, the effect of banking sector development is substantially larger than that of stock market development. The sample size, however, is very limited and it is not clear whether the use of quarterly data and a vector error correction model fully abstract from high frequency factors influencing the stock market, bank, and growth nexus to focus on long-run economic growth.

Antonios (2010) investigated the relationship between financial development and economic growth for 15 European Union member-states for the period 1965-2007 except for Greece (1978-2007), Portugal (1985-2007), Spain and Luxembourg (1975-2007). Estimating a simultaneous system equations model by the two-stage least squared method, he found that stock and credit market development in conjunction with the development of industrial production had a positive direct effect on economic growth for Austria, Belgium, Ireland and

Luxembourg, while the bank market development had a greater effect on economic growth for Sweden and UK. However, the stock market development had a greater effect on economic growth for Denmark, Finland, France, Germany, Greece, Netherlands, Italy, Portugal, and Spain. He concluded that there was a positive relationship between financial development and economic growth taking into account the negative effect of inflation and interest rates.

Arestis and Demetriades (1997) applied Johansen cointegration analysis within the VAR framework on quarterly time series from 1979 to 1991 for the US and Germany. They augmented the proxies for financial development by including indicators of stock market development and volatility. The study found two cointegrating vectors for each country and a unidirectional causality running from finance to growth. Stock market capitalisation was found to positively affect real GDP only through the banking system but stock market volatility had a clear negative effect on output in the case of Germany. In the US, however, the evidence suggests a reverse causality running from growth to banking system and capital market development. They concluded by showing that not only is it possible that the long-run causality may vary across countries but it is also possible, indeed likely, that the long-run relationships themselves exhibit substantial variation.

Agbetsiafia (2004) employed Johansen's approach to cointegration and the VECM based Granger causality to the finance-growth nexus to time series data covering 1963 to 2001 from 8 emerging countries in sub-Saharan Africa. Using five measures of financial development and real per GDP to proxy growth, he

found long-run relationship between growth and financial development. The results of causality test found mostly unidirectional causality running from financial development to economic growth in seven African countries thus lending support for the supply leading phenomena of the finance–growth nexus.

Ghirmay (2004) examined the finance-growth nexus using 13 sub-Saharan African countries with data covering 30 years. He used real GDP to proxy growth and credit to the private sector to real GDP as indicator of financial development. Employing cointegration and Granger causality techniques within a VAR framework, the results revealed that in almost all (11 out of 13) of the countries, financial development and economic growth were cointegrated over the sample period. Furthermore, the causality test yielded evidence of financial development causing economic growth in 8 countries, economic growth causing financial development (reverse causality) in 9 countries, and bidirectional causal relationships in six countries.

Neusser and Kugler (1998) carried out cointegration and causality tests for the 13 OECD countries between 1960 and 1994. They measured financial depth by the GDP of financial institutions, insurance companies, and pension funds. The empirical evidence indicated a weak causal link between financial development and economic growth especially for the smaller countries. Based on their results they concluded that it is not possible to make a general statement on whether financial development is truly an engine of growth or just a sign of the evolution of the whole economy due to independent factors.

Nowbutsing et al. (2010) examined the impact of financial development on the Mauritian economic growth between 1970 and 2009. They used two measures of financial development namely M2 as a percentage of GDP and claims of private sector in a multivariate VAR analysis. While the study found positive impact of financial development on growth, its effect is fairly minimal. The impulse response revealed that a shock in financial development had a positive response on growth. While they concluded that there is a need to invoke policies that increase the effectiveness of the financial sector.

Odhiambo (2007) studied the relationship between economic growth and financial development using time series data from 1980 to 2005 for three SSA countries. Using the ratios of currency to narrow money, bank claims on the private sector to GDP and broad money to GDP as indicators of financial development within a VAR/VECM framework, the study found conflicting results where the demand-following was supported in Kenya and South Africa while in Tanzania, the supply-leading response was found.

Odhiambo (2009) examined the impact of interest rate reforms on financial deepening and economic growth in Kenya employing annual series from 1968 to 2005. Employing the Johansen cointegration technique and Granger causality within an error-correction model, he found strong support for the McKinnon-Shaw hypothesis regarding the positive impact of interest rate liberalisation on financial deepening. The study also found support for the supply-leading hypothesis of the finance-led-growth argument. He concluded that the

interest rate liberalisation in Kenya has succeeded in increasing economic growth through its influence on financial depth.

Odhiambo (2008) in an attempt to avoid problems inherent in bivariate VAR models, examined the dynamic causal relationship between financial depth and economic growth in Kenya using annual series from 1969 to 2005. He proxied financial deepening with M2 to GDP and economic growth by per capita income within a trivariate VAR. Employing the cointegration and error-correction techniques, the empirical results of this study revealed that there is a distinct uni-directional causal flow from economic growth to financial development. The results also revealed that economic growth Granger causes savings, while savings drive the development of the financial sector in Kenya. The conclusion is that any argument that financial development unambiguously leads to economic growth should be treated with extreme caution.

Wadud (2005) investigated the causal relationship between financial development and economic growth for 3 South Asian countries namely India, Pakistan and Bangladesh using data from 1976 to 2008. He disaggregated the financial system into "capital market based" and "bank-based". Using the Johansen multivariate cointegration approach within the framework of vector autoregressive (VAR) model, the study found evidence for the finance-led-growth hypothesis.

Shan and Morris (2002) used the Granger causality technique to investigate the relationship between financial development and economic growth for nine OECD countries and China by estimating a vector autoregressive (VAR)

model. The results of their study showed that five out of ten countries exhibited a bi-directional Granger causality; three of them exhibited reverse causality with economic growth leading to financial development while two countries do not have a causal effect at all.

Xun, Fausten and Smyth (2006) empirically researched the linkage between financial sector development and economic growth by assisting capital accumulation and enhancing the productivity in case of China. Employing Johansen cointegration and Granger-causality approaches within a vector autoregressive (VAR) framework, they identified a bi-directional causality between financial development and capital accumulation but a weak link between financial development and productivity.

Dritsakis and Adamopoulos (2004) empirically investigated the causal relationship among financial development degree of openness of the economy and economic growth by using a Granger causality and cointegration approach in the case of Greece and found that there is one cointegrated vector among GDP, financial development and the degree of openness of the economy. A causal relationship between financial development and economic growth on one hand and also between the degree of openness of the economy and economic growth on the other hand were established.

Odedokun (1996) examining the finance-growth nexus for 71 developing countries with time series dataset that generally span the 1960s and 1980s period, employed the ordinary least square regression technique and concluded that financial intermediation promotes economic growth in roughly 85 percent of the

countries and that the growth-promoting patterns of financial intermediation are practically invariant across various countries and regions.

Jung (1986) empirically examined the relationship between financial development and economic growth for 56 countries consisting of Less Developed Countries (LDCs) and industrialised countries covering 1950-1980 period. Whereas the ratio of money stock (M2) to GDP and currency were used as indicators of financial, economic growth was measured by development real per capita GDP. Employing Granger causality technique, the results revealed that whereas finance causes growth: more frequently in LDCs, growth causes finance more frequently in industrialised countries. The study concluded that LDCs are characterised by the causal direction running from financial development to economic growth while the developed countries are characterised by the growth to financial development causality.

Al-Awad and Harb (2005) examined the linkages between financial development and economic growth in case of ten MENA countries for the period 1969-2000. Using both panel and individual country cointegration and Granger causality tests as well as variance decomposition within a quadvariate VAR framework, they found strong evidence of the existence of long-run relationship between financial deepening which is proxied by the ratio of private credit to monetary base and economic growth. They could not however clearly establish the direction of causality.

In a broad study of 41 countries over the 1960-1993 period, Xu (2000) used a VAR approach that permits the identification of the long-term cumulative

effects of finance on growth by allowing for dynamic interactions among the explanatory variables. He found evidence for the proposition that financial development causes long-run economic growth.

Mohapi and Motelle (2006) provided an empirical examination of the finance-growth nexus with annual time series dataset for the case of Lesotho. Applying cointegration and Granger causality tests within the framework of bivariate VECM to five alternative proxies of financial intermediation on the one hand and real GDP growth, they failed to find any long-run relationship between financial deepening and economic growth. The results further revealed support for the non-causality hypothesis implying that there is no relationship between financial deepening and economic growth.

Luintel and Khan (1999) studied the long-run relationship between financial development and economic growth within a multivariate vector autoregressive (VAR) framework using annual dataset ranging from a minimum of 36 to a maximum of 41 years from10 countries. Whereas financial depth was measured as a ratio of total deposit liabilities of deposit banks to one period lagged nominal GDP growth, real interest rate and capital stock were proxied by real per capita output, discount rate and real per capita stock respectively. By conducting a quadvariate VAR, this study addresses the mis-specification problem inherent in the existing bivariate studies. Johansen cointegration framework through tests of over-identifying restrictions identified that in the long-run, financial depth is positively and significantly affected by the levels of per capita real income and the real interest rate. Causality tests carried out revealed a

bi-directional causality between financial development and economic growth in all the sample countries.

Christopoulos and Tsionas (2004) observed that many time-series studies yielded unreliable results due to the short time span of data sets employed. In a quest to avoid this problem, they employed panel cointegration and causality analysis to examine the relationship between financial development and economic growth in ten developing countries. In contrast to Demetriades and Hussein (1996), Christopoulos and Tsionas (2004) found strong evidence in favour of the hypothesis that long-run causality runs from financial development to growth and that there is no evidence of bi-directional causality. Furthermore, they found a unique cointegrating vector between growth and financial development.

Vazakidis and Antonios (2009) empirically investigated the causal relationship between financial development and economic growth for Greece for the period 1978-2007 using Johansen co-integration Granger causality test within the Vector Error Correction Model (VECM). The study used the rate of change of real GDP as an indicator of growth, domestic bank credit to private sector as a percentage of GDP for credit market development, the general stock market index for the stock exchange market and the Industrial Production Index as proxy for the growth of industrial sector and its effect on economic growth. The results revealed that economic growth has a positive effect on stock market development and credit market development through industrial production growth in Greece.

Jean-Claude (2006) sought to explain the finance-growth nexus hypothesis using Granger causality tests in a Vector Error Correction Model (VECM)

framework for China over the period 1980–2002. His empirical results support a complex set of bi-directional causality between the financial development proxies and economic growth variables. Additionally, bi-directional causality results revealed the Chinese financial system to be more driven by the real sector activities. He concluded that the development of financial institutions in China should not be emphasised unilaterally but rather, attention should be given to the complementary and coordinated development of financial reforms and changes in other areas.

Acaravci, Ozturk and Acaravci (2007) sought to analyse the effect of the financial intermediaries' development on economic growth using quarterly time series data from 1986-2006 for the case of Turkey. Employing Granger causality test within the VAR framework, they found evidence for a one-way causal relationship running from financial development to economic growth in turkey.

Using data from 72 countries for the period 1978-2000, Demetriades and Law (2006) found that financial development had larger effects on growth when the financial system was embedded within a sound institutional framework. This was particularly true for poor countries, where more finance without sound institutions was likely to fail in delivering more growth. For these countries, they found that improvements in institutions were likely to deliver much larger direct effects on growth than financial development itself. They were also likely to have positive indirect effects through the financial system, particularly when the financial institutions were already providing large amounts of credit to the private sector.

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Additional econometric sophistication has also been brought to bear on the finance and growth nexus. Jalil, Ma and Naveed (2008) sought to investigate the relationship between development of the financial sector and economic growth for South Africa using time series dataset from 1965 to 2007. Employing three indicators of financial development within the ARDL framework and the principal component analysis, the results indicate a positive relationship between financial development and economic growth for South Africa. Specifically, they found support for the finance-led argument.

Esso (2010) investigated the causal relationship between financial development and economic growth in the Economic Community of West African States (ECOWAS) countries over the period 1960-2005. The ARDL approach to cointegration and the test for non-causality proposed by Toda and Yamamoto were employed. Using the ratio of M2 to GDP as an indicator of financial development, the results found a positive long-run relationship between financial development and economic growth in four countries-Cote d'Ivoire, Guinea, Niger and Togo and negative long-run relationship in Sierra Leone and Cape Verde. The results of the causality test showed that financial development causes economic growth only in Cote d'Ivoire and Guinea. The author concluded that the relationship between financial development and economic growth cannot be generalised across countries because these results are country specific.

Khan and Qayyum (2006) empirically investigated the impact of trade and financial liberalisation on economic growth in Pakistan using annual observations over the period 1961-2005. They constructed the financial development index in a

quest to circumvent the problem of multicollinearity in using several indicators of financial depth. Real GDP was employed as a proxy together with trade openness and real deposit rate as control variables. Estimating using the bound testing (ARDL) approach of cointegration, they found that both trade and financial policies play an important role in enhancing economic growth in Pakistan in the long-run. The feedback coefficient suggests a very slow rate of adjustment towards long-run equilibrium. This indicates that economic growth is a long-run phenomenon.

Zaman, Atif, Jadoon, Ismail and Seemab (2010) investigated the impact of financial development and trade openness on GDP growth in Pakistan using annual data over the period 1980-2009. Using the bound testing (ARDL) approach of cointegration advanced by Pesaran, Shin and Smith (2001) and Granger causality techniques, they found both long-run and short-run relationship among economic growth, trade openness and financial development. The results further confirmed the validity of trade led growth and finance led growth hypotheses in Pakistan. This study is limited in the number of growth determining factors controlled for. By using only one measure of financial deepening and not conducting variance decomposition, it could not test the robustness of its findings.

Ang (2008) estimated a six-equation model of financial development and economic growth for Malaysia using time series covering the period 1960 to 2003 in order to examine the mechanisms linking these two variables. Employing the ARDL approach to cointegration, the results indicate that financial development leads to higher output growth via promoting both private saving and private

investment. The findings also provide some support for the endogenous growth theory. However, other direct government interventions in the economy, such as resource allocation through the operation of a broad-based employee provident fund scheme and various public investment programmes seem to have impacted negatively on economic development in Malaysia.

Kargbo and Adamu (2010) examined the relationship between financial development and economic growth in Sierra Leone for the period 1970-2008. The method of principal components is employed to construct a financial sector development index used to proxy development in the sector. Employing the Autoregressive Distributed Lag (ARDL) approach, the study found a unique cointegrating relationship among real GDP, financial development, investment and real deposit rate. The results suggest that financial development exerts a positive and statistically significant effect on economic growth and investment is an important channel through which financial development feeds economic growth.

Wolde-Rufael (2009) re-examined the causal relationship between financial development and economic growth in Kenya for the period 1966–2005 within a quadvariate vector autoregressive (VAR) framework by including exports and imports as additional variables. They used four conventionally accepted proxies for financial development. Applying a modified version of the Granger causality test due to Toda and Yamamoto, the study found evidence for a bi-directional causality between financial development and growth in three out of the four measures of financial development. A major implication of the finding is

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that financial development promotes economic growth in Kenya and that policies at enhancing the development of the financial sector can help to spur economic growth.

Mohamed (2008) investigated the effect of financial development on economic performance in Sudan using time series between1970 and 2004. He modelled with M3 to GDP and credit to private sector to GDP as measures of financial development, growth rate of GDP for economic growth as well as control variables such as investment, government spending, inflation and trade openness. Using the ARDL approach to cointegration, the study found a weak relationship between financial development and economic growth in Sudan. These findings were attributed to the inefficient financial system, along with the absence of appropriate investment climate required to foster significant private investment and promote growth in the long-run.

Ege, Nazlioglu and Bayrakdaroglu (2008) examined whether financial development leads to economic growth in Turkey using quarterly time series from 1987 to 2007. They used five measures of financial indicators together with other control variables within the framework of the aggregate production function. Employing the bounds testing (ARDL) approach to cointegration and Granger causality, they found long-run relationship between financial development and economic growth. Results of Granger causality revealed a strong unidirectional Granger causality from economic growth to financial development.

Muhammad and Umer (2010) examined the finance-growth nexus in the case of Pakistan. Employing the bound testing (ARDL) approach for

cointegration and causality on annual dataset from 1973 to 2008, they found evidence for the demand-pulling hypothesis. The study showed a long-run association between broad money supply growth and economic growth but no evidence between domestic credit provided by banking sector and economic growth. They interpreted their findings as signifying a unidirectional causality running from real per capita income to financial development.

In the case of detailed country-case studies, Liang (2005b) examined the relationship between finance and economic growth using annual series from 1990 to1999 in the case of 29 Chinese provinces. He proxied financial deepening by loans to GDP, bank competition and share of private credit and growth by the growth rate of real GDP per capita. Using the Generalised Method of Moments (GMM) approach, the study found that financial development significantly promoted economic growth in the coastal region but not in inland region.

Jayaratne and Strahan (1995) studied the impact of finance on economic growth by examining individual states of the United States. Interestingly, 35 states relaxed impediments on intrastate branching since the 1970s. They estimated the change in economic growth rates after branch reform relative to a control group of states that did not reform. They sought to assess the impact of liberalising branching restrictions on state growth using a pooled time-series, cross-sectional. They found evidence showing that branch reform stimulated bank-lending quality and led to high real per capita growth rates.

Dehejia and Lleras-Muney (2003) extended these findings by also examining the impact of deposit insurance. By comparing states within the United

States, the study eliminated the problems associated with country-specific factors. The study employed a natural identifying condition and the change in branching restrictions to trace through the impact of financial development on economic growth. It found evidence that branch reform boosted lending. This study showed that branch reform accelerated economic growth by improving the quality of bank loans and the efficiency of capital allocation. It also found that financial development boosts growth. The study concluded that it is the quality, not the quantity of lending that matters.

Studying the individual regions of Italy using dataset on households and financial services, Guiso, Sapienza, and Zingales (2002) examined the effects of differences in local financial development on economic activity across the regions of Italy. They established that local financial development enhances the probability that an individual starts a business, increases industrial competition and promotes the growth of firms. These results are weaker for large firms, which can more easily raise funds outside of the local area. This study was unique in that it succeeded in eliminating many of the weaknesses associated with examining growth across countries.

Finally, although there have been extensive empirical studies testing the views on the finance-growth nexus, empirical evidence in the case of Ghana is scant and hard to come by. The study, however, present the few that were located.

Quartey and Prah (2008) sought to find out whether financial development in Ghana conforms to either the supply-leading, demand-following or Patrick's Stages of development hypotheses. They conducted Granger-causality test,

impulse response function and variance decomposition analysis within a bivariate VAR framework. The results revealed evidence in support of demand-following hypothesis, when growth of broad money to GDP ratio is used as a measure of financial development. However, when growth in domestic credit to GDP ratio, private credit to GDP ratio, and private credit to domestic credit ratios are used as proxies for financial development, they found support for the 'independent' hypothesis. The problem with studies employing bivariate VAR is that they suffer from omitted variables problem and lead to erroneous causal inferences (Loizides & Vamvoukas, 2005).

Frimpong and Adam (2010) examined whether financial sector development has caused economic growth and investment in Ghana using annual time series between 1970 and 2007.They employed credit to private sector to GDP, bank liquid reserve asset ratio and liquid liability ratio to GDP as proxies for financial development. Whereas GDP growth was used to measure economic growth, real domestic investment was used as control variable. Modelling these within the framework of a trivariate VAR and VECM, results of Johansen cointegration technique revealed a stable long-run relationship between growth rate and financial development. A similar result was found for the investment equation. However, with the exception of credit to private sector where causality run from economic growth only, they found bi-directional causality between growth and financial development. This study could be criticised n the basis that it could suffer from multicollinearity since it included three measures of financial development, which are bound to be highly correlated in a single equation. Hence,

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the possibility that the estimates may be invalid cannot be easily dismissed. Again, a major methodological flaw is its use of the pairwise Granger causality technique within a framework of cointegrated series. Darrat (1999) argues that the use of pairwise Granger causality technique within a model of cointegrated series produces large standard errors and result in erroneous inferences.

Conclusion

This chapter reviewed relevant literature on the Ghanaian economy and its financial sector development as well as theoretical and empirical work on the finance-growth nexus. It was observed that Ghana's economy and the financial sector displayed abysmal performance prior to 1983 and that the reforms could not have come at a more opportune period. Undoubtedly, the reform yielded somewhat enviable gains which could largely be attributed to the consistency and zeal in the implementation. The theoretical literature illuminated many channels through which the emergence of financial instruments, markets and institutions affect and are affected by economic development. However, the results of empirical studies on the nature and direction of causal relationships between financial development and economic growth are mixed and inconclusive as a consequence of using a variety of financial development proxies as well as the choice of econometric method. According to Levine (2004) and as the review reveals, a growing body of empirical studies demonstrates a strong positive link between the functioning of the financial system and long-run economic growth.

CHAPTER THREE

METHODOLOGY

Introduction

The purpose of this chapter is to present the methodological framework suitable for conducting the study. It discusses the methods and tools of analysis employed in this study. Specifically, the chapter presents a detailed description of the theoretical and empirical specification of the model, variables in the model, source and data type, estimation techniques as well as tools for data analysis.

Theoretical model specification

The theoretical literature predicts a positive link among financial deepening, real interest rate, investment and economic growth. This prediction is common to both the McKinnon-Shaw model and the endogenous growth literature. The McKinnon-Shaw thesis attempts to explain the positive link between financial deepening and economic growth through complementarity between money and capital and debt intermediation hypotheses. McKinnon (1973) assumed that investment is lumpy and self-financed and hence cannot be materialised unless adequate savings are accumulated in the form of bank deposits. On the other hand, the debt-intermediation view presented by Shaw (1973) postulates that financial intermediaries promote investment and raise

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output growth through borrowing and lending. These two arguments suggest that an increased level of financial development, which can be the outcome of financial liberalisation, will lead to higher output growth. In order to reach higher savings and investment rates, they recommended that governments should abolish interest rate controls and give up raising seignorage through inflationary monetary policies (Luintel & Khan, 1999). As a result, real interest rates will rise to the market clearing values. A positive real interest rate, in these models, increases financial depth through the increased volume of financial saving mobilisation and promotes growth through increasing the volume and productivity of capital. Higher real interest rates exert a positive effect on the average productivity of physical capital by discouraging investors from investing in low return projects (World Bank, 1989; Fry, 1995). Similarly, the endogenous growth literature also predicts a positive relationship between financial depth, real income, investment and real interest rate (King & Levine, 1993a). Well developed financial markets promote investment and growth by channelling financial resources to the most productive uses. Based on these theoretical postulates, consider an algebraic representation of the simplest endogenous growth model - the 'AK' model by Rebelo (1991) maximised for labour:

$$Y_t = AK_t^{\beta_1} \ell^{\varepsilon_t} \tag{1}$$

Where Y denotes the aggregate output at time t, K is the aggregate capital stock at time t, ℓ represents natural log and ε_t is an error term while A denotes total factor productivity growth (TFP). The TFP captures growth in output not

accounted for by increase in physical input (capital) in the model. Given that TFP is endogenously determined, the endogenous growth literature argues that financial deepening affects growth not only through capital accumulation but also through the TFP channel. This channel, suggests that an efficient financial system affects growth by facilitating the adoption of modern technology to boost development of the knowledge and technology-intensive industries. According to Durlauf, Johnson and Temple (2005), there are a large number of potential variables that affect TFP. However, due to data availability and following Christopoulos and Tsionas (2004) and Khan, Qayyum and Sheikh (2005), the study examined the following variables of interest resulting in:

$$A = f(FD, R, GOV) = FD^{\beta_2} R^{\beta_3} GOV^{\beta_4} \tag{2}$$

By substituting (2) into (1), we obtain;

$$Y_t = K_t^{\beta_1} FD_t^{\beta_2} R_t^{\beta_3} GOV_t^{\beta_4} \ell^{\varepsilon_t} \tag{3}$$

Where Y is economic growth, K is capital stock, FD is financial deepening, R is real interest rate and GOV is government expenditure.

Empirical model specification

Consistent with the objectives of the study and in accordance with the literature, the study applied natural logarithm to equation (3) and estimated a log-linear model of the following form:

$$\ln Y_t = \beta_0 + \beta_1 \ln K_t + \beta_2 \ln FD_t + \beta_3 R_t + \beta_4 \ln GOV_t + \varepsilon_t \tag{4}$$

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Where ln denotes natural logarithm, *Y*, *K*, *FD, R* and *GOV* have been defined already. The coefficients $\beta_1, \beta_2, \beta_3$ and β_4 are the elasticities of the respective variables, β_0 and α_0 are the drift components, *t* denotes time and ε is the error term. The following are expected $\beta_1 > 0, \beta_2 > 0, \beta_3 > 0$ and $\beta_4 > 0$. We applied natural logarithm in order to effectively linearise exponential trend (if any) in the time series data since the log function is the inverse of an exponential function (Asteriou & Price, 2007).

Justification and measurement of variables

Measuring Economic Growth (*Y*)

Economic Growth refers to sustained increases in the economy's real gross domestic product or national product overtime. Following standard practice, we use real per capita GDP (Y) as the measure for economic growth (Roubini & Sala-i-Martin, 1992; King & Levine, 1993a; Demetriades & Hussein, 1996; Levine et al, 2000). Real GDP per capita is real gross domestic product divided by population.

Measuring Financial Deepening (FD)

Financial development is usually defined as a process that marks improvement in quantity, quality, and efficiency of financial intermediary services. This process involves the interaction of many activities and institutions. Consequently, it cannot be captured by a single measure (Abu-Bader & Abu-

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Qarn, 2008). In this study, we employed two commonly used measures of financial development for the purpose of testing the sensitivity of our findings.

The first measure of financial deepening used is M2Y, which represents the ratio of money stock to GDP. It has been employed in most studies as the standard measure of financial deepening because it has been found to be a good one in some studies and in most cases data are readily available (World Bank, 1989; King & Levine, 1993a; Quartey & Prah, 2008). However, this ratio has been criticised as not been an entirely good measure of financial depth because it measures the extent of monetisation and economies with underdeveloped financial systems may have a high ratio of M2Y which may not measure financial depth, as money is used as a store of value in the absence of other more attractive alternatives (Demetriades & Hussein, 1996; Luintel & Khan, 1999). A high M2Y is expected to promote economic growth, all things been equal.

The second proxy is PRIVY, the ratio of credit to the private sector to GDP. Private credit is the credit extended to the private sector by commercial banks. This ratio stresses the importance of the role played by the financial sector, especially the deposit money banks, in the financing of the private economy. It isolates credit issued to the private sector from credit issued to governments, government agencies, and public enterprises. Also, it excludes credit issued by the Central Bank (Levine et al., 2000). This indicator is frequently used to assess the allocation of financial assets that M2Y cannot offer. An increase in private financial saving results in higher M2Y ratio, however, with high reserve requirements, credit to the private sector which eventually is responsible for the

quantity and quality of investment and therefore to economic growth, may not increase. A high PRIVY indicates a higher level of domestic investment, indicating higher output holding everything else constant. PRIVY has been used extensively in numerous works (Beck et al., 2000; Demetriades & Hussein, 1996; King & Levine, 1993a).

Thus *FD* entails increasing financial intermediation, raising pension funds, expanding bonds and equity markets and tapping international sources of capital. It is expected to stimulate economic growth by enlarging the services provided by financial intermediaries such as savings mobilisation, project evaluation, and risk management all things been equal. Consequently, the positive expected coefficient irrespective of the proxies used given that all things remain unchanged.

Other variables in the Model

Capital stock (*K*) is measured by the share of gross fixed capital formation to GDP and is expected to exert a positive impact on real GDP per capita. The higher the rate of investment, the higher the growth rate of the economy, all things being equal. This is in line with both the neoclassical and endogenous growth predictions.

The Real Deposit Rate (*R*) which is the rate paid by commercial or similar banks for demand, time or savings deposits deflated for inflation is used as a proxy for real interest rate (Acheampong, 2007; Jalil & Ma, 2008). *R* is expected

to have a positive impact on the output level in accordance with the theoretical predictions of the McKinnon-Shaw proposition.

Ratio of government expenditure to GDP (*GOV)* is commonly used as indicator of macroeconomic stability (Easterly & Rebelo, 1993; Levine et al., 2000). Government expenditure, according to the Keynesian proposition is expected to raise economic growth. It could, however, reduce economic growth because of the crowding out effect on private investment and the inflationary pressures it can lead to (Allen & Ndikumana, 2000). However, given that all things remain constant and following Keynesian proposition, we expect $\beta_4 > 0$. It is employed as a policy variable in our error correction formulation.

All variables are expressed as natural logarithms, with the exception of interest rate which is already in a preferred measure.

Sources of data

The study employed secondary data. Quarterly time series data were generated from the annual time series collected from 1983 to 2008 using Gandolfo (1981) algorithm. The choice of the data coverage was informed by the fact that it was extremely challenging getting data below 1984 on real deposit rate which is a key linking variable in the finance-growth nexus. Besides, the development of Ghana's financial sector undoubtedly started with the financial sector reforms in 1983. Thus any meaningful analysis of financial development and growth should start from the year of the reforms. The series were drawn from the Bank of Ghana and World Development Indicators (World Bank, 2010).

Estimation techniques

To test the direction of causality between financial development and economic growth the study applied Granger causality test within the framework of cointegration and error-correction models. The testing procedure involves the following steps. The study first investigated the time series properties of our data by using the Augmented Dickey–Fuller (ADF) and the Phillip-Perron (PP) tests. The unit root test was used to check the stationarity position of the data. In the second step, it tested for cointegration using Johansen's multivariate approach. In the third step, the study employed granger-causality to test for causality. The causality test is preceded by cointegration testing since the presence of cointegrated relationships have implications for the way in which causality testing is carried out. Finally, variance decomposition analysis and impulse response functions were conducted.

Unit Root Tests

It is crucial to test for the statistical properties of variables when dealing with time series data. Time series data are rarely stationary in level forms. Regression involving non-stationary time series often lead to the problem of spurious regression. This occurs when the regression results reveal a high and significant relationship among variables when in fact, no relationship exist. Moreover, Stock and Watson (1988) have also shown that the usual test statistics (t, F, DW, and R^2) will not possess standard distributions if some of the variables

in the model have unit roots. A time series is stationary if its mean, variance and autocovariances are independent of time.

The study employed a variety of unit root tests. This was done to ensure reliable results of the test for stationarity due to the inherent individual weaknesses of the various techniques. The study used both the PP and the ADF tests. These tests are similar except that they differ with respect to the way they correct for autocorrelation in the residuals. The PP nonparametric test generalises the ADF procedure, allowing for less restrictive assumptions for the time series in question. The null hypothesis to be tested is that the variable under investigation has a unit root against the stationarity alternative. In each case, the lag-length is chosen using the Akaike Information Criteria (AIC) and Swartz Information Criterion (SIC) for both the ADF and PP test. The sensitivity of ADF tests to lag selection renders the PP test an important additional tool for making inferences about unit roots. The basic formulation of the ADF is specified as follows:

$$\Delta X_t = \alpha + \delta t + \rho X_{t-1} + \sum_{i=1}^{P} \lambda_i \Delta X_{t-1} + \varepsilon_t \qquad (5)$$

Where X_t denotes the series at time t, Δ is the first difference operator, α, δ, β, λ are parameters to be estimated and ε is the stochastic random disturbance term. Thus, the ADF and the PP test the null hypothesis that a series contains unit (non-stationary) against the alternative hypothesis of no unit root (stationary). That is:

$H_0 : \rho = 0$

$H_1 : \rho \neq 0$

If the tau value or t-statistic is more negative than the critical values, the null hypothesis is rejected and the conclusion is that the series is stationary. Conversely, if the tau statistic is less negative than the critical values, the null hypothesis is accepted and the conclusion is that the series is non-stationary.

Johansen Multivariate Approach to Cointegration

A number of techniques for testing the presence of equilibrium long-run relationship among time series variables have been advocated and used by researchers. Most time series studies have used either the Engle-Granger (1987), the Fully Modified Ordinary Least Squares (FMOLS) procedures of Phillips and Hansen (1990), the Johansen (1988, 1991) or the Johansen and Juselius (1990, 1992) and the Autoregressive Distributed Lag (ARDL) approach by Pesaran and Shin (1999) and Pesaran, Shin and Smith (2001) to determine the long-run relationship in bivariate and multivariate frameworks. Johansen (1988) and Johansen and Juselius (1992) particularly developed multivariate method that explicitly used the vector autoregressive (VAR) and the vector error correction (VECM) framework for the testing of the presence of cointegration and estimation of long-run and short-run relationships among non-stationary macroeconomic time series. The VAR and VECM provide a useful framework to study the impact of unanticipated shocks (individual and system) on the endogenous variables (impulse response functions). Additionally, we can identify the relative importance of each variable in explaining the variations of endogenous variables (variance decomposition analysis). Moreover, both long-run

(cointegration) relationships and short-run dynamics of the variables in the system can be established. The relationship between VAR and VECM is expressed as follows. Assume an unrestricted reduced form VAR (p):

$$X_t = \mu + \theta_1 X_{t-1} + \ldots + \theta_k X_{t-k} + v_t, \qquad t = 1, 2, \ldots, n, \tag{6}$$

Where X_t is a 4 x1 vector of integrated series of order one (economic growth, capital formation, financial deepening and interest rate), μ is a vector of intercepts while v_t is a vector of error terms and k represents the lag length of the series. It is important to note that a VAR does not contain explanatory variables. Estimation of equation 6 requires that $v_t \sim ID(0, \Omega)$ where Ω is a non-diagonal covariance matrix that remains constant overtime. Following Johansen (1991) and provided that the variables are integrated of order one and cointegrated, further assuming Δ represent the first differences, equation 6 is transformed into an equilibrium error correction model of the form:

$$\Delta X_t = \mu + \Gamma_1 X_{t-1} + \Gamma_2 X_{t-2} + \ldots + \Gamma_{p-1} \Delta X_{t-p+1} + \Pi X_{t-1} + \varepsilon_t \tag{7}$$

Where $\Gamma_i = -(\theta_{i+1} + \ldots + \theta_k)$, $i = 1, \ldots, k-1$, and $\Pi_i = -(I - \theta_1 - \ldots - \theta_k)$. Γ_i represent a 4 x 4 matrix of coefficients of the first difference variables that capture the short-run dynamics. The coefficients of the lagged dependent variable indicate inertia as well as the formation of expectations. The coefficients of the other lagged endogenous variables provide estimates impact assessment. The coefficient matrix Π contains information about the long-run relationships among the variables involved in the model. Given that the rank of Π is $0 < r < n$, then it

can be decomposed into $\Pi = \alpha\beta$ and the error correction representation of equation 6 can be reformulated as:

$$\Delta X_t = \mu + \Gamma_1 X_{t-1} + \Gamma_2 X_{t-2} + ... + \Gamma_{p-1}\Delta X_{t-p+1} + \alpha(\beta' X_{t-p}) + \varepsilon_t \qquad (8)$$

Where the columns of β are interpreted as distinct cointegration vectors providing the long-run relationships $(\beta' X_t)$ among the variables, and the α's are the adjustment or error correction coefficients (loading matrix) indicating the adjustment to long-run equilibrium. One major problem in the estimation of VAR and VEC models is the selection of an appropriate lag length. Most researchers have selected lag lengths in an arbitrary way. The lag length plays a crucial role in diagnostic tests as well as in the estimation of VECM and VAR models (Bhasin, 2004). As a result, appropriate lag length (p) will be chosen using standard model selection criteria (AIC and SBC) that ensure normally distributed white noise errors with no serial correlation.

Johansen (1988) cointegration techniques allow us to test and determine the number of cointegrating relationships between the non-stationary variables in the system using a maximum likelihood procedure. In making inferences about the number of cointegrating relations, Johansen (1988, 1991) and Johansen and Juselius (1990) proposed the use of two test statistics: the trace statistic and the maximum Eigen value statistic. The trace statistic is determined using the following formula:

$$\lambda_{trace} = -T \sum_{i=r+1}^{n} \log(1 - \lambda_i) \qquad r = 0, 1, 2, ..., \text{n-1} \qquad (9)$$

T = number of observations

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λ_i = is the ith Eigen value.

The maximum Eigen value statistic is determined using the following formula:

$$\lambda_{max} = - T \log (1 - \lambda_{r+1}) \qquad r = 0,1,2, \dots, n-2, n-1 \qquad (10)$$

The trace and maximum Eigen value statistics are compared with the critical values tabulated in Osterwald-Lenum (1992).

Granger Causality Test

    The study of causal relationships among economic variables has been one of the main objectives of empirical econometrics. According to Engle and Granger (1987), cointegrated variables must have an error correction representation. One of the implications of Granger representation theorem is that if non-stationary series are cointegrated, then one of the series must granger cause the other (Gujarati, 2001). To examine the direction of causality in the presence of cointegrating vectors, Granger causality is conducted based on the following:

$$\Delta Y_t = \mu_0 + \sum_{i=1}^{p} \beta_{1i} \Delta Y_{t-i} + \sum_{i=0}^{p} \phi_{1i} \Delta X_{t-i} + \xi_{1i} ECT_{t-1} + v_t \qquad (11)$$

$$\Delta X_t = \mu_0 + \sum_{i=1}^{p} \beta_{2i} \Delta X_{t-i} + \sum_{i=0}^{p} \phi_{2i} \Delta Y_{t-i} + \xi_{2i} ECT_{t-1} + u_t \qquad (12)$$

Where ΔY and ΔX are our non-stationary dependent and independent variables, ECT is the error correction term, ξ_{1i} and ξ_{2i} are the speed of adjustments. p is the optimal lag order while the subscripts t and $t\text{-}i$ denote the current and lagged values. If the series are not cointegrated, the error correction terms will not appear in equations 11 and 12. To find out whether the independent variable (X) granger-

causes the dependent variable (Y) in equation 11, we examine the joint significance of the lagged dynamic terms by testing the null hypothesis:

$H_0 : \phi_{1i} = 0$, implying that the independent variable (X) does not granger-cause the dependent variable (Y), against the alterative hypothesis that

$H_1 : \phi_{1i} \neq 0$, implying that the independent variable (X) granger-cause the dependent variable (Y).

Similarly, to find out whether the independent variable (Y) granger-cause the dependent variable (X) in equation 12, we examine the significance of the lagged dynamic term by testing the null hypothesis

$H_0 : \phi_{2i} = 0$, implying that the independent variable (Y) does not granger-cause the dependent variable (X), against the alterative hypothesis that

$H_1 : \phi_{2i} \neq 0$, implying that the independent variable (Y) granger-cause the dependent variable (X).

Using the standard F-test or Wald statistic, four possibilities exist: First, rejection of the null hypothesis in equation 11 but failing to reject the null in equation 12 at the same time implies unidirectional causality running from X to Y. Second, a rejection of the null hypothesis in equation 12 but at the same time failing to reject the null in equation 11 implies unidirectional causality running from Y to X. Third, simultaneous rejection of the two null hypotheses indicates bi-directional causality. Fourth, simultaneous failure to reject the two null hypotheses indicates independence or no causality between the variables of interest.

Variance Decomposition

The forecast error variance decomposition provides complementary information for a better understanding of the relationships between the variables of a VAR model. It tells us the proportion of the movements in a sequence due to its own shock, and other identified shocks (Enders, 2004). While impulse response functions trace the effects of a shock to one endogenous variable on to the other variables in the VAR, variance decomposition separates the variation in an endogenous variable into the component shocks to the VAR. Therefore variance decomposition provides information about the relative importance of each variable in explaining the variations in the endogenous variables in the VAR. To assign variance shares to the different variables, the residuals in the equations must be orthogonalised. Therefore, the study applied the Cholesky decomposition method.

Impulse Responses

In order to analyse the impact of unanticipated shocks emanating from other variables in the VAR to one endogenous variable, the study conducted the impulse response functions. The impulse response function traces the effect of each shock on each variable in the VAR over a given time horizon. A shock to the ith variable directly affects the ith variable and is also transmitted to all the endogenous variables through the dynamic structure of the VAR (Enders, 2004). This information will help policy makers to predict the consequences of unanticipated shocks so that they can better react to these changes in future.

Data analysis

The study employed both descriptive and quantitative analysis. Charts such as graphs and tables were employed to aid in the descriptive analysis. Unit root tests were carried out on all variables to ascertain their order of integration. Furthermore, the study adopted the multivariate Johansen's maximum likelihood econometric methodology for cointegration introduced and popularised by Johansen (1988), Johansen and Juselius (1990) and Johansen (1991) to obtain both the short and long-run estimates of the variables involved. All estimations were carried out using Econometric views (Eviews) 5.0 package.

Conclusion

This chapter developed and presented the methodological framework suitable for conducting the study. The model was developed from the theoretical formulations of both the endogenous growth and the Mackinnon-Shaw theories. Specifically, the study adopted the augmented form of the simplest endogenous growth model by Rebelo (1993). Quarterly time-series data on real GDP per capita, real deposit rate, broad money supply to GDP ratio, credit to private sector to GDP ratio, gross fixed capital formation to GDP ratio and government expenditure to GDP ratio from 1983 to 2008 was employed for the study. Stationarity test was conducted using ADF and PP tests. Moreover, Johansen cointegration test, VAR and VECM were used to examine the long-run and short-run dynamics among the variables. Variance decomposition analysis was employed to determine the relative contributions of each endogenous variable to

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the forecast error variance of a targeted variable. Impulse response was conducted

in order to trace the effects of a shock to one endogenous variable on to the other

variables in the VAR. Finally, the chapter used the Granger-causality technique to

determine whether the direction of causality between financial deepening and

economic growth would change given the proxy used as an indicator of financial

deepening.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

The objective of this study is to investigate the long-run relationship between economic growth and financial deepening as well as establish the causal relationship between them. This chapter, therefore, presents and discusses the results from the study. The results of the descriptive statistics of the relevant variables, both ADF and PP unit root tests, Johansen's approach to cointegration, Granger-causality test and variance decomposition analysis are presented and discussed. These results are discussed in relation to the hypotheses of the study.

Descriptive statistics

The study conducted the descriptive statistics of the relevant variables involved. Table 4 illustrates vividly these statistics. It can be observed from Table 4 that all the variables with the exception of real deposit rate (R) have positive average values (means). This is not strange considering that R is a rate that could assume negative values. The minimal deviation of the variables from their means with the exception of R as shown by the standard deviation gives indication of slow growth rate (fluctuation) of these variables over the period.

Table 4: Summary statistics

	LY	LK	LM2Y	LPRIVY	LGOV	R
Mean	0.0409	0.0151	0.0104	0.0152	0.0055	-0.0082
Median	0.0408	0.0165	0.0099	0.0153	0.0033	-0.0043
Maximum	0.04378	0.0215	0.0157	0.0217	0.0192	0.0397
Minimum	0.0387	0.0036	0.0050	0.0086	-0.0073	-0.0707
Std. Dev.	0.0013	0.0043	0.0021	0.0035	0.0065	0.0230
Skeweness	0.3343	-0.6196	0.4849	-0.1077	0.1055	-0.1954
Kurtosis	2.2765	2.4368	3.3174	1.8916	1.8786	2.6367
Jarque-Bera	3.8813	7.4124	4.1643	5.1001	5.2085	1.1387
Probability	0.1436	0.0246	0.1247	0.0780	0.0739	0.5659
Sum	3.9305	1.4505	1.0031	1.4628	0.5300	-0.7897
Sum Sq. Dev.	0.0002	0.0018	0.0004	0.0012	0.0040	0.0503
Observations	96	96	96	96	96	96

Note: Std. Dev. represents Standard Deviation while Sum Sq. Dev. represents

Sum of Squared Deviation

Source: computed using Eviews 5.0 Package

Table 4 shows that R exhibits wide deviation from its mean. Again, most of the variables show signs of positive skeweness. The Jarque-Bera statistic show that the null hypothesis that the series are drawn from a normally distributed random process cannot be rejected for GDP per capita (Y), government expenditure to GDP (GOV) and real deposit rate (R).

Unit root tests

Before applying the Johansen's multivariate approach to cointegration and Granger-causality test, unit root test was conducted in order to investigate the stationarity properties of the data. As a result, all the variables were examined by first inspecting their trends graphically (Appendix C). From the graphs in Appendix C, it can be seen that, all the variables except real deposit rate appear to exhibit behaviours of non-stationary series. However, the plots of all the variables in their first differences exhibit some stationary behaviour. Additionally, the Augmented Dickey-Fuller (ADF) and Phillips and Perron (PP) tests were applied to all variables in levels and in first difference in order to formally establish their order of integration. The Schwartz-Bayesian Criterion (SBC) and Akaike Information Criterion (AIC) were used to determine the optimal number of lags included in the test. The study presented and used the P-values for making the unit root decision which arrived at similar conclusion with the critical values. The results of both tests for unit root for all the variables at their levels with intercept and trend and their first difference are presented in Tables 5 and 6:

Table 5: Unit root test: ADF Test for the order of integration

Levels (Trend & Intercept)			1st Difference (Trend & Intercept)			
Var.	ADF-Statistic	Lag	Var.	ADF-Statistic	Lag	*IO*
LY	1.618855 (1.0000)	1	DLY	-4.2748 (0.005)***	3	*I*(1)
LPRIVY	-2.855842 (0.1819)	5	DLPRIVY	-6.2010 (0.000)***	7	*I*(1)
LM2Y	-3.141270 (0.1036)	9	DLMY	-3.6942 (0.028)**	8	*I*(1)
LK	-2.045975 (0.5679)	4	DLK	-5.3165 (0.000)***	4	*I*(1)
LGOV	-2.039344 (0.5718)	5	DLGOV	-3.2305 (0.085)*	4	*I*(1)
R	-2.264418 (0.4486)	4	DR	-4.3710 (0.0039)***	4	*I*(1)

Note: *IO* represents order of integration and D denotes first difference. ***, **
and * represent significance at the 1%, 5% and 10% levels respectively.
Source: computed using Eviews 5.0 Package

Table 6: Unit root test: PP Test for the order of integration

Levels (Trend & Intercept)			1st Difference (Trend & Intercept)			
Var.	PP-Statistic	BWd	Var.	PP-Statistic	BWd	*OI*
LY	2.348832(1.0000)	4	DLY	-4.8132 (0.0009)***	5	*I*(1)
LPRIVY	-2.731265(0.2268)	5	DLPRIVY	-5.2039(0.0002)***	4	*I*(1)
LM2Y	-3.426586(0.5300)	4	DLM2Y	-5.6591(0.0000)***	4	*I*(1)
LK	-3.388919(0.5900)	4	DLK	-6.0921(0.0000)***	3	*I*(1)
LGOV	-2.099176(0.5394)	6	DLGOV	-4.0183(0.0112)**	5	*I*(1)
R	-3.407688(0.0564)*	5	DR	-5.0367(0.0004)****	4	*I*(0)

Note: *** and ** represent significance at the 1% and 5% levels respectively.
BWd is the Band Width. The values in parenthesis are the P-values.

Source: computed using Eviews 5.0 Package

From the results of the unit root test in Tables 5 and 6, it can be observed that at levels, the null hypothesis of the presence of unit root for all the variables with the exception of real interest rate cannot be rejected since the P-values of the ADF and the PP statistic are not significant at all the conventional levels of significance. With the interest rate variable, ADF showed it was not stationary at level but PP indicated stationarity at level. However, at first difference, all the variables are stationary since the unit root hypothesis could be rejected for all the variables. It is therefore clear that all the variables are integrated of order one $I(1)$. Therefore, in order to eliminate the possibility of spurious regression results, the first difference of the variables should be employed in the estimation process.

Johansen maximum likelihood test for cointegration

Contributing to the significance and rational for cointegration analysis, Johansen (1991) argued that cointegration can be used to establish whether there exists a linear long-term economic relationship among variables of interest. Pesaran and Shin (1995) added that cointegration enable researchers determine whether there exists disequilibrium in various markets. In this regard, Johansen (1991) asserts that cointegration allows us to specify a process of dynamic adjustment among the cointegrated variables and in disequilibrated markets. Given that the series are $I(1)$, the results of both the trace and maximum-eigenvalue statistic of the Johansen cointegration test when credit to private sector to GDP (PRIVY) was employed as a proxy for financial deepening as presented in Appendix D are vividly displayed in Tables 7 and 8.

Table 7: Johansen's cointegration test (Trace) results

Hypothesised No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	P-Value
None	0.605831	107.7292	54.07904	0.0000***
At most 1	0.152885	23.01054	35.19275	0.5277
At most 2	0.052024	7.911917	20.26184	0.8315
At most 3	0.032963	3.050145	9.164546	0.5714

Note: *** indicates rejection of the null hypothesis. The Trace statistic indicates 1 cointegrating equation at 1% level of significance

Table 8: Johansen's cointegration test (Maximum Eigenvalue)

Hypothesised No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	P-Value
None	0.605831	84.71866	28.58808	0.0000***
At most 1	0.152885	15.09862	22.29962	0.3670
At most 2	0.052024	4.861771	15.89210	0.8999
At most 3	0.032963	3.050145	9.164546	0.5714

Note: *** indicates rejection of the null hypothesis at 1% level of significance.

Source: computed using Eviews 5.0 Package

From Tables 7 and 8, the results of both the trace statistic and the maximum-eigenvalue statistic indicate the presence of cointegration among the variables when credit to private sector to GDP is used to proxy financial

deepening. Specifically, the null hypothesis of no cointegrating relationship is rejected since the computed values of the trace and the maximum-eigenvalue statistics of 107.7292 and 84.71866 are greater than their respective critical values. The P-value of 0.0000 further confirms the rejection of the null hypothesis at 1 percent significance level by both trace and the maximum-eigenvalue statistics implying the failure to reject the alternative hypothesis of at most one cointegrating relationship. This confirms the existence of a stable long-run relationship among economic growth (Y) as measured by real GDP per capita, financial development as measured by the ratio of credit to private sector to GDP (PRIVY), capital stock as measured by the share of gross fixed capital formation to GDP (K) and real interest rate as measured by real deposit rate (R).

Empolying the ratio of broad money to GDP (M2Y) as a proxy for financial deepening and estimating a separate economic growth equation, the results of Johansen Maximum Likelihood Cointegration test are displayed in Tables 9 and 10 respectively. It can be observed that the results of both the trace statistic and the maximum-eigenvalue statistic from Tables 9 and 10 indicate no cointegration when broad money to GDP was used as an indicator of financial deepening. The null hypothesis of no cointegrating relationship could not be rejected since the calculated trace and the maximum-eigenvalue statistics of 47.67556 and 21.08302 are less than their respective critical values. This is confirmed by the P-values being insignificant at all the conventional levels of significance for both the trace and the maximum-eigenvalue statistics.

Table 9: Johansen's cointegration test (Trace) results

Hypothesised No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	P-Value
None	0.208841	47.67556	54.07904	0.1646
At most 1	0.134877	26.59253	35.19275	0.3098
At most 2	0.098940	13.55302	20.26184	0.3213
At most 3	0.045346	4.176544	9.164546	0.3865

The Trace statistic indicates no cointegrating equation at the 0.05 critical values

Table 10: Johansen's cointegration test (Maximum Eigenvalue)

Hypothesised No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	P-Value
None	0.208841	21.08302	28.58808	0.3338
At most 1	0.134877	13.03951	22.29962	0.5529
At most 2	0.098940	9.376473	15.89210	0.3945
At most 3	0.045346	4.176544	9.164546	0.3865

The Maximum Eigenvalue statistic indicates no cointegrating equation at the 0.05 critical values.

Source: computed using Eviews 5.0 Package

The implication is that there exist no long-run relationship among economic growth (Y), financial development (M2Y), capital stock (K) and real interest rate (R).

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Long-run estimates

Given the results of the cointegration analysis, we can only establish a long-run relationship in the model in which financial deepening has been proxied by credit to private sector to GDP (PRIVY). In order to establish the long-run equation, Eviews automatically normalises the first variable in the VAR which is the growth variable. This variable is also of considerable interest to the study. The estimated long-run equilibrium relationship for economic growth (GDP per capita) derived from the normalised vectors, with standard errors in brackets and the t-statistics in parenthesis is expressed as follows:

$$LY \ = \ 3.689145 \ + \ 0.180234 \ LK \ + \ 0.066511 \ LPRIVY \ - \ 0.001674 \ R \qquad (13)$$
$$(0.01599) \qquad (0.01147) \qquad (0.00864) \qquad (0.00136)$$
$$[230.7158] \qquad [15.7135] \qquad [7.6980] \qquad [1.2309]$$

From equation 13, it can be observed that the ratio of credit to private sector to GDP (PRIVY) and the share of gross fixed capital formation to GDP (K) have the expected positive sign and exert statistically significant effect on real GDP per capita (Y) in the long-run. The constant is also positive and statistically significant. However, the results show theoretically incorrect sign for real interest rate (R).

Holding the influence of all the variables in the model constant, the positive and statistically significant constant term implies that the Ghanaian

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economy will grow by approximately 3.7 percent due to the influence of all other variables that are not included in the model.

The positive and statistically significant results of gross fixed capital formation to GDP (K) confirm the theoretical postulation that capital stock contributes positively to growth of the economy (real GDP per capita) The coefficient of 0.180234 indicates that a 1 percent change in capital input results in a 0.18 percent change in real GDP per capita. This means that in the long-run, a 1 percent increase in investment in physical capital has the potential of stimulating economic growth in Ghana by about 0.18 percent. Its statistical significance is shown by the t-statistic approximating 16. This result is consistent with conclusions by Aryeetey and Fosu (2005) as well as Fosu and Magnus (2006) in the case of Ghana.

The positive and statistically significant effect of the ratio of credit to private sector to GDP (PRIVY) is consistent with the predictions of the endogenous growth theorists as well as the supply leading view of the relationship between financial development and economic growth. Both the McKinnon-Shaw and the Endogenous growth theorists predict that financial deepening affects growth through investment. The endogenous growth theory emphasises the role of the financial sector in promoting innovations, income distribution and the speed of technological progress, thus contributing to long-term economic growth (King & Levine, 1993a). Consistent with the endogenous growth theory, the financial sector promotes long-run economic growth through two major channels: the volume of investment and the efficiency of investment. This has been totally

validated since the ratio of gross fixed capital formation to GDP (K) exerts a positive and statistically significant effect on economic growth. The positive effect of the ratio of credit to private sector to GDP (PRIVY) on economic growth (Real GDP per capita) could therefore, be viewed from the positive influence of investment on economic growth. The coefficient of the financial development variable (PRIVY) implies that a 1 percent increase in PRIVY increases real GDP per capita by 0.07 percent. The results accord with the findings of Khan and Qayyum (2006) for Pakistan and Quartey and Prah (2008) in Ghana but contradict the findings by Esso (2010) and Ahmed (2008) for Sierra Leone. Ahmed (2008) found negative but significant relationship for Sierra Leone when private sector credit was used. The findings by Esso (2010) showed negative impact of financial development on real GDP per capita in the long-run.

The results could not however, validate the McKinnon-Shaw (MS) predictions. This is because real interest rate as measured by real deposit rate (R) exerted negative impact on economic growth though not statistically significant since the t-statistic of 1.2 is very low considering the rule of thumb value of two (2). This finding is however, consistent with the argument of the Keynesian school of thought that negative income effect dominates the positive substitution effect leading to a decrease in investment and ultimately a fall in output. The results concur with those by Ang and McKibbin (2005) for Malaysia and Arestis et al. (2001) for Greece, India and the Philippines. It however contradicts studies by Odhiambo (2009) for Kenya. The magnitude of the coefficient implies that an

increase in real interest rate by 1 percent will reduce real GDP per capita by 0.002 percent, if all things remain constant.

Short-run dynamics

Engle and Granger (1987) argued that when variables are cointegrated, their dynamic relationship can be specified by an error correction representation in which an error correction term (ECT) computed from the long-run equation must be incorporated in order to capture both the short-run and long-run relationships. The error correction term indicates the speed of adjustment to long-run equilibrium in the dynamic model. In other words, its magnitude shows how quickly variables converge to equilibrium when they are disturbed. It is expected to be statistically significant with a negative sign. The negative sign implies that any shock that occurs in the short-run will be corrected in the long-run. The larger the error correction term in absolute value, the faster the convergence to equilibrium. Given that our variables are non-stationary but cointegrated, estimation of the VECM, which included a first differenced VAR with one period lagged error correction term yielded an over-parameterised model. To arrive at a more parsimonious model, insignificant variables were deleted using the rule of thumb against the t-ratios. The reduce form model is presented in Table 11.

The results from the vector error correction model as displayed in Table 11 suggest that the ultimate effect of previous periods' values of real GDP per capita on current values of real GDP per capita in the short-run is positive and significant.

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Table 11: Results of error-correction model (VECM)

Variable	Coefficient	Std Error	t-value
DLY_1	0.662750	0.09480	6.99107
DLY_4	-0.716418	0.08448	-8.48012
DLY_5	0.378292	0.11420	3.31262
DLPRIVY_4	-0.009742	0.00240	-4.06336
DLPRIVY_5	0.008242	0.00279	2.95253
DLK_4	-0.006035	0.00284	-2.12533
DLK_5	0.008169	0.00296	2.76198
DR_4	-0.000482	0.00021	-2.26609
ECT_1	0.029171	0.00816	3.57326
R-Squared	0.875392		
Adjusted R-Squared	0.834476		
Residual Serial Correlation LM	18.80862(0.278)		
Residual Heteroskedasticity (Chi-sq)	498.3631(0.1051)		

Source: Computed using Eviews 5.0 Package

The implication is that current values of real GDP per capita are affected by previous quarters' values of real GDP per capita. This is expected in that previous growth and expansion of the economy serves as an indication of prosperity and may attract more investment leading to more growth.

The study also found that in the short-run, although financial deepening (PRIVY) negatively affects economic growth in the fourth quarter, it improves

economic growth in the subsequent period. For example, in the fifth quarter, the magnitude of 0.3783 implies that a 1 percent increase in PRIVY will increase growth by approximately 0.38 percent. This is in line with the proposition that positive and significant impact of financial deepening on growth is a long-run phenomenon.

Moreover, the short-run results indicate that gross fixed capital formation to GDP despite exhibiting a negative effect on economic growth in the fourth quarter, had a more significant positive effect on economic growth in the fifth quarter. The cumulative effect of capital stock on economic growth in the short-run is positive and significant comparing both the magnitudes of the estimates and the t-ratios. This is also consistent with the findings from the long-run model.

Furthermore, real interest rate exerts a negative but significant effect on economic growth confirming the results from the long-run estimation. This result concurs with findings by Jalil and Ma (2008). The ratio of government expenditure to GDP (GOV) which served as an exogenous variable was deleted because it was statistically insignificant although it exerted a positive impact on economic growth. This could be due to the fact that most of the expenditure could have been directed towards profligate spending that did not add much to the real sector.

Indeed, Bannerjee, Dolado and Mestre (1998) asserted that a highly significant error correction term further confirms the existence of a stable long-run relationship. The coefficient of the lagged error correction term for economic growth is statistically significant taking into consideration its t-ratio although it

does not carry the expected negative sign. In such a case, Amiruddin, Mohd Nor and Ismail (2007) note that even though the variables adjust in the long-run, their values are too high to be in equilibrium when disturbed. The speed of adjustment of economic growth in the long-run is 2.92 percent per quarter. The implication is that economic growth remains in disequilibrium or divert from its long-run steady state for a number of quarters (Bhasin, 2004). This is as a result of the fact that the real side of the economy is saddled with sticky expectations, which may tend to stifle production and productivity (Acheampong, 2007).

In a study aimed at testing the McKinnon-Shaw hypothesis in Ghana, Acheampong (2007) found the speed of adjustment to be positive and statistically significant for economic growth and savings. Bhasin (2004) studying the interrelationship among exchange rate, price level and terms of trade found a positive and statistically significant error correction term for the domestic price level equation. This finding is also in consonance with the Schumpeter's argument that technological shocks (innovations) especially in the real sectors of the economy create imbalances and obscure the tendency of the sectors to revert to equilibrium in the long-run.

Evaluation of vector autoregressive model

Since the estimation of a VAR is a means to analysing impulse response functions and variance decompositions, inappropriately estimated VAR will render the impulse response and variance decomposition invalid. The study

therefore conducted the diagnostic tests of the VAR. The results are summarised in Table 12.

Table 12: VAR diagnostic test

Diagnostic	Statistic	Conclusion
Stability condition	Highest Root is 0.995656	VAR is stable
Lag Exclusion Test	Chi-square =180.1496	6 lags are important
	p-value = 0.0000	and valid
Serial Correlation	LM test statistic = 5.592593	No serial correlation
	p-value = 0.9919	at lag order 6
Multivariate Normality	Jarque-Bera test = 12.14009	Residuals are
	p-value = 0.1451	normal
Heteroscedasticity	Chi-square = 505.7371	Residuals are not
	p-value = 0.2011	heteroskedastic

Source: conducted using Eviews 5.0 package

The results from Table 12 indicate that the VAR passes all the diagnostic test of stability, lag exclusion, residual serial correlation, residual multivariate normality and residual hetroscedasticity.

One other problem in the estimation of VAR models is the selection of an appropriate lag length. The lag length plays a crucial role in diagnostic tests as

well as in the estimation of VAR models for cointegration, impulse response and variance decomposition (Bhasin, 2004). Appropriate lag length (p) is chosen using standard model selection criteria (AIC and SBC) that ensure normally distributed white noise errors with no serial correlation. The results of the VAR lag selection criteria are presented in Table 13.

Table 13: VAR lag order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-73.53799	NA	6.85e-05	1.762227	1.874833	1.807593
1	554.4041	1184.527	6.25e-11	-12.14555	-11.58252	-11.91872
2	613.4741	106.0576	2.35e-11	-13.12441	-12.11096	-12.71612
3	619.9055	10.96262	2.94e-11	-12.90694	-11.44306	-12.31718
4	623.5701	5.913271	3.94e-11	-12.62659	-10.71229	-11.85537
5	718.8415	145.0723	6.61e-12	-14.42822	-12.06348	-13.47552
6	796.4647	111.1424*	1.67e-12*	-15.8287*	-13.0136*	-14.6946*
7	807.0096	14.13973	1.97e-12	-15.70476	-12.43918	-14.38914
8	816.1454	11.41972	2.42e-12	-15.54876	-11.83275	-14.05167

* indicates lag order selected by the criterion

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

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Source: computed using Eviews 5.0 Package

It can be observed from the VAR lag selection criteria presented in Table 13 that there are asterisks attached to some statistics of the five lag selection criteria (AIC, LR, SC, FPE and HQ). Tracing these statistics against the first column labeled 'lag' shows that they coincide with lag 6. This implies that the appropriate lag length chosen is 6.

Variance decomposition analysis

Following the VAR estimation, the study decomposed the forecast error variance by employing Sim's Recursive Cholesky decomposition method. The forecast error variance decomposition provides complementary information for a better understanding of the relationships between the variables of a VAR model. It tells us the proportion of the movements in a sequence due to its own shock, and other identified shocks (Enders, 2004). Thus, the variance decomposition analysis will enable us identify the most effective instrument for each targeted variable based on the share of the variables to the forecast error variance of a targeted variable. The results of the forecast error variance decomposition of the endogenous variables, at various quarters are shown in Table 14.

Table 14: Results of variance decomposition

Variables	Quarters	LY	LPRIVY	LK	R
DLY	2	98.16407	0.068602	1.611947	0.155381
	4	90.93561	0.440029	8.102566	0.521790
	8	44.43801	14.82613	32.57953	8.156330
	12	40.40966	13.56453	28.38324	17.64257
	16	36.10661	11.77952	29.97575	22.13812
	20	34.63827	11.78220	29.55118	24.02835
DLPRIVY	2	6.946655	92.83075	0.005473	0.217120
	4	6.951671	92.01709	0.003369	1.027869
	8	23.40871	62.18886	0.387054	14.01537
	12	24.35412	59.02066	3.453253	13.17197
	16	24.69326	61.75000	4.220686	9.336053
	20	28.26825	61.36022	3.991416	6.380118
DLK	2	0.884521	1.687109	97.33817	0.090195
	4	5.833756	3.661764	88.56414	1.940342
	8	42.24455	3.393697	51.42716	2.934596
	12	34.86548	11.38211	43.07028	10.68213
	16	32.14967	29.60101	29.74353	8.505784
	20	33.68933	30.40171	27.82380	8.085155

Table 14: Results of variance decomposition

DR					
DR	2	6.270395	1.160012	8.057578	84.51201
	4	3.340630	0.430441	5.706587	90.52234
	8	6.900164	0.385784	9.450362	83.26369
	12	10.77694	22.73357	6.850605	59.63888
	16	8.861429	46.86070	7.832870	36.44500
	20	7.750473	53.64929	6.848220	31.75202

CHOLESKY ORDERING: LY LPRIVY LK LR

Source: Computed using Eviews 5.0 Package

Table 14 depicts that the largest source of variations in GDP per capita's forecast error is attributable to its own shocks. The innovations of gross fixed capital formation to GDP, real deposit rate and credit to private sector to GDP are other important sources of the forecast error variance of GDP per capita. The ratio of credit to private sector to GDP contributed least to the forecast error variance from the second quarter up to the fourth quarter. It however, contributed about 14.83 percent compared to the contribution of about 8.16 percent by real deposit rate. The results suggest that all the three variables played a part in economic growth with the most effective variable being the ratio of gross fixed capital formation to GDP.

In explaining the forecast error variance of financial deepening, it can be observed that the innovations of economic growth (Y) are next to its own shocks contributing about 6.95 percent and 28.27 percent in the fourth and twentieth quarters respectively. The other important variable for the forecast error variance

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of financial deepening seems to be the interest rate. The source of least forecast error variance of financial deepening is the innovations of the capital stock throughout the quarters. Growth and interest rate seem to be the most effective variables in affecting financial deepening.

While looking at the decomposition of the forecast error variance of capital stock, the study observed that the innovations of economic growth (Y) and financial deepening (PRIVY) contributed largely besides its own shocks. The source of least forecast error variance of capital stock seemed to be the innovations of the interest rate.

As vividly displayed by Table 14, the forecast error variance of interest rate is largely explained by the innovations of its own shocks. Capital stock seems to explain a greater portion of the forecast error variance of interest rate in the early quarters/horizon. In the quarters thereafter, financial deepening and economic growth largely explains the forecast error variance of interest rate. Therefore, the source of greater forecast error variance of interest rate in the medium term and long term horizons are the innovations of financial deepening and economic growth.

Impulse response functions

It is generally argued that unanticipated shocks in the financial sector that arise from credit to private sector or real interest rate or investment or other sources can lead to disturbances in the real sector of the economy. The effect of these unanticipated shocks on the stability of the economy (deviation of the short-

run equilibrium values from the long-run equilibrium values) can be ascertained from the impulse response functions from a VAR model. If the response is such that the short-run values converge to the long-run values, then it can be deduced that stability can be achieved in the future (Bhasin, 2004). The conclusion from the short-run estimates that no adjustment to equilibrium will occur in the long-run can, therefore, be ascertained from the results of the impulse response analysis. The impulse responses of the real GDP per capita owing to one standard deviation shock in the innovations of the ratio of credit to private sector to GDP, ratio of gross fixed capital formation to GDP and real deposit rate extracted from the complete results in Appendix E, are presented in Figure 3. The functions are discussed as they appear in the figure.

Considering the response of real GDP per capita to gross fixed capital formation, it is evident from Figure 3 that any unanticipated increase in the ratio of gross fixed capital formation to GDP will increase the deviation between the short-run equilibrium values of the real GDP per capita and its long-run equilibrium values in the short-term horizon and after the twelfth quarter. However, the deviation seems to be closing up from the eighth to the twelfth quarters even though it does not show signs of adjustment to equilibrium.

Similarly, any unanticipated increase in the ratio of credit to private sector to GDP will increase the deviation between the short-run equilibrium value of the real GDP per capita and its long-run equilibrium value into the eighth quarter and thereafter maintains a constant deviation.
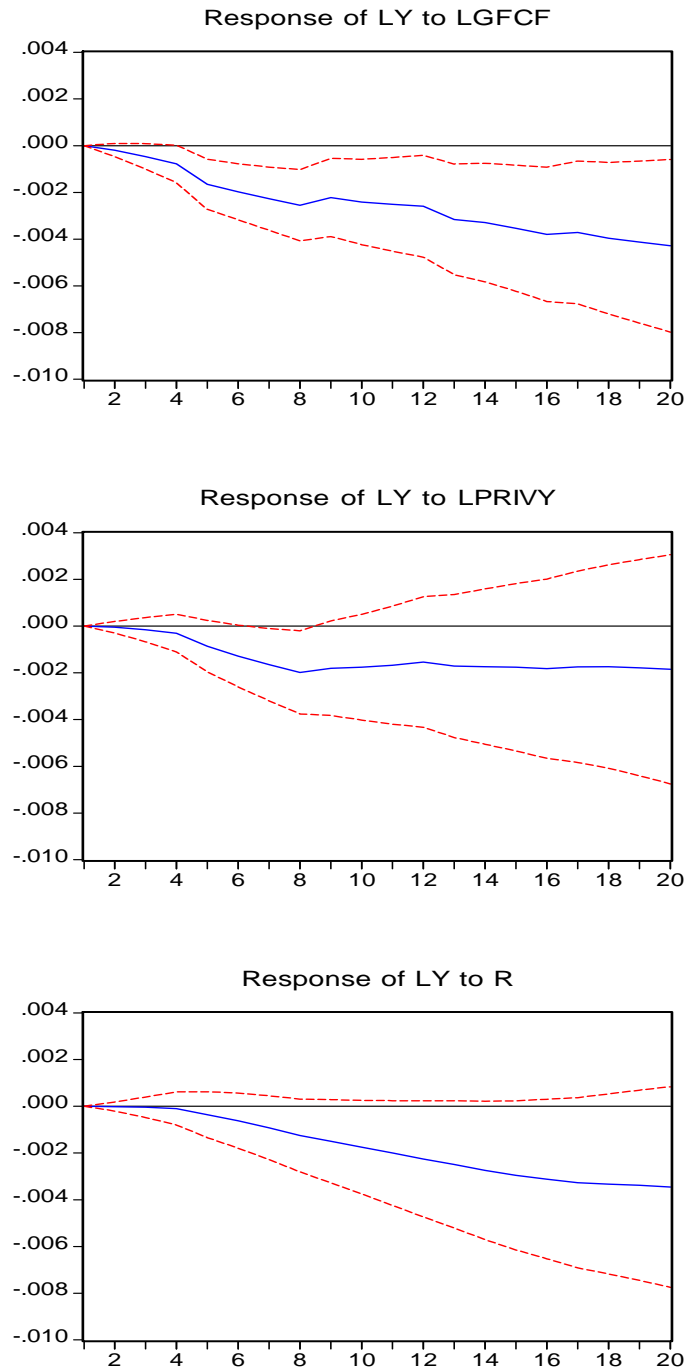
Response to Cholesky One S.D. Innovations ± 2 S.E.

Figure 3: Selected impulse response functions from the VAR model

Source: Generated from WDI (2010) using Eviews 5.0 Package

However, real GDP per capita when disturbed by a shock in the ratio of credit to private sector to GDP could not be stabilised within a period of 20 quarters.

Regarding the impact of unanticipated shock from the real deposit rate on the real GDP per capita, Figure 3 shows that any unanticipated increase in the real deposit rate will increase the deviation between the short-run equilibrium value of the real GDP per capita and its long-run equilibrium value throughout the 20 quarters under consideration.

The results of the impulse response further confirm the VECM results that a disequilibrium resulting from the short-run will not be corrected in the long-run.

Granger-causality test

To find out whether the direction of causality will be affected given the indicators of financial deepening, the study used the ratios of credit to private sector to GDP (PRIVY) and broad money supply to GDP (M2Y) as alternative indicators. The study conducted both the pairwise and the VECM based Granger causality tests for the purpose of comparison when financial deepening was proxied by PRIVY. The VECM based Granger causality was employed together with the pairwise Granger causality test on the basis that the use of the simple pairwise Granger causality has been identified as not sufficient if variables are $I(1)$ and cointegrated (Shan & Morris, 2002). Despite the differences in the estimates, both approaches arrived at similar conclusions. Table 15 presents the

pairwise Granger causality results when PRIVY was used to proxy financial deepening.

Table 15: Granger causality between growth and financial deepening (PRIVY)

Null Hypothesis:	F-Statistic	Probability
PRIVY does not Granger Cause Y	2.43633	0.03288**
Y does not Granger Cause PRIVY	3.98986	0.00157***
K does not Granger Cause Y	2.31135	0.04186**
Y does not Granger Cause K	1.94260	0.08445*
R does not Granger Cause Y	0.91490	0.48894
Y does not Granger Cause R	2.05936	0.06776*
K does not Granger Cause PRIVY	0.39399	0.88076
PRIVY does not Granger Cause K	1.29779	0.26832
RDP does not Granger Cause PRIVY	6.57088	0.0000***
PRIVY does not Granger Cause R	6.66852	0.0000***
R does not Granger Cause K	1.04209	0.40491
K does not Granger Cause R	6.17615	0.0000***

Note: *, ** and *** denote rejection of null hypothesis at 10%, 5% and 1% level of significance.

Source: conducted using Eviews 5.0 package

The results of the granger causality test in Table 15 show that financial deepening (PRIVY) granger causes economic growth (Y) at 5 percent level of significance. Likewise, the results reject the null hypothesis that economic growth does not granger cause financial deepening at 1 percent level of significance. This implies that there exist a positive feedback effect between economic growth and financial deepening which further confirms the position of the endogenous growth theorists. The implication is that real economic growth predicts financial deepening and financial deepening also predicts economic growth. The endogenous growth literature predicts a bi-directional causality between economic growth and financial deepening. They argued that the financial sector contributes to economic growth through its effects on the volume of investment and efficiency of investment by: collecting and analysing costly information on entrepreneurs/investment projects; allocating credit to its highest productive use; enabling technological advancement; transforming the composition of savings to suit investment and financing of human capital formation. Similarly, economic growth also influences development of the financial sector by creating the demand for financial services, thereby enabling the creation of new financial products and deepening of the financial system. In the empirical literature, the result is in consonance with the findings of Demetriades and Hussein (1996), Luintel and Khan (1999), Abu-Bader and Abu-Qarn (2008) and Xun et al. (2006).

This finding is, however, inconsistent with both the supply leading and demand pulling hypothesis already discussed. In the empirical literature, the results contradict the findings of Frimpong and Adam (2010) and Quartey and

Prah (2008) in the case of Ghana. Frimpong and Adam (2010) found evidence for the demand pulling hypothesis with causality running from economic growth to financial deepening when financial deepening is proxied by credit to private sector. The findings of Quartey and Prah (2008) revealed support for demand-following hypothesis, when growth of broad money to GDP ratio was used as a measure of financial development. However, when growth in domestic credit to GDP ratio, private credit to GDP ratio, and private credit to domestic credit ratio were used as proxies for financial development, they found support for the 'independent' hypothesis.

Similarly, the results indicate a bi-directional causality between gross fixed capital formation and economic growth at 5 percent and 1 percent significance level respectively. It is important to note, however, that causality from investment to growth is stronger than the causality from growth to investment. This is in line with the long-run findings. It also gives credence to the fact that investment in productive capital is a real boaster for every economy including that of the Ghanaian economy. Nevertheless, growth in the economy also creates income for reinvestment.

Moreover, the test reveals that liberalisation of the financial sector and its effect on interest rate granger causes financial deepening and that financial deepening also granger causes interest rate. This seems to support the McKinnon-Shaw hypothesis that interest rate liberalisation leads to more savings which further enhances financial intermediation and ultimately deepens the financial system.

Aside the pairwise causality test, Table 16 presents the VECM based granger causality test. Despite the differences in the estimates, both approaches arrived at similar conclusions. Appendix E displays the Wald test results of the VECM causality test. From Table 16, the chi-squared statistic is used to test for short-run causality while the t-statistic or the P-value is used to test for long-run causality.

Table 16: Results of VECM based granger causality test

Reg.	LY	LK	LPRIVY	R	ECT
	$\chi^2(3)$	$\chi^2(3)$	$\chi^2(3)$	$\chi^2(3)$	
LY	na	50.3598***	9.7897**	0.402513	0.6077***
LPRIVY	12.1299***	3.9855	na	9.537138	0.069129

Note: na means non applicable. *** and ** represents significance at 1% and 5% respectively.

Source: conducted using Eviews 5.0 Package

The results in Table 16 indicate the significance of the error correction term at 1 percent level implying a rejection of the null hypothesis of no long-run causality from investment, financial deepening and interest rate to economic growth. This suggests the existence of long-run causality running from investment, financial deepening and interest rate to economic growth. This result is consistent with that of the pair wise causality test. It also confirms the position that the relationship between financial deepening and economic growth is a long-run phenomenon. However, when financial deepening was used as the dependent

variable, the study found no evidence of long-run causality. This is because the error correction term is not significant at all the conventional levels of significance implying a failure to reject the null hypothesis of no long-run causality.

With respect to the short-run causality, the study found evidence of short-run causality running from investment and financial deepening to economic growth at 1 percent and 5 percent significance levels respectively. Similarly, evidence for short-run causality running from economic growth and interest rate to financial deepening was found when financial deepening was made the dependent variable. Overall, the study found short-run bi-directional causality between economic growth and financial deepening which is consistent with the endogenous growth theory predictions. Similar conclusions have been drawn by the pairwise causality test. These results concur with findings by Luintel and Khan (1999) and Abu-Bader and Abu-Qarn (2008).

Granger Causality between growth and financial deepening (M2Y)

Employing broad money to GDP (M2Y) as an alternative proxy for financial deepening, the traditional pairwise Granger causality was conducted on a first differenced VAR since no cointegration was established. An alternative measure was used to find out whether the direction of causality between economic growth and financial deepening will change so that appropriate policies could be recommended. Table 17 presents the Granger causality test results.

It can be observed from Table 17 that whereas the null hypothesis that financial deepening does not granger cause economic growth could not be rejected, the null hypothesis that economic growth granger causes financial deepening is rejected at 1 percent level of significance.

Table 17: Granger causality between growth and financial deepening (M2Y)

Null Hypothesis:	F-Statistic	Probability
M2Y does not Granger Cause Y	1.23841	0.29618
Y does not Granger Cause M2Y	6.89590	0.0000***
R does not Granger Cause Y	0.91490	0.48894
Y does not Granger Cause R	2.05936	0.06776*
K does not Granger Cause Y	2.31135	0.04186**
Y does not Granger Cause K	1.94260	0.08445*
R does not Granger Cause K	1.04209	0.40491
K does not Granger Cause R	6.17615	0.0000***
M2Y does not Granger Cause K	1.94067	0.08476*
K does not Granger Cause M2Y	0.37526	0.89262
M2Y does not Granger Cause R	4.35870	0.00077***
R does not Granger Cause M2Y	4.52889	0.00055***

Note: *, ** and *** denote rejection of null hypothesis at 10%, 5% and 1% level of significance.

Source: conducted using Eviews 5.0 package

This implies unidirectional causality running from economic growth to financial deepening (M2Y) which is a support for the demand pulling hypothesis. According to this paradigm, any evolution in financial markets is simply a passive response to a growing economy. Therefore, the lack of financial growth is a manifestation of the lack of demand for financial services. As the real side of the economy develops, its demand for various new financial services materialises, and these are met rather passively from the financial side. Simply, economic development creates demand for financial services and the financial system responds automatically to these demands (Levine, 1997). In the empirical literature, the result concurs with findings by Zang and Kim (2007), Odhiambo (2009), Ang and McKibbin (2005), Quartey and Prah (2008) among others. In particular, Quartey and Prah (2008) found support for demand-following hypothesis, when growth of broad money to GDP was used as a measure of financial development.

Similarly, the results from Table 17 indicate a bi-directional causality between gross fixed capital formation and economic growth at 5 percent and 1 percent significance level respectively. As anticipated, this result is similar to those presented in Table 15.

As expected, the test confirmed the results obtained in Table 15 that interest rate liberalisation granger causes financial deepening and that financial deepening also granger causes interest rate. Thus, a bi-directional causal relationship exists between interest rate and financial deepening.

Conclusion

This chapter examined the time series properties of the data used for estimation, presented and discussed the results. Unit root test employing both the ADF and the PP techniques essentially showed that all the series had to be differenced once to achieve stationarity. This implied that all the series are integrated of order one, $I(1)$. The presence of non-stationary variables implied the possibility of the presence of a long-run relationship, which the study verified using Johansen's cointegration test. The results indicated the presence of one cointegrating relationship between financial deepening and economic growth when the indicator for financial deepening was PRIVY but no cointegration when financial deepening was proxied by M2Y. Whereas financial deepening and capital stock exerted positive and statistically significant impact on economic growth, a negative and insignificant effect from real interest rate to growth was observed.

The results of the VECM showed that the error correction term for economic growth did not carry the expected negative sign. Similar findings by Acheampong (2007) and Bhasin (2004) were sighted in support of this result. The study attributed the unexpected sign to the fact that the real side of the economy are saddled with sticky expectations and technological shocks which could create imbalances that could obscure the apparent reversion to equilibrium in the long-run from the short-run.

The findings from variance decomposition showed that, the predominant source of variations in GDP per capita's forecast errors is attributable to its own

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shocks with the most effective variable being capital stock (K). It was also observed that the largest portion of the forecast error variance of financial deepening was its own shocks. Growth and interest rate seem to be the most effective variables in affecting financial deepening. Moreover, the decomposition of the forecast error variance of capital stock revealed that the innovations of economic growth and financial deepening contributed largely besides its own shocks. Finally, the forecast error variance of interest rate was largely explained by the innovations of its own shocks. The source of greater forecast error variance of interest rate in the medium term and long term horizons were the innovations of financial deepening and economic growth.

The results of the impulse response analysis showed that unanticipated shocks emanating from financial deepening, capital stock and real interest rate increase the deviation between the short-run equilibrium values of real GDP per capita and its long-run equilibrium values within the period under consideration.

Granger-causality test suggested a bi-directional causality between economic growth and financial deepening when credit to private sector was used to proxy financial deepening indicating support for the endogenous growth theorists. Evidence for long-run causality running from investment, financial deepening and interest rate to economic growth was also established. However, the direction of causality changed to unidirectional from economic growth to financial deepening when broad money to GDP was used to proxy financial deepening indicating support for demand pulling hypothesis. Given the alternative

findings, the implication is that the finance-growth nexus could be estimated either in a single or two equation framework.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

The purpose of this final chapter is to present the summary, conclusions and recommendations. Whereas the summary presents a brief overview of the research problem, objective, methodology and findings, the conclusions capture the overall outcomes regarding the findings of the study in light of the hypotheses. Recommendations also present specific remedies to be implemented by specific bodies. The chapter also presents the limitations and direction for future research.

Summary

This study examined the relationship between financial deepening and economic growth in Ghana using quarterly time series data from 1983 to 2008. Specifically, it investigated the long-run and causal relationship between financial deepening and economic growth in Ghana using the cointegration, vector error correction (VECM), vector autoregressive (VAR) and Granger causality approaches. It employed Johansen (1988) approach to cointegration and the VECM to examine the long-run and short-run dynamics among the variables used in the estimation. The VAR approach was used to conduct variance decomposition analysis in order to identify which variables contributed to the

forecast error variance of a targeted variable. Finally, the study examined the causal relationship between financial deepening and economic growth including other variables in the model using both the pairwise Granger-causality and the VECM based causality techniques. The variables employed in the study included real GDP per capita, the ratio of gross fixed capital formation to GDP, share of credit to private sector to GDP, share of broad money to GDP, real interest rate and the share of government expenditure to GDP. All tests and estimations were conducted using econometric view (Eviews) 5.0 package.

The study observed that, the debate on the nature of the relationship between financial deepening and economic growth is still ongoing and has been characterised into four main paradigms: Patrick's opposing supply-leading and demand-pulling hypotheses, the mutual impact of finance and growth proposition and the Stern-Lucas proposition. However, empirical evidence especially time series studies have generally been mixed and inconclusive.

The cointegration analysis revealed the presence of one economically interpretable long-run relationship among real GDP per capita, credit to private sector to GDP, gross fixed capital formation to GDP and real interest rate. No cointegration was found when financial deepening was measured by M2Y. Capital stock and financial deepening in the long-run model exhibited positive and significant relationship with economic growth (real GDP per capita) except for real interest rate which was negatively related to growth. This result answers the first hypothesis and vindicates partially the McKinnon-Shaw hypothesis that financial deepening affects growth positively through investment. This is also

consistent with the predictions of the endogenous growth literature. It could not, however, vindicate the positive effect of financial deepening on growth through real deposit rate since real deposit rate impacted negatively on growth.

The empirical evidence from the VECM showed that all the variables except real interest rate exhibited both positive and negative effect on economic growth in the short-run with the positive impacts being dominant. The share of government expenditure to GDP which served as a policy variable was deleted because it was not significant although it was positively related to growth. The speed of adjustment, though significant did not carry the expected negative sign. The implication is that economic growth followed its own path when destabilised in the short-run. This was attributed to the fact that the real side of the economy is saddled with sticky expectations and other constraints which may stifle growth and productivity and obscure the tendency of reversion to equilibrium from disequilibrium.

The evidence from the forecast error variance decomposition suggests that the variables that influenced economic growth significantly were capital stock and financial deepening. Similarly, the forecast error variance decomposition of financial deepening revealed that economic growth and interest rate were the variables that exerted much influence.

The results of the Granger-causality test suggested a bi-directional causality between economic growth and financial deepening when the ratio of credit to private sector to GDP was used to proxy financial deepening. Similarly, the study found a bi-directional causality between the share of gross fixed capital

formation to GDP and economic growth and between financial deepening and interest rate. However, the direction of causality changed to unidirectional running from economic growth to financial deepening when the ratio of broad money to GDP was used to proxy financial deepening.

Conclusions

The finance-growth nexus has captured the interest of development practitioners, finance experts and researchers as well as policy makers in recent times given the turbulent experiences of the financial world and its accompanying consequences.

This study, in line with the empirical literature, revealed a positive long-run relationship between financial deepening as measured by credit to private sector to GDP and economic growth but found no relationship when financial deepening was measured by the ratio of broad money to GDP. There was also no adjustment to equilibrium from the short-run.

From the results of the forecast error variance decomposition, the most important variable for economic growth is capital stock. For financial deepening and capital stock the most influential variable is economic growth. Considering real interest rate, financial deepening is the most important variable.

Consistent with the endogenous growth predictions, the study found evidence for bidirectional causality between economic growth and financial deepening when credit to private sector to GDP is used to proxy financial deepening. This suggests that growth can stimulate development of financial

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resources and financial deepening could also stimulate growth. However, evidence for the demand–pulling hypothesis was found when financial deepening was proxied by broad money to GDP. This implies that economic development or growth in the real side of the economy creates demand for financial services which in turn leads to financial deepening.

Recommendations

Taking cognisance of the findings from the study, the following recommendations are proposed.

The study revealed a positive long-run relationship between financial deepening and economic growth which is an indication that financial deepening plays an important role in growth of the economy. In respect of this, government with the Bank of Ghana and other stakeholders in the financial sector should deepen and maintain a continued implementation of the financial sector reforms in order to foster a growing financial deepening so as to promote economic growth.

The empirical evidence also showed no adjustment to equilibrium from the short-run and this was attributed to the presence of constraints in the real side of the economy. As such, there is the need for the government to ensure that constraints such as inadequate investible resources in the real sector of the economy that may affect productivity and growth are resolved so that a self sustained economic growth and development can take place.

The forecast variance decomposition analysis results indicated that the most effective variables influencing economic growth were capital stock and financial deepening. In order to ensure growth in the economy, the Government of Ghana should provide an enabling climate for attracting both domestic and foreign investors. Maintaining a stable exchange rate and level of inflation as well as operating a balanced budget will help in this regard. The Bank of Ghana could also work with other stakeholders in the financial sector to draft and implement policies aimed at ensuring the ready accessibility of credit for investment at moderate cost. Bank of Ghana together with the players in the financial market must design policies to improve the efficiency of savings mobilisation through the banking system accompanied by efficient allocation of resources to the productive sectors of the economy.

The most effective variables for financial deepening were economic growth and interest rate. Therefore, to ensure development of the financial sector, the Government of Ghana should implement a consistent development policy that meets the requirements of the economy. The Bank of Ghana in conjunction with other financial institutions could revise the conventional financial institutional lending to make it more conducive for micro-borrowing. Solidarity group lending, where a group member can guarantee for one another should be encouraged to allow the poor access to credit at low cost without requiring collateral. This will facilitate the development of financial services leading to financial deepening.

The bi-directional causality between financial deepening and economic growth implies that policy orientation towards either financial deepening as

measured by the ratio of credit to private sector to GDP (PRIVY) or economic growth will in turn affect the other. The direction of causal relationship was changed to unidirectional from growth to financial deepening when the ratio of broad money supply to GDP (M2Y) was used. This implies that to ensure development of the financial sector, the government needs to first ensure that there is growth in the economy. Taking the bi-directional causality into consideration, however, the government through the Bank of Ghana could consider enhancing the improved institutional, legal and regulatory framework to enable financial institutions perform their roles without friction as well as ensure efficient allocation of resources. This would be effectively carried out if the Bank of Ghana was made completely independent in practice since the bank is normally being seen treated as an extension of the Ministry of finance and as such serves the agenda of the President whether prudent or not. One way out is to ensure that the governor was appointed by the President but confirmed by parliament as is the case with the United States.

In addition, government could consider creating and maintaining macroeconomic stability necessary for financial development and competition while encouraging the players in the financial sector to enhance technological and human resource development for efficient delivery of financial services. Overall, while the government needs to put in place policies geared at developing the financial sector so that it plays rightful role in the economy it should closely monitor the real side of the economy as well.

Limitations of the study

The main limitation of the study typical of such studies in developing nations had to do with the quality and limited availability of annual data on some key variables used in the study. To produce highly reliable estimates especially with cointegration analysis, long span of annual time series data of all the variables was needed. As a result of the inadequate annual series, quarterly series were generated through interpolation for the purpose of estimation. However, there is no gain in the power of these tests by switching from low frequency to high frequency data and merely increasing the number of observations over a short time period (Hakkio & Rush, 1991; Campbell & Perron, 1991). The use of interpolated quarterly series did not, however, pose danger to the reliability of the results because other authors including Osei (2005) have employed similar approach and arrived at reliable results.

One limitation with the Johansen's approach to cointegration employed in this study is that it is based on VAR methodology which is inherently over parameterised and sensitive to both model specification and lag length selection. The selected lag length has implications for the outcome of the cointegration, variance decomposition and causality test. Nevertheless, the cointegration, variance decomposition and causality test produced consistent results. Our choice of the optimal lag length was based on the standard model selection criteria (AIC, SIC, HQ, FPE and LR) that ensured white noise residuals.

Direction for future research

Financial deepening involves the interaction of many activities and institutions. Consequently, it cannot be captured by a single or two measure (s). In this regard, future research could consider using many more measures of financial deepening for both cointegration and causality tests in addition to using improved econometric techniques and long span of annual time series data.

Financial development could also be looked at in terms of both the market based (stock market) and the bank based perspectives to ensure a better and rigorous analysis.

Again, given the possibility of bidirectional causality between economic growth and financial deepening, two separate models could be estimated. The argument that financial deepening can affect output growth indirectly through its impact on capital accumulation and real interest rate can also be explored.

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APPENDIX A

GHANA BANKING SYSTEM INDICATORS (1988-2008)

	1988	1991	1992	1998	2008
Number of Banks	10	12	13	17	24
Of which private	2	-	4	9	21
Number of branches	405	328	-	315	639
Banking System Assets/GDP21	21	19	23	26	60.7
Non-Performing Loans/total credit	-	41	-	27	7.7
Asset Concentration					
4 largest banks	81	77	72	55	51.9
Public Sector Share					
Of total assets	79	73	70	37	24.9
Of total capital	-	77	76	34	31.9
Of total deposits	73	71	65	32	22.9
Of total advances	71	70	63	54	30.7
Of non-performing loans	-	-	-	84	29.8
Number of Accounts Holders:					
Commercial Banks					3,915,788
Rural Banks					2,827,023

Source: Bank of Ghana, IMF (as cited in Bawumia, 2010)

APPENDIX B

**STRUCTURE OF THE GHANAIAN BANKING SECTOR, DECEMBER,**

2001

Bank	Ownership (%)		Number of	% Share of
	Ghanaian	Foreign	Branches	Total Assets
Commercial Banks				
Ghana Commercial Bank Ltd.	97	3	134	24.8
SSB Bank Ltd.	46	54	38	9.2
Barclays Bank of Ghana Ltd.	10	90	24	14.5
Standard Chartered Bank	24	76	23	16.1
The Trust Bank Ltd.	39	61	6	2.5
Metropolitan and Allied Bank	53	47	4	0.7
International Commercial Bank	0	100	3	0.6
Stanbic Bank Ghana Ltd.	9	91	1	1.2
Unibank	100	0	1	0.3
Merchant Banks				
Merchant Bank Ghana Ltd.	100	0	5	0.4
Ecobank Ghana Ltd.	6	64	4	7.1
CAL Merchant Bank	34	66	3	2.5
First Atlantic Bank	71	29	2	1.5
Amalgamated Bank	100	0	1	0.6
Development Banks				
Agricultural Development Bank	100	0	39	
National Investment Bank	100	0	11	
Prudential Bank	100	0	5	

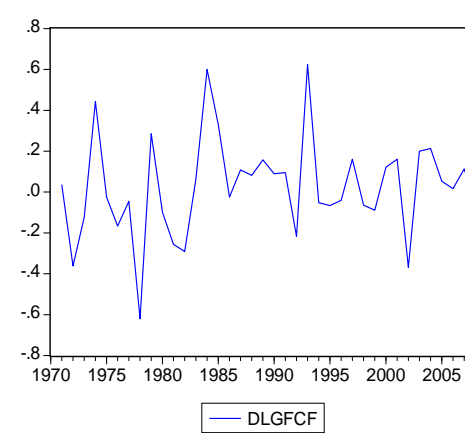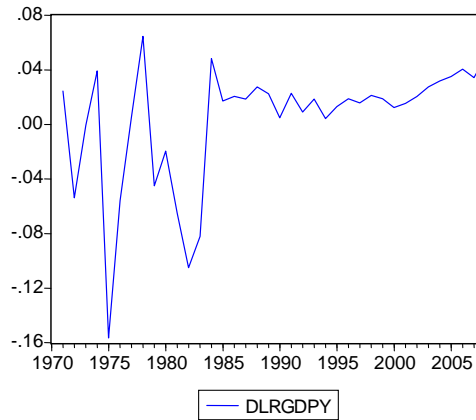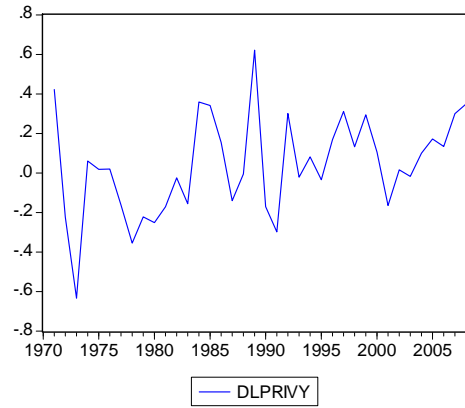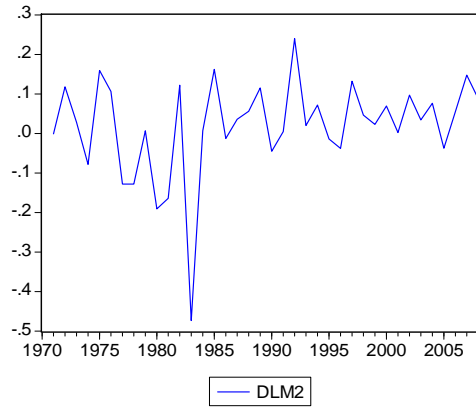Source: Bank of Ghana (as cited in Bawumia, 2010)

APPENDIX C

PLOTS OF VARIABLES

(a) Plots of Variables in Levels
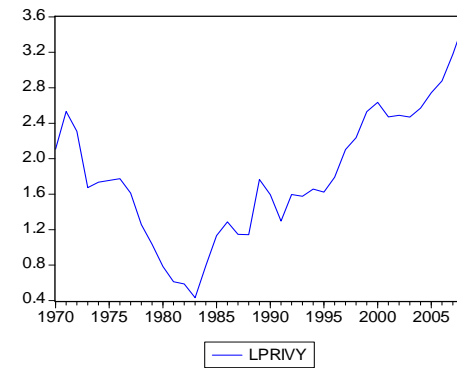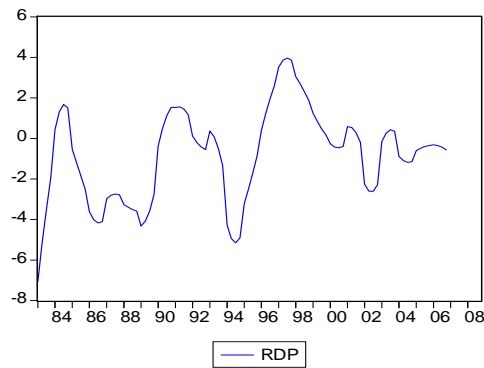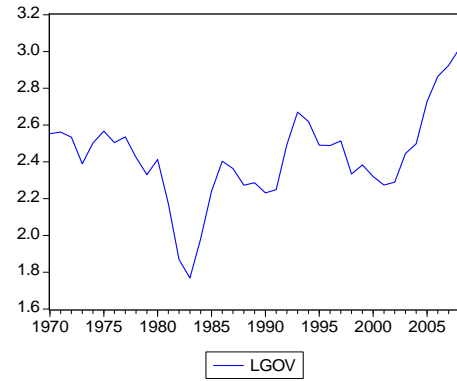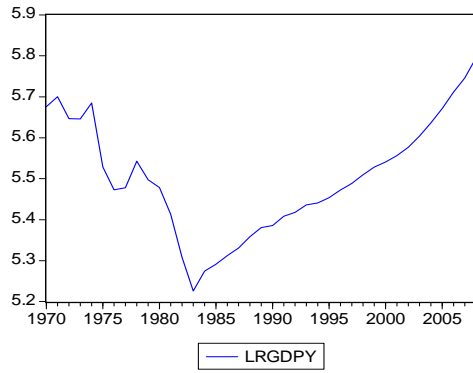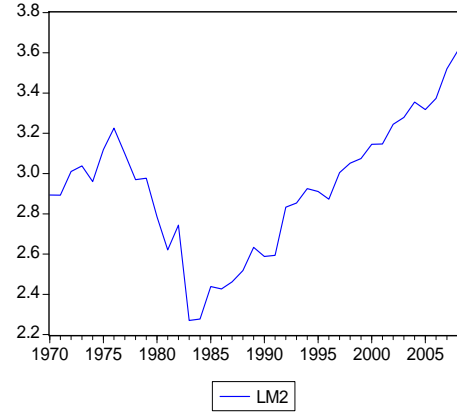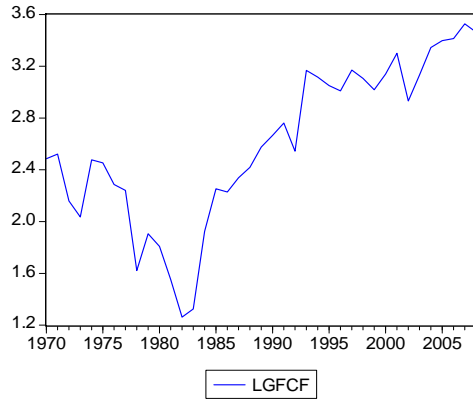
Source: WDI (2010) and Bank of Ghana Data

(b) Plots of Variables in First Differences
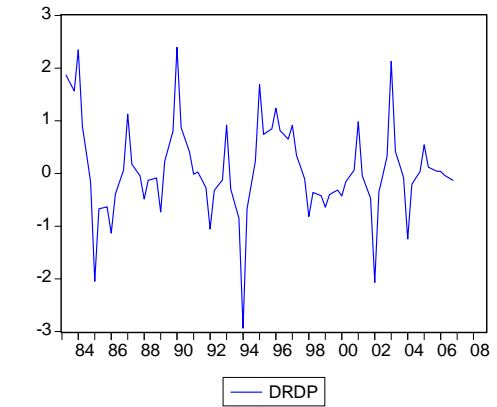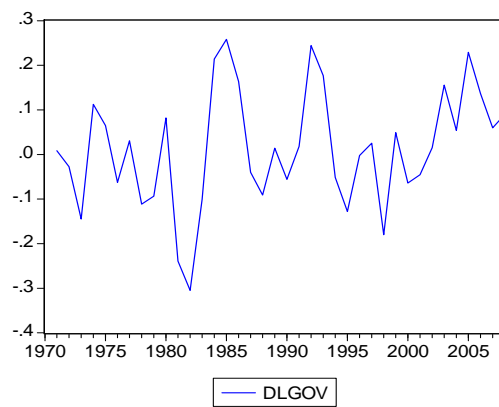
Note: D denotes first difference operator; L = Natural logarithm

Source: WDI (2010) and Bank of Ghana Data

APPENDIX D

RESULTS OF JOHANSEN ML COINTEGRATION APPROACH

Trend assumption: No deterministic trend (restricted constant)

Series: LGDPYD LPRIVY LGFCF RDP

Unrestricted Cointegration Rank Test (Trace)

Hypothesised No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.605831	107.7292	54.07904	0.0000
At most 1	0.152885	23.01054	35.19275	0.5277
At most 2	0.052024	7.911917	20.26184	0.8315
At most 3	0.032963	3.050145	9.164546	0.5714

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesised No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.605831	84.71866	28.58808	0.0000
At most 1	0.152885	15.09862	22.29962	0.3670
At most 2	0.052024	4.861771	15.89210	0.8999

| At most 3 | 0.032963 | 3.050145 | 9.164546 | 0.5714 |

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

Unrestricted Cointegrating Coefficients (normalised by b'*S11*b=I):

LGDPYD	LPRIVY	LGFCF	RDP	C
-47.05562	3.129718	8.481013	-0.078783	173.5950
26.41995	-4.935158	-3.423390	0.534707	-100.3933
-31.39147	6.148490	-0.941266	0.005016	125.4238
4.965215	0.007943	-1.841283	-0.481519	-18.53303

1 Cointegrating Equation(s):   Log likelihood   729.8980

Normalised cointegrating coefficients (standard error in parentheses)

LGDPYD	LPRIVY	LGFCF	RDP	C
1.000000	-0.066511	-0.180234	0.001674	-3.689145
	(0.00864)	(0.01147)	(0.00136)	(0.01599)

Equation 2

Trend assumption: No deterministic trend (restricted constant)

Series: LGDPYD LM2 LGFCF RDP

Unrestricted Cointegration Rank Test (Trace)

Hypothesised		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.208841	47.67556	54.07904	0.1646
At most 1	0.134877	26.59253	35.19275	0.3098
At most 2	0.098940	13.55302	20.26184	0.3213
At most 3	0.045346	4.176544	9.164546	0.3865

Trace test indicates no cointegration at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesised No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.208841	21.08302	28.58808	0.3338
At most 1	0.134877	13.03951	22.29962	0.5529
At most 2	0.098940	9.376473	15.89210	0.3945
At most 3	0.045346	4.176544	9.164546	0.3865

Max-eigenvalue test indicates no cointegration at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalised by b'*S11*b=I):

LGDPYD	LM2	LGFCF	RDP	C
-25.87153	1.904280	2.949521	0.531801	95.30730
-59.14619	17.88743	2.820403	-0.430094	206.3573
4.733071	11.54801	-10.31103	0.040799	-19.52729
0.656188	-0.156305	-2.341793	-0.207615	0.575741

APPENDIX E

RESULTS OF VECTOR ERROR CORRECTION MODEL BASED

CAUSALITY TEST

Equation 1

LY and LK

Wald Test:

Test Statistic	Value	df	Probability
F-statistic	16.78660	(3, 77)	0.0000
Chi-square	50.35979	3	0.0000

LY and LPRIVY

Wald Test:

Test Statistic	Value	df	Probability
F-statistic	3.263236	(3, 77)	0.0259
Chi-square	9.789707	3	0.0204

LY and R

Wald Test:

Test Statistic	Value	df	Probability
F-statistic	0.134171	(3, 77)	0.9394
Chi-square	0.402513	3	0.9397

Equation 2

LPRIVY and LY

Wald Test:

Test Statistic	Value	df	Probability
F-statistic	4.043285	(3, 77)	0.0100
Chi-square	12.12986	3	0.0070

LPRIVY and LK

Wald Test:

Test Statistic	Value	df	Probability
F-statistic	1.328497	(3, 77)	0.2713
Chi-square	3.985491	3	0.2630

LPRIVY and R

Wald Test:

Test Statistic	Value	df	Probability
F-statistic	3.179046	(3, 77)	0.0287
Chi-square	9.537138	3	0.0229

APPENDIX F

IMPULSE RESPONSE FUNCTIONS FROM THE VAR MODEL

Response to Cholesky One S.D. Innovations ± 2 S.E.