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CAPITAL MARKET DEVELOPMENT AND INVESTMENT GROWTH IN SUB -SAHARAN AFRICA

Master Thesis

Submitted to

Wits Business School

University of Witwatersrand

Submitted by:

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ASTRACT

This study sought to investigate the impact of capital market development on investment growth in six Sub-Saharan Africa countries. Literature review identified three main factors that can proxy capital market development in an economy, and that can also directly affect investment growth. Investment growth is proxied by changes in gross fixed capital or capital formation. Data used in this study span a period of 18 years converted from quarterly to monthly frequency. Quarterly frequency data was obtained from DataStream terminal raging from January 2000 to December 2017. Broad Market Liquidity, Changes in the Index price, and market capitalization are regressed against investment growth variable using Pooled OLS and Panel Causality test. Results indicate that market liquidity, return of the market and market capitalization are significantly positive determinates of investment growth in the six countries included in the study. Panel Causality Test reveal that market liquidity and market return have reverse causal relationship. On policy grounds, this study recommends to governments in Sub-Saharan Africa to create an enabling environment for capital market to flourish and by so doing, investment growth will be attracted

DECLARATION

I, Charles Eliet Mgeta, declare that this research is my own work, except for references which have been dully acknowledged. It is submitted in fulfilment of the requirements for the master's degree of Management in Finance and Investment in the University of the Witwatersrand. This Thesis has not been Submitted before for the award of any other academic degree.

_____

Charles Eliet Mgeta

DEDICATION

This Thesis is dedicated to my late father Damas Stephano Mugeta, I also dedicate this Thesis to my mother Christine Mpare Mugeta and my son Giovanni Charles Mgeta.

ACKNOWLEDGEMENT

I would like to dedicate my sincere gratitude to my supervisor Professor Kalu Ojah for your guidance and valuable helping support. You have always been available to mentor and steer me in the right direction. It was always very exciting having discussions around my work and always you would share your insights in the ways that made this work to progress, I am very Grateful.

I would also like to thank my special academic advisors Dr. Jones Mensah, Wycliffe Ouma and Meisie Moya for your support, friendship and encouragements in various occasions. To my friends Mzingisi Mapasa, Kabelo Baloyi, Nyasha Takawira and Taguma Nyanga you have been very instrumental and supportive throughout my stay in South Africa, I thank you very much for your friendship, time and motivation. I welcome you all to Dar es Salaam.

Finally, I would like to extend my profound gratitude to my mother Christine Mpare Mugeta, brothers and sisters, my son Giovanni and my mentor John Mbaga. Mother, thank you very much for your prayers, Giovanni, take action get to work it is your time and John, we can now sit and enjoy our favourite 15 years old Glen without any destructions. Thank you all.

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CHAPTER 1: INTRODUCTION

1.1 Introduction

The absolute active functioning economy has been a dream, yet to be unfolded by nations branded as developing countries in the world. An active economy is comprised of collective growing activities that consistently facilitate and support the production and delivery of goods and services in the country (Fleming, Roman, & Farrell, 2000). The road to realize complete active operations in the economy and subsequently economic growth requires robust development in sectorial performance that have direct and indirect influence on the production and delivery of goods and services to the economy as well as the magnitude of peoples' involvements towards the process. The sectors include government and supporting institutions, economic policies, financial systems, legal systems, banking institutions, physical infrastructures, labour, innovations, entrepreneurship and peoples' level of involvement and accountability. The interaction between these broad sectors are made possible by the effective coexistence of real economy and the financial sector (Boyd & Smith, 1996).

1.2 Capital Markets, Investment Growth and Sub-Saharan Africa (SSA)

A sound economy ensures that capital is efficiently allocated to all sectors. This strategic role is performed by capital markets through financial markets by offering an avenue for buying and selling of long-term debt or equity-backed securities. This takes a two-step process; deficit unit of the economy get funds that can be used to transform value, while surplus sources earn interest or capital gain in the process. Typically, the market channels the wealth of savers (i.e. via the commercial banks and non-bank financial intermediaries, such as insurance companies, finance houses, unit trusts, investment trusts, venture capital, mutual funds, and building societies) to the units of the economy that can put it to long-term productive use, such as companies or

governments making long-term investments that create value (Wurgler, 2000). They are viewed as markets in which money is provided for periods longer than a year.

One of the primary roles of financial institutions and capital markets is to allocate capital efficiently, that is to allocate funds to the investment projects with the highest marginal product of capital (Bekaert, 1997; Peia & Roszbach, 2015). This phenomenon consequently results in the development of commerce and industry through the private and public sector investment, thereby inducing economic growth. Capital markets function through the stock exchange markets, whereby a stock exchange is a market for the trading of shares to individuals and organizations seeking to invest their excess funds through purchase of shares, it is a market for old and new shares and securities; therefore, the capital market is related to the supply and demand for new capital, and the stock exchange facilitates such transactions.

A sound banking sector plays a vital role as the financial intermediary between borrowers and investors. With growing economies, a developed and sophisticated capital market is a necessary component for providing long term capital that firms need to invest and expand. This mechanism is regarded as capital formation.

According to the World Bank, in developing regions (Sub-Saharan Africa included), access to finance is regarded as a major barrier to business success, this results in slowing down business performance growth, leading to slow growth of the companies. Failure to strongly compete in the free economic markets, ultimately negatively affect domestic investment growth. Access to finance is regarded to be the largest problem that outweighs corruption, political instability and excessive tax rates (*World Bank, Enterprise Survey*, 2014).

Sub-Saharan Africa is considered to be one of the least developed regions in the world, the growth in Sub-Saharan Africa was projected to slow again in 2016, to 2.5 percent, down from an estimated 3.0 percent in 2015. The forecast was 1.7 percentage points lower than the January 2016

projections. Low commodity prices, tightening global financial conditions, and drought in parts of the region will continue to weigh on growth in 2016, (*World Bank Global Economic Prospects* 2016).

Financial markets in Sub-Saharan Africa remain underdeveloped and are not yet effective tools for improving economic prospects. The financial market status varies from country to country, but the majority has immature domestic capital markets and rely on relatively shallow banking sectors. Outside of South Africa, equity markets in Sub Saharan Africa are small and illiquid and few countries operate viable domestic bond markets (Standley, 2010). But despite this, the stock market has been a surprisingly important source of finance for funding the growth of large corporations in some African countries.

1.3 Statement of the Problem

Given the fundamental role of capital markets in the economy, it follows that a well-functioning capital markets should lead to a healthy economy. In developing countries, falling economic growth rate is one of the major problems, alongside the widening current account and balance of payments deficits, rising inflation rates and growing foreign debts. It is, therefore, critical to understand the problems bedevilling the capital markets in developing economies in order to ensure growth prospects.

Recent studies have shown a positive relationship between financial development and economic growth. "The theoretical reasoning and empirical evidence suggest a positive, first order relationship between financial development and economic growth" Levine (1997).

Studies by McKinnon (1973, 1991), Gelb (1989), Fry (1988), and Montiel (1996) stress the positive contribution of capital market development to growth, while King and Levine (1993) and Ghani (1992) find a strong correlation between measures of banking development and economic growth.

In the context of capital market development and investment growth, few studies have been on paper, especially for SSA. Ndikumana (2000) documented a positive relationship between domestic investment and various indicators of financial development, in which financial development leads to higher future levels of investment and thus stressing that financial development can stimulate economic growth through capital accumulation.

On a related area, a study by Ojah, Gwatidzo and Kaniki (2010), indicated that property rights, external finance, internal finance, firm size, and an export orientation are important determinants of investment. Despite these previous studies and findings, that to a larger extent focused on different regions of the developing world (Southeast Asia, Latin America and the Caribbean), Sub-Saharan Africa has not received the same level of attention. Moreover, the majority of the studies on SSA and other developing countries have been focusing on whether capital market development has a positive relationship with economic growth. It is worthwhile, therefore, to further assess the impacts of capital market development towards investment growth in the context of Sub-Saharan African Countries.

The result provides knowledge to SSA governments and investors to ascertain the effect of capital market development on investment and economic growth. The same will also help the governments to develop investment growth policies and strategies that align with capital market development. Additionally, the study provides additional knowledge to scholars about the financial and investment spaces of SSA countries.

1.3 Objective of the Study

The purpose of this study is to assess the linkage between capital market development and investment growth in Sub-Saharan Africa, focusing on selected countries, that will enable us to provide a broad understanding and knowledge on how capital market development enhances investment growth in Sub Saharan Africa. Therefore, this study focuses on the following specific objectives:

i. Investigate the impact of broad market liquidity on capital formation in Sub-Saharan African countries.
ii. Determine the effect of stock market price changes on capital formation in Sub-Saharan African countries.
iii. Examine the impact of market capitalization on Capital Formation in Sub-Saharan Africa countries

1.4 Significance of the Study

i. To provide knowledge to SSA governments and investors of ascertaining the effect of capital market development on investment and economic growth.
ii. To help support SSA governments to develop investment growth policies and strategies that align with the impact of capital market development.
iii. To provide additional literature and knowledge to scholars about financial and investment position of SSA countries.

1.5 Outline of the Report

The next chapter, which is Chapter 2 discusses literature on capital market development and investment growth. Literature review chapter helps to shed more light on the variables selected to investigate the relationship between capital market development and investment growth in Sub-Saharan Africa. This chapter is followed by Chapter 3 which discusses the methods employed to answer the questions and objectives as defined in chapter 1. Chapter 4 presents the analysis of the proposed model in Chapter 3. Results are also discussed, and references made connecting the present study with other competing studies. Chapter 5 concludes and presents recommendations for further studies. In Chapter 5, weaknesses that were encountered in the process of carrying out this study are also presented, and recommendations made to overcome them in future studies of this type.

2.0 LITERATURE REVIEW

2.1 Introduction

This section of the study strives to strengthen the identified gaps in chapter one. This is done by analysing literature that tie both theoretical and empirical findings on the factors contributing to capital market development in Sub-Sahara Africa. This chapter is crucial for a clear understanding of the variables that proxy investment growth and capital market development in Africa. Therefore, a judicious review of empirical studies investigating investment growth is taken in this chapter.

2.2 Capital Market and Growth

A number of scholars in the field of finance and economics have contributed immensely to the growing literature around the world about the impact of financial systems towards sectorial growth, investment growth and general economic growth in different countries globally. For instance, Arestis, Demetriades, and Luintel (2001) investigate the interaction between stock market development and economic growth. The authors control for banking system and stock market volatility. Their result indicate that the banking system is more important for stock market development than the other three tested variables. In conclusion, given the varying results across different countries, they indicate that this may be due to varying institutional characteristics and circumstances in different countries.

In an extant review of literature spanning three decades on the relationship between financial development and economic development, Levine (1999) notes that there are different channels through which financial development affects economic growth and that advancement in financial system of a country on its own does not necessarily lead to industrialization and hence economic growth is a by-product. Levine (1999) also opines that, “although financial panics and recessions are critical issues, the finance-growth link goes beyond the relationship between finance and shorter-term fluctuations.” This conclusion could be at variance with many researchers of

post 2007 Global Financial Crisis, (see Ciro, 2016; Jackson, 2018; Pragidis, Aielli, Chionis, & Schizas, 2015; Thalassinos, Pintea, & Raţiu, 2015).

In a recent study, Leonce Ndikumana (2000b), *Financial Determinants of Domestic Investment in Sub Saharan- Africa,* Ndikumana reviewed factors that determine investments in SSA, focusing mainly on financial and non-financial factors. The author argues that financial factors mostly presented by a number of studies in SSA lack a full-fledged model of investment applicable to the context of developing countries. Stressing on the role of financial determinants for investments in developing countries, the author enumerate the views from recent studies pointing out issues like finance and technological progress, the state of credit and credit market, accumulation of real money, financial intermediaries and savings, while for non-financial factors issues like growth rate, policies, inflation, trade flows, external debt and black market have the role in investment progress.

Theoretically, financial development leads to high future investment levels. Using dynamic serial correlation on a sample of 30 SSA countries, Leonce Ndikumana (2000b), find that financial development contributes to higher level of investment which in turn leads to financial development and economic growth. Leonce Ndikumana (2005) further queries the effect of financial intermediation on domestic investment. Using data from 99 countries globally, strong evidence is found to support the hypothesis that higher financial development induces higher domestic investment in the countries included in the sample. This finding is vital to this study as it supports the hypothesis that finance and development vary across countries and are important for investment growth. The changing economic and financial development landscape as well as increasing integration of SSA with the rest of world form a strong basis to test this phenomenon using recent data.

Easterly and Levine (1997) paint a blurry picture of SSA where they opine that ethnic divisions and poor policies are major hindrances to economic and financial transformation of the continent. Accordingly, Easterly and Levine (1997) state that development is affected by distorted foreign exchange markets, high government deficits, and insufficient infrastructure among a myriad of factors. Yet Levine (1999) presents convincing evidence that financial development predicts future economic growth, capital accumulation and technological advancement. The author concludes that a number of factors lead to lower or slow transformation of financial sector and hence economic growth. Levine (1999) also states that the link between capital market development and real sector growth can be explained by factors such as liquidity liabilities (being currency plus demand deposits of banking and non-banking financial institutions), bank credit as a ratio of total credit by the banking sector and the central banking sector, credit allocated to private sector as a ratio of total credit and credit extension to the private sector divided by GDP. Test results indicate a positive relationship between the early mentioned factors of capital market development and real sector growth as represented by per capita income.

Levine (1999)'s views on financial market development factors similar to Ndikumana (2000)'s views on financial factors, since they both give an indication of what is required from the financial point of view to ensure growth in sectors, investments and the economy. Generally, quite a number of studies have shown that financial development facilitates investment and economic growth (King and Levine 1993; De Rajan and Zingales, 1998; Levine et al., 2000).

2.3 Capital Accumulation and Financial Development

Considered as a recipe for financial development, capital accumulation depicts investment in an economy from a broader definition where it encompasses all forms of investment that can possibly take place in an economy. The definition include investment in real estate, capital markets products, exchange rates, savings, interest gains, plants and equipment, human capital among

others (Romer, 1986). Literature has been consistent on how capital accumulation affect development as a whole. However, there is scant information on how capital accumulation influence financial development in an economy. Some authors have considered the effect of capital accumulation on financial liberalization of an economy (Arteta, Eichengreen, & Wyplosz, 2001; Klein & Olivei, 2008). Others document how capital accumulation contribute to institutional quality and economic growth (Eichengreen & Leblang, 2003; Klein, 2003, 2005).

Bonfiglioli (2008) adduces elegant evidence on the contribution of capital accumulation in an economy. The author opines that capital accumulation leads to two important consequences in an economy, financial openness and income growth. It is therefore very interesting for this study to consider capital accumulation as a variable that can substantially offer insights into financial development in economies of Sub-Sharan African countries.

2.4 Legal Environment and Investment

Investment has been viewed in different perspectives by different scholars. One of the very influential factors of investment decision and growth other than financial development is legal environment, as shown by Ojah, Gwatidzo and Kaniki (2010), one of the latest studies in the context of Sub Saharan countries with regard to non-financial factors impacting investment. They ascertained how legal environment (represented by security of property rights and pervasiveness of corruption) and availability of finance, independently and interactively, relate to determine firms' investment decisions in the EAC. The results from this study concluded that property rights, external and internal finance channels are important determinants of the investment decision.

Access to finance is regarded as one of the major barriers to business success, (Word Bank Enterprise Survey, 2014). In the same line of thinking, an effective legal environment facilitates firm's access to finance (La Porta et al., 1998; Beck and Levine, 2004).

This study ultimately finds out what drive investment growth. The legal factor was one of the variables under focus and has provided a wide range of dependent variables that give an explanation about investment growth.

2.5 Technological advancement, Institutions, Capital Markets and Investment

Institutions and technological advancement have a powerful influence on investments. Schumpeter (1912) portrayed how financial development impacts technological innovation and consequently leading to growth, with the view that good banking systems provide funding to entrepreneurs who produce innovative products, thus facilitating growth.

For capital markets to effectively and efficiently operate, speedy and timely flow of information is vital. This resulted in the development of computerized trading at the stock exchange like JSE. The same growing demand and advancement of technology goes to the banks, non-financial institutions and telecommunication companies, where the current trading environment incorporates these sectors to enhance information and transactions through internet banking and mobile banking. These sectors, as pointed out earlier, are linked to capital markets and they also provide the funding access to small scale investors whose access to the stock exchange is limited. In this view therefore, this study appreciates Schumpeter's (1992) views by considering the development of capital markets in which technological innovation could be one of the enablers and the impacts of such towards investment growth.

2.6 Governments, Macroeconomic Policies and Capital markets

Government and macroeconomic policies not only stimulate general economic prosperity they also lay down good environment for various institutions within the country to operate optimally, the government should ensure a more conducive macroeconomic environment that can support the institutional framework that is necessary for the development of a well-functioning capital market (Montiel, 1996).

Lack of sound macroeconomic policies is not only an impediment to the development of the local capital market, but has also become a major source of weakness in the economy once local capital markets are developing and become more integrated with global capital markets, making the country more vulnerable to volatile capital flows, exchange rate volatility and financial crisis,("The Development of Local Capital Markets:Rationale and Challenges," 2014).

Inefficient government policies have resulted in consistently high and unpredictable inflation in many African countries. High and unstable inflation adversely affect investment by increasing the degree of uncertainty about macroeconomic environment, whereby inflation discourages long term lending by financial intermediaries (Ndikumana, 2010).

The views of Ndikumana, (2010) above appeal for sound and reliable macroeconomic policies that will pave the way for the development of well- functioning capital market. It is with these views, therefore, this study highlights how macroeconomic position and components of various SSA countries affect the development and performance of capital markets in the region, and for that reason gives a broader understanding of the various interrelated concerns which in different ways bring about investment growth and thus lead to economic growth ultimately.

2.7 Literature Conclusion

Given the literature review in this section, it is evident that research is not complete on the factors that account for capital market or financial market development. As is seen in the surveyed literature, little attention is given to the markets in developing countries especially those in the Sub-Saharan Africa. Even though Leonce and Ndikumana (2000a) and Léonce, Ndikuman and Boyce, (2003) advanced considerable efforts in understanding capital market development in the less developed countries of Africa, most of this work has been eclipsed by time and new technological developments in these countries. Therefore, new set of data is necessary to determine if the same factors still account for capital market development or other new factors have emerged. Other scholars argue that these markets are becoming integrated and there should be new determinants of capital market development. These endeavours include (Ahmed, 2016; Asongu & De Moor, 2017; Mecagni, Marchettini, & Maino, 2015). And this being challenge to the old order, qualifies the current study to use the most recent data and more robust econometric models to determine factors that impact on financial markets and capital markets development in Sub-Sahara Africa. The next chapter of this study addresses these new methods and data to be used in investigating the phenomenon deliberated in this literature review.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This study investigates the interaction between capital market development indicators and investment growth in a selected group of countries in SSA. These capital market variables are selected based on considerations of their theoretical relationship with investment growth and data availability. In the end, three capital market variables are selected, namely broad market returns, represented by the leading index in a country, broad market liquidity defined as the turnover ratio or change in the volume traded, and broad market size which is defined as the total market capitalization or index price multiplied by total shares outstanding.

3.2 Sample Data and Data Sources

This study initially sought to include 10 SSA countries. However, due to data availability problems experienced in the process of gathering data, only six countries survived the selection criteria. These include Botswana, Ghana, Kenya, Mauritius, Nigeria and South Africa. This group of countries can be taken to have a suitable geographical representation of the sub-continent, as the East, the West and the South are well represented. Kenya represents the East, Ghana and Nigeria represent the West, while Botswana, Mauritius and South Africa represent the Southern part of the geographical region. Data on capital market development indicators; Market Capitalization, Value Traded or Turnover Ratio of volume Traded, and Market Return are for the period between January 2000 and December 2017. The investment variable is proxied by Capital Accumulation which is only available in annual and quarterly frequencies. Due to this shortcoming in the series' frequency, all the capital accumulation (investment growth) variable quarterly series are collected and transformed into monthly series using quadratic match averaging function available in EViews.

The series were sourced from Bloomberg and DataStream. Using a mix of these two sources provide the study with ability to compare and contrast data, given that the sample under review are known for lack of quality data that may result from data reporting and capturing inconsistencies.

3.3 Definition of Variables

As mentioned already, this study investigates the relationship between capital market development variables and investment growth in SSA. Literature points to a causal relationship between these two categories of macroeconomic variables in an economy (Arestis et al., 2001; Demetriades & Hussein, 1996; Paramati, Ummalla, & Apergis, 2016; Rajan & Zingales, 1996). Literature is however vast on finance-growth nexus where variables such as savings, economic growth (Levine & Zervos, 1996) have been identified and extensively investigated in markets and regions across the globe. Foreign Direct Investment, Stock Market Development and Economic Growth have also been studied extensively, (see Alfaro, Chanda, Kalemli-Ozcan, & Sayek, 2004; Stiglitz, 2000), but the literature is narrow on the capital market variables and general investment growth. In order to strictly address the main objective of this study, capital market development variables are judiciously chosen and appraised. And the main variable of focus, investment growth, is proxied by a broader variable that looks across the entire investment spectrum in an economy. Therefore, capital accumulation/formation was deemed to capture the relevant view of the study. Capital accumulation is a broad definition of investments. This is because it encompasses investment in fixed capital like factories and production plants, portfolio of financial assets like bonds and company stocks, as well as portfolio of currencies in a given country. It also takes into account fixed asset investment such as housing and physical amenities. In general, a sound capital market is expected to move in tandem with investment growth in a country (Bond, Leblebicioğlu, & Schiantarelli, 2010; Richards, 2013).

The independent (regressor) variables in this study include market liquidity, market return and market size. These variables are selected mainly because of their influence on investability of the economy. Liquidity, for instance, is the ease and timeliness of transfer of value without suffering much of a loss. It is argued in literature that liquidity is an enabling factor in investment in the capital market, hence qualifies as one of the main pillars of its development (Adjasi & Yartey, 2007; Enisan & Olufisayo, 2009). It is also conjectured that a highly liquid market fosters the general investment in that market because buyers and sellers can easily find the market and make investment value in the process. A constituent of liquidity that many studies have focused on is market volatility. It is postulated that a moderately volatile market with good returns reversals is preferred by investors (Allen & Gale, 1994; Pástor & Stambaugh, 2003). Therefore, a liquid market is an active market that creates value to investors and the economy at large.

Market size or the 'size' effect in stock markets is a well-documented phenomenon (Banz, 1981). Since size which is measured by market capitalization. it is the price multiplied by the shares outstanding. It is indicative of the depth of the market. Intuitively, this can only be so if there is growth on the sizes of the firms listed in that market. And that in itself is an indication of the types of investment activities the firms listed in that market undertake.

Lastly market return which is measured by the return of the major or broader index of the stock market, like Johannesburg All Share Index, NSE 20 Share Index of Kenya, are taken as yardsticks of measuring the general performance of the firms listed in the economy. Information obtained from the leading stock market index is indicative of the investment activities that pass through stock markets, be it raising capital through bonds, selling ownership rights, or general buy and sell activities in the stock market. It is argued that stability of the leading stock index spells the resilience of the entire economy. This is because stock market movements and the general economy are intricately connected (Ojah & Kodongo, 2015; Ouma & Muriu, 2014).

In conclusion, the chosen variables in this study are deemed to have theoretical connection. Thus, a change in one would lead to change in the other and vice versa. This expected relation guides us on the choice of model for analysis. Given that all the variables are expected in their rates of change (e.g., liquidity is the change in volume, market return is the change in the market price index, and investment growth is the rate of change in the capital accumulation/formation). The only exception may be on the size factor. Due to this anticipation, common problems of unit root in financial time series variables are not of serious concern in this study.

3.4 Model and Data Analysis

The empirical model that postulates the relationship between capital accumulation (investment growth) and the three selected capital market development variables can be presented in equation form as:

$$Inv_{j,t} = \alpha_j + \gamma_{j,t} Liq_{j,t} + \theta_{jt} Ret_{j,t} + \beta_{j,t} Size_{j,t} + \varepsilon_{j,t} \quad (1)$$

Where $Inv_{j,t}$ indicate investment growth of country j at time t, $Liq_{j,t}$ denote liquidity of country j at time t, and $Size_{j,t}$ is the market capitalization of country j at time t. α_j is the constant of regression while $\varepsilon_{j,t}$ is the idiosyncratic term that should be independent of the innovations in other variables in the model. The term should have zero mean and constant variance. Parameters γ, θ and β are the coefficients of the regression. We also include lagged values of investment variables in a var setup in order to control for the gamut of factors influencing capital formation or investment growth in SSA. This is implemented in a VAR analysis as reported in the Appendix which acts as a robustness test for the validity of the main model.

3.5 Empirical Model

Equation (1) is implemented using Ordinary Least Squares for individual country series and Pooled OLS for panel series. As a prerequisite for these models, stationarity of the variables included in the regression is determined upfront. Even though this is not a major concern for this study because as expected, majority of the variables included are in their rates of change except for size variable. Time series unit root test are conducted using Augmented Dickey-Fuller (ADF) test of Dickey and Fuller (1979) complemented with Philips-Peron (PP) test of Phillips and Perron (1988) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test of Kwiatkowski, Phillips, Schmidt and Shin (1992). The results are reported in the Appendix. Using a variety of these tests ensures that all the unit root/stationarity tests hypotheses are handled, and the series are ensured to be free of time influence in the time series data generating process. Arguably, ADF and PP tests favour non-stationarity or unit root due to their null hypothesis of presence of unit root, while KPSS is argued to favour stationarity due to its null hypothesis of series being stationary. Panel Unit root is tested using panel procedures which are discussed at length in the following sections (3.4.2)

Causality

As indicated already, this study investigates the relationship between investment growth and three capital market development variables. As such, classical linear regression model would be deemed to do the job. However, due to the depth of information required and the fact that these variables could have reverse causality. That is to say, liquidity can cause growth in investment in a country, likewise as investment grows, the capital markets become more liquid and vice versa. A model that can capture this dynamic is applied. The model is panel granger causality implemented through systems of equations.

3.5.1 Panel Causality Test

The main concern of this study is to understand the drivers of investment growth in the selected sample of markets. As reported earlier, the selected left-hand-side and right-hand-side variables could have causal relationships, and it is imperative for this study to model and understand the direction of this causality. For an individual country, using time series observations, Granger Causality of Granger (1969) does the job, while as a panel, this model struggles. Therefore, panel causality test introduced by Dumitrescu and Hurlin (2012) is employed to address the shortcomings that are likely in modelling panel series using Granger Causality test of causal relations in time series data, because it was predominantly developed to model time series economic data. Panel causality as proposed by Dumitrescu and Hurlin (2012) involves testing cross-sectional linear restrictions on the coefficients of the model which ordinarily extend information on causality from one variable to the next. This simple, yet important task, is completely impossible to model using a time series procedure. Therefore, in this study, the Dumitrescu and Hurlin (2012) 'Pairwise Dumitrescu Hurlin Panel Causality Tests' are employed for the panel series.

To model Pairwise Dumitrescu Hurlin Panel Causality Tests of Dumitrescu and Hurlin (2012), let us denote two stationary variables A and B, with N dimension and T periods. For each individual stationary variable, $i = 1, \cdots, N$ and $t = 1, \cdots, T$. The following linear model can be used to demonstrate the effect of cross-sectional linear restrictions on the parameters of the model,

$$A_{i,t} = \alpha_i + \sum_{k=1}^{K} \varphi_i^{(k)} A_{i,t-k} + \sum_{k=1}^{K} \omega_i^{(k)} B_{i,t-k} + \varepsilon_{i,t} \qquad (2)$$

For equation (2) model parameters to hold, individual effects of α_i are fixed in time dimension, while $(A_{i,} - K, \cdots, A_{i,0})$ and $(B_{i,} - K, \cdots, B_{i,0})$ of both individual processes $A_{i,t}$ and $B_{i,t}$ are observable. This allows autoregressive parameters $\varphi_i^{(k)}$ and regression coefficient slopes $\omega_i^{(k)}$ to be independent across the groups. In this case, the lag orders K should be identical for all cross-section units of a balanced panel. Data employed for this empirical investigation are required to be balanced, so that these conditions can be met. This study has ensured this remains true of the panel data series.

3.5.2 Panel Unit Root Test

Conventionally, testing long-run causal relationship among variables are done with stationary variables to ensure that change in time does not cause persistent innovations in the chosen series. This is mostly done using time series Granger Causality. Panel Unit Root test of Dumitrescu and Hurlin (2012) is employed in this study and is complimented by Pesaran (2007) which principally assumes cross-section time dependence.

3.5.3 Robustness Checks

The study models the relationship between investment growth and capital market development using capital accumulation as the dependent variables against broad market liquidity, broad market return and broad market size as capital market development variables. This analysis involves ascertaining the complete contribution if any, of the specific market development variables to the changes in investment for the chosen sample of markets. This task can be done using simple Pooled Ordinary Least squares and Random/Fixed Effects models. However, the realised coefficients of the chosen variables could have time series/panel data problems such as autocorrelation and heteroscedasticity which eventually distort the parameter estimates and can result in a spurious regression output. To mitigate this, panel system Generalized Method of Moments is used to ascertain the validity of the instruments (the coefficients of the independent variables).

CHAPTER 4: DATA ANALYSIS, RESULTS AND DISCUSSIONS

4.1 Introduction

The previous chapters of this study have helped to introduce the problem, discuss the literature to show where the empirical gaps lie and present appropriate methodology to answer the questions put forward in the study. As such, this study investigates the relationship between investment growth and capital market development variables in a selection of countries in Sub-Saharan Africa. This chapter presents the results of the statistical analysis and discusses the empirical implications of the results. The chronology of this chapter shows that the most basic behaviour of the variables is shown in the form of graphical analysis and common statistics (descriptive statistics). What follows is the basic relationship among the variables which ideally reveal the movement and co-movement in the series, and how the series relate to each other. This is done using Pearson's Correlations coefficient.

These three procedures: graphical analysis, common statistics analysis and correlations analysis helps to understand the behaviour of the series over time. As commonly expected, time series variables manifest the effect of time in the time series data generating process. Therefore, it is appropriate to determine this persistence, and if it exists, then appropriate procedures should be taken so the errors do not influence the estimates of the parameters and hence the inference from the estimates. Unit root test is therefore done to ascertain this. Upon doing all these, the appropriate model of analysis is arrived at. The empirical regression analysis is conducted. Last but not least, the results from the analysis are subjected to post-model analysis to find out if the idiosyncratic term still have influence on the results. Robustness check is done last, and the concluding remarks are made.

4.1 Graphical Analysis

This procedure is done on the series before any transformations. Graphical analysis provides basic visual inspection of individual data series as opposed to summaries. Here, information such as trend, the highs and the lows of the series can be visually inspected. Graphical analysis of all the variables and countries are reported in **Appendix 1**. **Appendix 1 (a)** reports the output of Botswana. As can be seen, all the series show effect of time of the years. They also manifest a growing trend. Capital Formation Cap FM has some peculiar graph. The variable starts from almost zero and grows steadily over time. The other series show similar trend except for volume which show strange picture from the year 2000 to 2008.

Appendix 1(b) reports graphical analysis of Ghana. All the series show a closely related picture, except for volume, which ideally is not far off. Ghana series reveal trend and some similar co-movement that may suggest a causal relationship in the variables. Kenyan graphical analysis is reported in **Appendix 1(c)**. According to the graphs, Kenyan series seems to reveal common information in their time series innovation process. Volume variables doesn't reveal a clear picture, but this can be apportioned to scale problems as the data series are reported in US Dollar terms for ease of cross-sectional comparison. As a result, when Kenyan volume series are converted to USD, the results are lower scale figures that results into the graph showing a difference from the rest of the series.

Mauritius graphical series are presented in **Appendix 1(d)**. The series are not any different from the behaviors realized in the first three countries, with volume showing a similar strange visual picture. **Appendix 1(e)** reports Nigerian series which reveal a slightly different behavior from the four countries analyzed so far. According to Nigerian graphs, capital formation (accumulation) variable seems to have same time series innovation process with index price and looks like they move in lockstep. South African graphical analysis output is reported in **Appendix 1(f)**. Far from

the rest, South African series manifest a clear trend and relationship between the variables, which seems to follow the same data generating process. They all manifest trend and co-move almost the same way over the years. This relationship may be interesting especially in establishing the causality among the variables.

4.3 Descriptive Statistics

Also known as common statistics, descriptive statistics present the information in the data series as summaries. The main components include the averages (mean) values of the series, median values, standard deviation, maximum and minimum values, skewness and Kurtosis. In some circumstances, the Jacque Berra statistic is reported.

Table 4.1 Descriptive Statistics

	CAP_FMT	VOL	PRICE	CAP
		Botswana		
Mean	4586015.	152166.4	825.2992	3285759.
Median	5604127.	85176.49	916.0151	4151659.
Maximum	7851764.	489291.8	1606.512	5672092.
Minimum	611206.1	1289.570	111.3742	150562.0
Std. Dev.	2366397.	145380.5	316.7749	1894450.
Skewness	-0.730668	0.894602	-0.283859	-0.790581
Kurtosis	1.960381	2.423222	2.673968	1.992630
Observations	216	216	216	216
		Ghana		
Mean	2866457.	118876.9	3012.644	2027392.
Median	3304701.	10798.55	1474.344	2221958.
Maximum	7222879.	1991276.	10014.76	5389476.
Minimum	14570.81	49.80000	395.9429	2791.777
Std. Dev.	2027496.	292127.4	2736.185	1444795.
Skewness	-0.970924	3.970924	0.818957	0.040155
Kurtosis	2.084868	21.06274	2.383105	2.278180
Observations	216	216	216	216
		Kenya		
Mean	15967814	580747.3	43.83603	11393749
Median	15691041	381408.6	41.71085	11380521
Maximum	37179304	23966145	85.61053	27224345
Minimum	57660.86	36015.20	12.78800	3583.000
Std. Dev.	11576876	1969082.	17.20300	8533612.
Skewness	0.054729	10.46480	0.376814	0.090526
Kurtosis	1.874005	115.0578	2.695510	1.870789
Observations	216	216	216	216
		Mauritius		
Mean	6598445.	28789.32	30.52734	4919173.
Median	6270285.	6602.850	30.30000	4655376.
Maximum	17174187	305378.9	36.45000	12638018
Minimum	104707.1	16.13333	25.46500	78165.00
Std. Dev.	5199536.	48702.81	2.670889	3870188.
Skewness	0.245645	3.035965	0.421916	0.242298
Kurtosis	1.854716	14.49331	2.669820	1.855713
Observations	216	216	216	216
		Nigeria		
Mean	14950741.	177.3496	50583646	4609650.
Median	1284241.	158.9539	46812437	5069683.
Maximum	8014543.	556.0542	1.98E+08	18887478
Minimum	131089.4	57.90539	4962388.	81878.20
Std. Dev.	1371305.	100.0989	39977352	3829276.
Skewness	2.596354	1.719353	1.839504	0.465543
Kurtosis	10.66364	5.985588	7.337940	2.642102
Observations	216	216	216	216
		South Africa		
Mean	5.16E+08	16648.21	3050.015	3.83E+08
Median	6.01E+08	16545.10	3548.271	4.45E+08
Maximum	8.91E+08	34282.00	4849.442	6.65E+08
Minimum	1.05E+08	4607.300	854.6952	76498529
Std. Dev.	2.45E+08	8934.150	1314.638	1.83E+08
Skewness	-0.465613	0.246922	-0.441553	-0.460749
Kurtosis	1.758674	1.811336	1.643452	1.757280
Observations	216	216	216	216

This table presents summary statistics of the variables included in this study at country level. All the variables are in their nominal terms for the period of 18 years. Data used in this analysis is monthly frequency totaling 216 months for the entire period. Variables in this table are in their nominal values. Mean, median, skewness and kurtosis are analyzed to give insights into the summery statistics of the data series for this study

Table 4.1 presents the results of summary statistics of Capital Formation, Volume of Trade, Stock Market Index Price and Stock Market Capitalization for the six countries included in this

study. The statistics reveal average information of the variables included. For instance, mean values of the series reveal that South Africa had the highest mean capital investment for the 18 years tested, followed by Nigeria, Kenya, Mauritius, Botswana and Ghana, respectively. Mean values indicate that on average, these countries' capital investments in dollar terms are varied, which is also indicative of their economic strength and investment environment. Over the 18 years of data, the median investment values varied from each country to the next. Statistically, median values indicate the midpoint of the mean values. If the median value is higher than the mean value, then the series manifest negative skewness. In other words, majority of the values lie on the left of the midpoint, and vice versa.

Summary statistics is used as a yardstick of normality in the distribution of the series (Peia & Roszbach, 2015). Accordingly, if median values are lower than mean values, then the series are experiencing negative skewness which is not desirable for a normally distributed series. If mean is equal to median, the skewness is 0, which is indicative of normal distribution. Skewness therefore is a measure of degree of asymmetry and the statistical rule of thumb requires a normally distributed series to have a value of 0. Another critical measure of normality is kurtosis. According to Brooks (2014) and Wang (2005), for a normally distributed series, the kurtosis metric should be 3. Kurtosis therefore measures the peakedness, flatness or tail of distribution, where for a normally distributed series, the value 3 represents mesokurtic distribution, whereas a value less than 3 is known as platykurtic, and a value more than 3 is known as leptokurtic distribution. Normal distribution is therefore a function of kurtosis which means that fat tails are either platykurtic or leptokurtic in their distribution.

Results in **Table 4.1** do not meet the requirements of normal distribution as both the metrics fall off. Screening through the table, one can notice that almost in all of them, there is positive skewness and leptokurtic distribution indicated by the coefficient of kurtosis which in most of the

results are above the standard 3. These results therefore reveal that there are problems of distribution in the variables that a classical regression models can not fit the data in their current form. This calls for transformation of the variables, or further check on the possible causes of this non-normality in the distribution. It is also imperative to understand the relationship between the variables, as this information become important in choosing a suitable model for the data.

4.4 Correlation Analysis

Correlation analysis is a statistical process that helps to understand the interactive relationship between the variables. This information is crucial given that some economic variables might be highly correlated to the point that including them in the same model may result in multicollinearity. Multicollinearity is a condition where two or more variables have a close relationship, where one can actually be taken in place of the other because the innovations in one reflects the innovations in the other. This is common in most economic time series data (Bell & Jones, 2015). Standard rule of correlation or covariance is that if the coefficient between two regressor variables is more than 0.8, then the two variables cannot be included in the same regression model. Possible remedies to this problem include orthogonalizing or performing principal components analysis (PCA) to extract common information in the series that form a principal component.

Table 4.2 Correlation Matrix

	Cap FM	VOL	PRICE	CAP
	Botswana			
CAP_FMT	1.000			
VOL	-0.813	1.000		
	0.000	-----		
PRICE	0.807	-0.872	1.000	
	0.000	0.000	-----	
CAP	0.699	-0.838	0.822	1.000
	0.000	0.000	0.002	-----
	Ghana			
CAP_FMT	1.000			
VOL	0.349	1.000		
	0.0000	-----		
PRICE	-0.092	0.197	1.000	
	0.173	0.003	-----	
CAP	0.981	0.165	-0.139	1.000
	0.000	0.015	0.040	-----
	Kenya			
CAP_FM	1.000			
VOL	0.488	1.000		
	0.002	-----		
PRICE	0.571	-0.679	1.000	
	0.117	-0.059	-----	
CAP	0.773	0.579	0.489	1.000
	0.071	0.479	0.014	-----
	Mauritius			
CAP_FM	1.000			
VOL	-0.456	1.000		
	0.000	-----		
PRICE	0.856	0.169	1.000	
	0.000	0.012	-----	
CAP	-0.856	-0.756	-0.656	1.000
	0.487	0.001	0.050	-----
	Nigeria			
CAP_FM	1.000			
VOL	-0.356	1.000		
	0.000	-----		
PRICE	0.856	0.169	1.000	
	0.000	0.012	-----	
CAP	-0.753	-0.556	-0.854	1.000
	0.487	0.001	0.050	-----
	South Africa			
CAP_FMT	1.000			
VO	0.856	1.000		
	0.000	-----		
PRICE	0.677	0.557	1.000	
	0.000	0.000	-----	
CAP	0.745	0.455	0.671	1.000
	0.000	0.000	0.000	-----

Table 4.2 presents Pearson's Correlation Coefficient for all the variables included in the study.

Variables that indicate perfect correlation have a coefficient of 1. This relationship can either be positive or negative. In positive correlation, it means that a change in one series correspond to a change in the other series in the same direction, while negative correlation indicates that, as one series change, the other also change but in opposite direction. This relationship can be strong or weak. In strong correlation, the coefficient is more than 0.5, while weak is below 0.5 in either of the directions.

According to **Table 4.2** the correlation matrix for Botswana indicate closely related variables. All the three variables have strong positive and significant correlation with the dependent variable except for volume which has a negative and significant coefficient of -0.83 and a p-value of 0.00. This means that all the variables have explanatory power of the capital formation. All the three variables have strong relationship, but not above the standard 0.8. This may result into high regression fit (R-square).

Ghana manifests a healthy correlation output, except for high values of market capitalization and capital formation. This could spell danger, but being that one is dependent, and the other is independent, this relationship could be speaking of how closely capital formation and the size of the market in Ghana co-moves, which is not far from the *apriori.* In summary, all the countries more or less show the same correlation behaviour with majority of the variables; indicating significant and positive correlation. This information is crucial for the next stage of analysis in this study. In conclusion, all the variables maybe included in the same regression model, but heteroskedasticity and autocorrelation may prove to be a problem. This however can be solved using an appropriate model of analysis.

4.5 Stationarity Test

As mentioned in the third chapter of this study, persistence of error term in economic time series data is well documented. This concept is called presence of unit root, or non-stationarity. Analysis

done on series manifesting non-constant error term results in spurious statistical output, hence the results cannot be relied upon. Unit root test helps to determine if indeed there is effect of time on the series. In this study, three major time series unit root test were proposed, that is ADF, PP and KPSS.

Appendix 2 reports the group output of stationarity test. As can be seen, there is mixed results, however, there is a reliable explanation for this. Most of these variables presented in Appendix 2 are still in their nominal values. The study is however investigating the rates of change in these variables. Therefore, unit root might not be a major problem for three of the variables involved in the study; that is, investment growth, liquidity, and market return. Size (cap) on the other hand is expected to manifest serious effect of time in its data generating process because it is not a rate of change. The next unit root tests primarily test the size variable. For the other variables, a confirmatory test is done, though not discussed because non-stationarity is not expected in them. The next step will involve transforming the variables and renaming them to conform to equation (1) in the third chapter.

4.5.1 Size variable stationarity Test

Upon transforming all the variables to conform to equation (1), size variable is specifically singled out for a test of stationarity. This is because the variable is not transformed into rates of change, but rather renamed from cap to size. Only tests of Botswana are reported here in terms of size stationarity test. All the proposed three tests fail the test as the size series manifest presence of unit root. The results of these analyses are reported in **Appendix 3**. However, upon subjecting the series to rates of change, taking a log difference of the series, all the unit root tests become positive. The rest of the countries are not reported here, but the behaviour of the size variables largely remains the same.

4.6 Regression Analysis

This study involves multiple analysis, from country level to a panel of the combined countries. In this section, only the results of the panel are presented and discussed. The results of individual country analysis are available in **Appendix 4**. The decision to only present and analyse panel

results are guided by the main objective of this study. The study proposed to investigate the relationship between investment growth and capital market development variables in Sub-Saharan Africa. Therefore, the combined panel analysis meets the intended objective.

4.6.1 Pooled OLS

The conversion of the variables into rates of change is a pivotal requirement in this study. This transformation allows for the use of classical linear regression model because the variables become stationary before subjecting them to analysis. The only problem here is the size variable, which is log differenced to be stationary. In an otherwise case, the use of OLS may not be permitted. Therefore, Fixed and Random effects model is implemented to take care of the size variable, and also to determine if there exists random or fixed effects in the countries analysed. Results of these analyses are presented in Table 4.3.

Table 4.3 Results for Panel Least Square

Variable	Coefficient	T-stat	P-values
LIQ	0.030	3.468	0.0210
RET	0.259	5.979	0.0025
CAP	0.050	2.688	0.0521
	Summary Statistics		
$Adjusted\ R^2$	0.341		
MSE	0.019		
F stat	3.017		
P value of F stat	0.021		

This table provides results for the main model used to analyse the data presented in this study. The table presents the coefficient of the regressor variables and their t-statistics. Summery statistics reveal the model fit, adjusted R squared, Mean Squared Error and F statistics are used to determine the validity of this model. The equation analyzed is; $INV_t = LIQ_t + RET_t + CAP_t + \varepsilon_t$ where INV is the investment growth variable or changes in capital formation, LIQ is Liquidity defined as the changes in broad market volume of trade and CAP as the broad market capitalization. All the variables are stationary by their definitions except for CAP that is made stationery by taking the Log Difference.

According to Table 4.3, the investigated variables influence the innovations in the capital formation or investment growth in the six countries included in this study. This is informed by their significant coefficients as per the values of the t-statistic. Accordingly, all the variables indicate positive relationship with investment growth in the Sub-Saharan African countries investigated. This result is not surprising judging from the earlier basic relationships revealed by the correlation analysis. In the correlation analysis, only volume in Botswana had a negative relationship with the capital formation variable, while all the variables were positively correlated to the dependent variables for the entire sample of countries in the analysis. The results provided in Table 4.3 also indicate that, jointly the variables describe the changes in investment growth in the six countries by 34.1% as revealed by the value of the adjusted R square. This result is further bolstered by the low values of the Mean Squared Errors which indicate that the errors in the regression interfere with the relationships between the variables at 1.9%, which by any standard is quite negligible. The values of F statistics of 3.017 with p value of 0.021 indicate that the model is stable, and the variables included in the regression describe the relationship reliably using the Panel Least Squares model or Pooled OLS model.

4.7 Causality

Correlation analysis presented earlier in **Table 4.2** of this study reveals a picture of close association among the variables, especially the close co-movement between the dependent variable and the independent variables. Size variable, for instance, shows a close correlation with the dependent variable in which countries like South Africa manifest close to perfectly positive correlation. This information could be indicative of the variables having bidirectional causal relationship. This is, however, not a surprise because variables included in this study have strong theoretical connection and could have lead-lag relationships (Ayadi, Arbak, Naceur, & De Groen, 2015; Pagano, 1993). In this section of the study, this connectedness is investigated.

Since at this point the significant variables have been identified and their contributory powers to the variations of investment growth ascertained, it is imperative to find out which variables have causal relationships as this information helps in policy making instances. **Table 4.4** present causal structure among the variables included in this study. According to the table, the contemporaneous causal relationship reveals two instances of double/reverse causality. Accordingly, liquidity and investment have reverse causality, likewise market return and investment have double causality. Although there is no directly comparable study using the exact variables in this study, liquidity and investment double causality can be inferred from results presented by Ahlers, Cumming, Günther, and Schweizer (2015) who conclude that liquidity of the market acts as signal for better and mature markets which in turn encourages investment. The reverse of this can also be postulated to be true, as Ayadi et al. (2015) report that investment growth in banking sector spur liquidity of the sector. The results in **Table 4.4** show that size and investment have one direction causality as the null hypothesis of Size does not homogeneously causes Investment is rejected at 1% level of significance. The same result is also manifested by return and liquidity, while return and size have causality running from size to return at 10% level of significance.

Table 4.4 Pairwise Causality Test

Pairwise Dumitrescu Hurlin Panel Causality Tests			
	W-Stat.	Zbar-Stat.	Prob.
LIQ does not homogeneously cause INV	2.32575	0.36798	0.0529**
INV does not homogeneously cause LIQ	2.27088	0.30207	0.0626**
SIZE does not homogeneously cause INV	4.96000	3.53237	0.0004*
INV does not homogeneously cause SIZE	2.59240	0.68830	0.4913
RET does not homogeneously cause INV	16.1668	16.9945	0.0000*
INV does not homogeneously cause RET	10.9471	10.7244	0.0000*
SIZE does not homogeneously cause LIQ	1.91414	-0.12647	0.8994
LIQ does not homogeneously cause SIZE	1.50752	-0.61491	0.5386
RET does not homogeneously cause LIQ	1.57185	-0.53764	0.5908
LIQ does not homogeneously cause RET	4.35213	2.80217	0.0051*
RET does not homogeneously cause SIZE	2.93800	1.10344	0.2698
SIZE does not homogeneously cause RET	3.76761	2.10002	0.0357***

This table presents the results of causality between the variables included in this study. Asterisk (*) present the level of significance whereas * is at 1%, ** 5% and *** at 10% level of significance respectively

4.8 Robustness Test

Vector Autoregression (VAR) models have been employed to help validate the results reported in this study. VAR analysis uses three of the independent variables as exogenous variables to the model and subjects the variables in a system of equations into their lagged values. Lagged values of investment, size and market return are significant as reported in Appendix (6). The result reveal that past values of these three variables, except for liquidity influence their future innovations. This is well within the expectations of the apriori. Liquidity results sharply contradicts the OLS and GMM outputs, especially their past innovations. Nonetheless, these results are indicative of the influence of the selected variables on capital formation in SSA.

CHAPTER 5: CONCLUSION AND RECOMMENDATION

5.1 Introduction

This chapter presents the summary of the findings from the study. It offers recap of output from the analysis undertaken from the study by way pf conclusion. It also offers recommendation for further studies that can provide more insight into the phenomenon investigated here. This is done by recognising the shortcomings realised in the process of carrying out this study. The chapter begins with discussing the main findings of the study and ends with recommendations for further studies.

5.2 Conclusion

This study sought to investigate the factors that affect investment growth in Sub-Saharan Africa countries. Initially, ten countries were proposed to be included in the study, however, due to data scarcity and availability, only six countries were included in the analysis. Capital Formation was chosen to proxy investment growth, while broad market volume of trade, stock market index price and market capitalization were chosen to proxy capital market development in the six markets investigated.

Descriptive and correlation statistics presented at the beginning of Chapter 4, revealed that the variables included in this study have some relationship with one another. This was not surprising though; economic and financial variables have close relationships (Calderón & Liu, 2003; Samargandi, Fidrmuc, & Ghosh, 2015). The results of unit root test revealed that only capitalization variable had unit root. This was not a surprise too, as the definition of the other three variables implied rates of change, which statistically transform the variables to a stationary process. Main model of analysis, Pooled OLS or Panel Least Square, revealed that all the variables, judging by the t-statistic of their coefficients were significantly positively influenced by the related to investment growth in the six sample of countries in Sub-Saharan Africa. This result was further

interrogated using panel causality process to determine if the variables have reverse causation among each other. Only liquidity and return of the market proved to have reverse causal relationship. Other tests such as Radom effect, fixed effects and GMM all revealed that the right variables were included in the regression analysis, and that the results of the Pooled OLS can be relied upon.

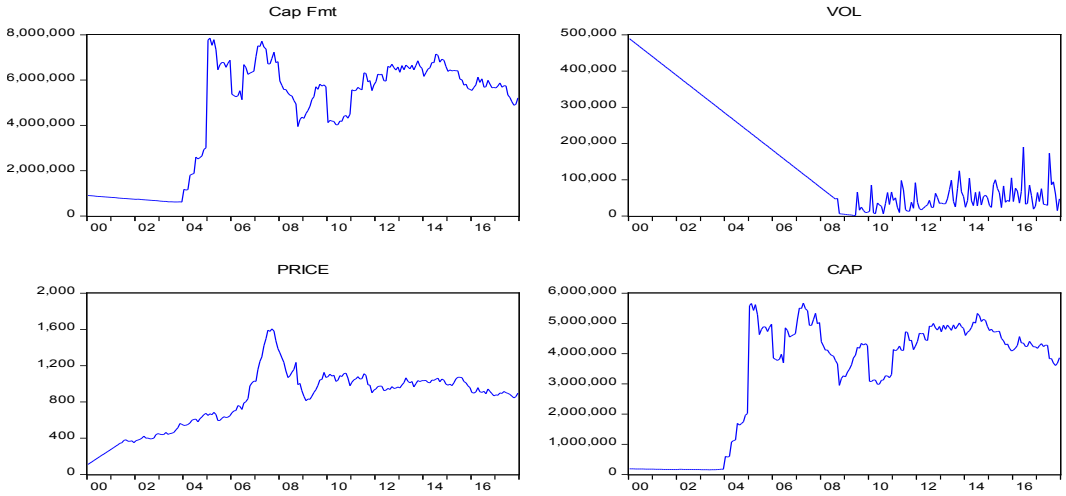
5.3 Recommendation

The scope of this study was to investigate the factors that influence investment growth in all the countries in Sub-Saharan Africa. This was not met due to paucity of data. In recommendation, more data points should be included in such a study and investigation can be extended to other geographical regions with almost similar economic characteristics as the ones investigated here to gain more insight into the relationship. Given that this study was only restricted to quarterly data frequency for a period of 18 years producing 216 data points, it would be interesting for a follow-up study to use more frequency data with a much superior model of analysis to validate or invalidate the results found in the analysis.

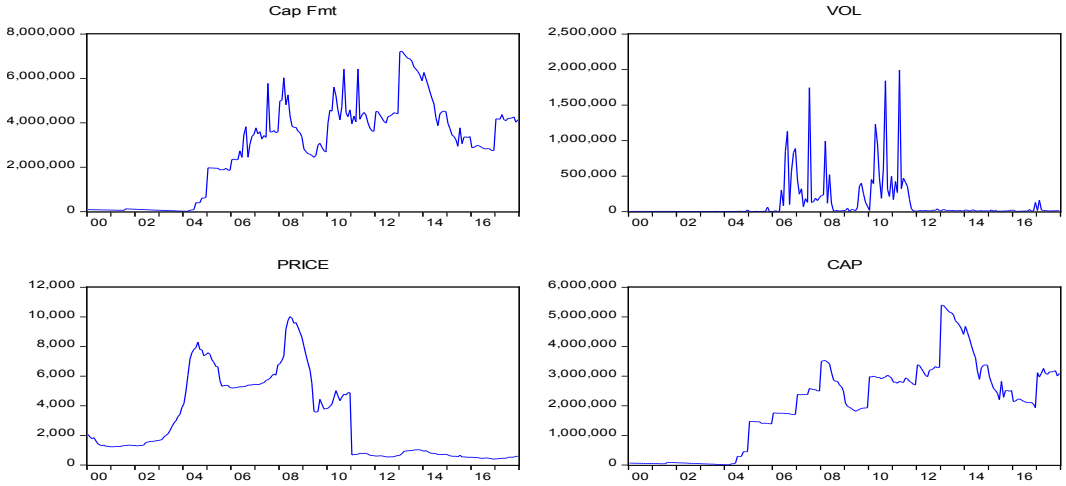
APPENDICES

Appendix 1: Graphical Analysis

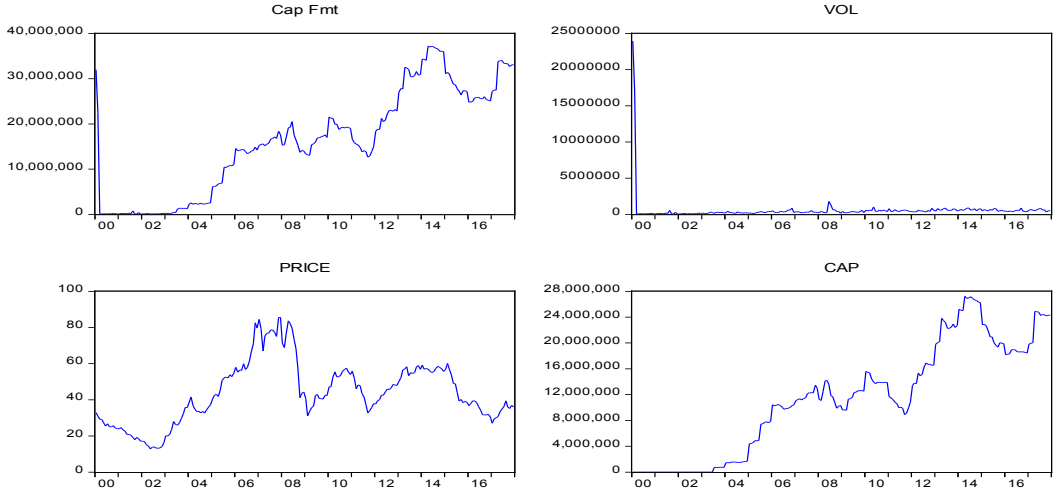
Appendix 1(a): Botswana



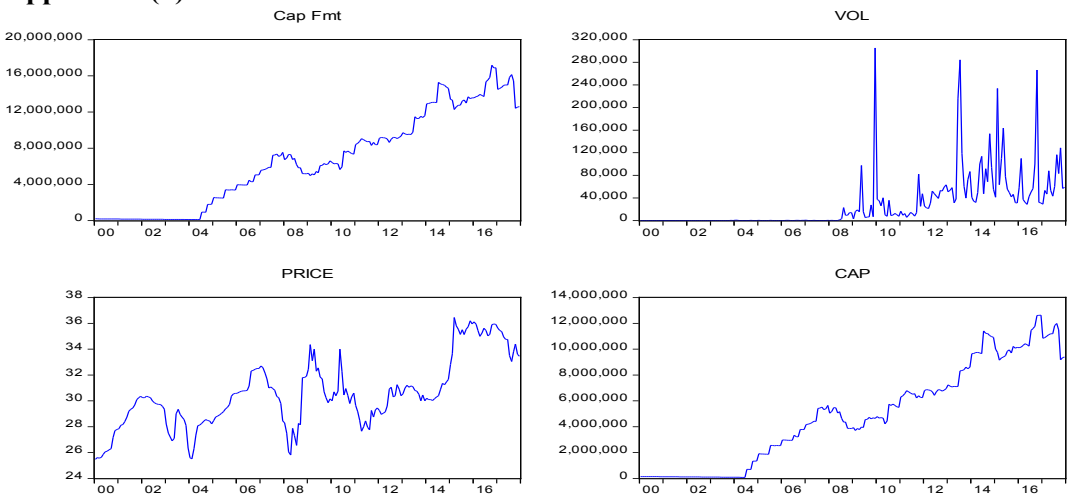
Appendix 1(b): Ghana



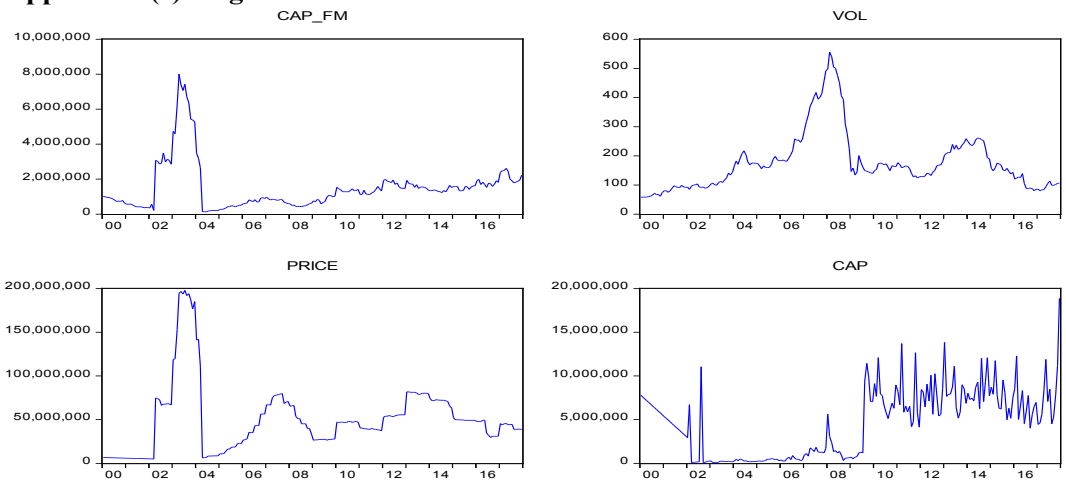
Appendix 1(c): Kenya



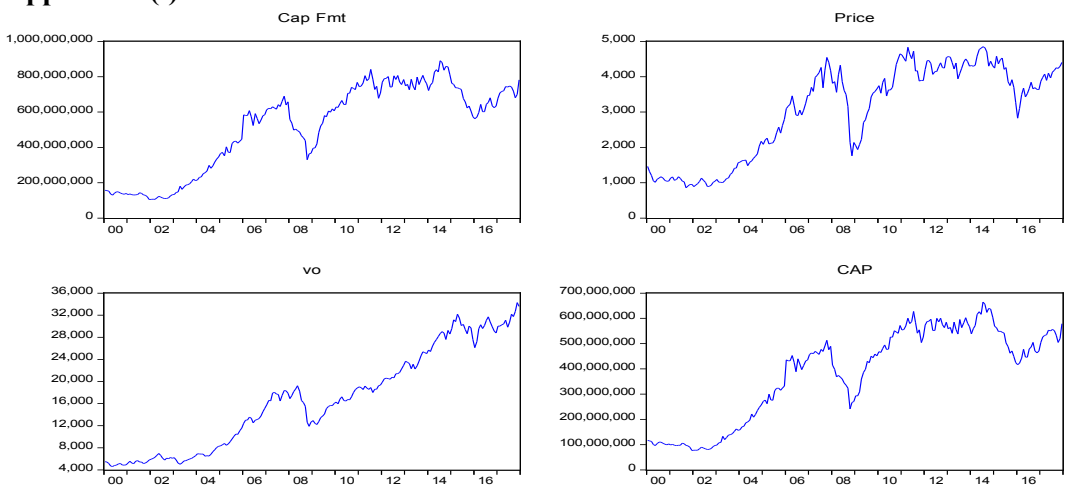
Appendix 1(d): Mauritius



Appendix 1(e): Nigeria



Appendix 1(f): South Africa



Appendix 2: Unit Root Tests

Appendix 2(a): Botswana Group Unit Root Test

Group unit root test: Summary
Series: CAP_FMT, VOL, PRICE, CAP
Date: 12/23/18 Time: 06:28
Sample: 2000M01 2017M12
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 5
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-3.21630	0.0006	4	853
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-2.10486	0.0177	4	853
ADF - Fisher Chi-square	18.9863	0.0149	4	853
PP - Fisher Chi-square	11.2859	0.1860	4	860

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Appendix 2(b): Ghana Group Unit Root Test

Group unit root test: Summary
Series: CAP_FMT, VOL, PRICE, CAP
Date: 12/23/18 Time: 06:29
Sample: 2000M01 2017M12
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 6
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-0.10095	0.4598	4	852
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-0.50609	0.3064	4	852
ADF - Fisher Chi-square	7.84021	0.4492	4	852
PP - Fisher Chi-square	84.6372	0.0000	4	860

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Appendix 2(c): Kenya Group Unit Root Test

Group unit root test: Summary
Series: CAP_FMT, VOL, PRICE, CAP
Date: 12/23/18 Time: 06:31
Sample: 2000M01 2017M12
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 2
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	5.89476	1.0000	4	857
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-2.32216	0.0101	4	857
ADF - Fisher Chi-square	38.3620	0.0000	4	857
PP - Fisher Chi-square	21.9107	0.0051	4	860

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Appendix 2(d): Mauritius Group Unit Root Test

Group unit root test: Summary
Series: CAP_FMT, VOL, PRICE, CAP
Date: 12/23/18 Time: 06:32
Sample: 2000M01 2017M12
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 3
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-0.35267	0.3622	4	857
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-0.67379	0.2502	4	857
ADF - Fisher Chi-square	13.6822	0.0904	4	857
PP - Fisher Chi-square	65.1656	0.0000	4	860

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Appendix 2(e): Nigeria Group Unit Root Test

Group unit root test: Summary
Series: CAP_FMT, VOL, PRICE, CAP
Date: 12/23/18 Time: 06:33
Sample: 2000M01 2017M12
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 2 to 3
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-1.42276	0.0774	4	849
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-3.41125	0.0003	4	849
ADF - Fisher Chi-square	28.6063	0.0004	4	849
PP - Fisher Chi-square	25.4220	0.0013	4	860

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Appendix 2(f): South Africa Group Unit Test

Group unit root test: Summary
Series: CAP_FMT, VOL, PRICE, CAP
Date: 12/23/18 Time: 06:35
Sample: 2000M01 2017M12
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 11
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-0.17131	0.4320	4	849
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0.97220	0.8345	4	849
ADF - Fisher Chi-square	2.75823	0.9486	4	849
PP - Fisher Chi-square	10.8542	0.2101	4	860

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Appendix 3: Size Unit Root Test

1. ADF Botswana

Null Hypothesis: SIZE has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.792079	0.3838
Test critical values:	1% level	-3.460739	
	5% level	-2.874804	
	10% level	-2.573917	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(SIZE)
Method: Least Squares
Date: 12/23/18 Time: 06:57
Sample (adjusted): 2000M02 2017M12
Included observations: 215 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SIZE(-1)	-0.021279	0.011874	-1.792079	0.0745
C	86943.71	45004.96	1.931869	0.0547

R-squared	0.014854	Mean dependent var	17083.30
Adjusted R-squared	0.010229	S.D. dependent var	331461.6
S.E. of regression	329762.1	Akaike info criterion	28.25939
Sum squared resid	2.32E+13	Schwarz criterion	28.29074
Log likelihood	-3035.884	Hannan-Quinn criter.	28.27206
F-statistic	3.211548	Durbin-Watson stat	1.980532
Prob(F-statistic)	0.074540		

2. PP Botswana

Null Hypothesis: SIZE has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.795425	0.3822
Test critical values:	1% level	-3.460739	
	5% level	-2.874804	
	10% level	-2.573917	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	1.08E+11
HAC corrected variance (Bartlett kernel)	1.09E+11

Phillips-Perron Test Equation
Dependent Variable: D(SIZE)

Method: Least Squares
Date: 12/23/18 Time: 06:59
Sample (adjusted): 2000M02 2017M12
Included observations: 215 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SIZE(-1)	-0.021279	0.011874	-1.792079	0.0745
C	86943.71	45004.96	1.931869	0.0547

R-squared	0.014854	Mean dependent var	17083.30
Adjusted R-squared	0.010229	S.D. dependent var	331461.6
S.E. of regression	329762.1	Akaike info criterion	28.25939
Sum squared resid	2.32E+13	Schwarz criterion	28.29074
Log likelihood	-3035.884	Hannan-Quinn criter.	28.27206
F-statistic	3.211548	Durbin-Watson stat	1.980532
Prob(F-statistic)	0.074540		

3. KPSS Botswana

Null Hypothesis: SIZE is stationary
Exogenous: Constant
Bandwidth: 11 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		1.178257
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	3.57E+12
HAC corrected variance (Bartlett kernel)	3.91E+13

KPSS Test Equation
Dependent Variable: SIZE
Method: Least Squares
Date: 12/23/18 Time: 06:59
Sample: 2000M01 2017M12
Included observations: 216

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3285759.	128901.0	25.49056	0.0000

R-squared	0.000000	Mean dependent var	3285759.
Adjusted R-squared	0.000000	S.D. dependent var	1894450.
S.E. of regression	1894450.	Akaike info criterion	31.75137
Sum squared resid	7.72E+14	Schwarz criterion	31.76700
Log likelihood	-3428.148	Hannan-Quinn criter.	31.75769
Durbin-Watson stat	0.030552		

Null Hypothesis: RET_SIZE has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.009261	0.0000
Test critical values:	1% level	-3.461178	
	5% level	-2.874997	
	10% level	-2.574019	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RET_SIZE)
Method: Least Squares
Date: 12/23/18 Time: 07:01
Sample (adjusted): 2000M05 2017M12
Included observations: 212 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RET_SIZE(-1)	-0.687128	0.114345	-6.009261	0.0000
D(RET_SIZE(-1))	-0.341337	0.094412	-3.615414	0.0004
D(RET_SIZE(-2))	-0.295032	0.066266	-4.452232	0.0000
C	0.009957	0.008882	1.121063	0.2636

R-squared	0.551876	Mean dependent var	0.000256
Adjusted R-squared	0.545413	S.D. dependent var	0.188652
S.E. of regression	0.127195	Akaike info criterion	-1.267501
Sum squared resid	3.365151	Schwarz criterion	-1.204169
Log likelihood	138.3551	Hannan-Quinn criter.	-1.241903
F-statistic	85.38570	Durbin-Watson stat	2.003303
Prob(F-statistic)	0.000000		

Null Hypothesis: RET_SIZE has a unit root
Exogenous: Constant
Bandwidth: 7 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-15.11487	0.0000
Test critical values:	1% level	-3.460884	
	5% level	-2.874868	
	10% level	-2.573951	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.017257
HAC corrected variance (Bartlett kernel)	0.026663

Phillips-Perron Test Equation
Dependent Variable: D(RET_SIZE)
Method: Least Squares
Date: 12/23/18 Time: 07:01
Sample (adjusted): 2000M03 2017M12
Included observations: 214 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RET_SIZE(-1)	-1.016526	0.068678	-14.80124	0.0000
C	0.014393	0.009073	1.586404	0.1141

R-squared	0.508208	Mean dependent var	0.000253
Adjusted R-squared	0.505889	S.D. dependent var	0.187764
S.E. of regression	0.131985	Akaike info criterion	-1.202950
Sum squared resid	3.693069	Schwarz criterion	-1.171492
Log likelihood	130.7156	Hannan-Quinn criter.	-1.190238
F-statistic	219.0768	Durbin-Watson stat	1.998405
Prob(F-statistic)	0.000000		

Null Hypothesis: RET_SIZE is stationary
Exogenous: Constant
Bandwidth: 7 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.272122
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.017184
HAC corrected variance (Bartlett kernel)	0.025766

KPSS Test Equation
Dependent Variable: RET_SIZE
Method: Least Squares
Date: 12/23/18 Time: 07:01
Sample (adjusted): 2000M02 2017M12
Included observations: 215 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.014071	0.008961	1.570298	0.1178

R-squared	0.000000	Mean dependent var	0.014071
Adjusted R-squared	0.000000	S.D. dependent var	0.131392
S.E. of regression	0.131392	Akaike info criterion	-1.216622
Sum squared resid	3.694467	Schwarz criterion	-1.200945
Log likelihood	131.7869	Hannan-Quinn criter.	-1.210288
Durbin-Watson stat	2.032616		

Appendix 4: Regression Output

Appendix 4(a): Botswana Regression and diagnostics

Dependent Variable: INV
Method: Least Squares
Date: 12/23/18 Time: 07:08
Sample (adjusted): 2000M02 2017M12
Included observations: 215 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.002842	0.001875	-1.515564	0.1311
LIQ	0.009257	0.002815	3.288771	0.0012
RET	0.071469	0.040467	1.766115	0.0788
RET_SIZE	0.739336	0.013988	4.856440	0.0000

R-squared	0.631082	Mean dependent var	0.008155
Adjusted R-squared	0.570102	S.D. dependent var	0.101271
S.E. of regression	0.026774	Akaike info criterion	-4.384318
Sum squared resid	0.151258	Schwarz criterion	-4.321608
Log likelihood	475.3142	Hannan-Quinn criter.	-4.358980
F-statistic	950.2018	Durbin-Watson stat	1.973273
Prob(F-statistic)	0.000000		

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.972008	Prob. F(2,209)	0.3800
Obs*R-squared	1.981395	Prob. Chi-Square(2)	0.3713

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 12/23/18 Time: 07:15
Sample: 2000M02 2017M12
Included observations: 215
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.32E-05	0.001876	-0.017694	0.9859
LIQ	-0.000290	0.002826	-0.102458	0.9185
RET	0.002606	0.040531	0.064293	0.9488
RET_SIZE	0.000908	0.014015	0.064790	0.9484
RESID(-1)	0.011294	0.069018	0.163632	0.8702
RESID(-2)	0.095704	0.069257	1.381864	0.1685

R-squared	0.009216	Mean dependent var	-3.49E-18
Adjusted R-squared	-0.014487	S.D. dependent var	0.026586
S.E. of regression	0.026778	Akaike info criterion	-4.374972
Sum squared resid	0.149864	Schwarz criterion	-4.280907
Log likelihood	476.3095	Hannan-Quinn criter.	-4.336965
F-statistic	0.388803	Durbin-Watson stat	2.011076
Prob(F-statistic)	0.856174		

Heteroskedasticity Test: ARCH

F-statistic	0.022285	Prob. F(2,210)	0.9780
Obs*R-squared	0.045196	Prob. Chi-Square(2)	0.9777

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/23/18 Time: 07:15
Sample (adjusted): 2000M04 2017M12
Included observations: 213 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000722	0.000399	1.806976	0.0722
RESID^2(-1)	-0.014321	0.069006	-0.207526	0.8358
RESID^2(-2)	-0.002879	0.069006	-0.041720	0.9668

R-squared	0.000212	Mean dependent var	0.000709
Adjusted R-squared	-0.009310	S.D. dependent var	0.005712
S.E. of regression	0.005738	Akaike info criterion	-7.469304
Sum squared resid	0.006915	Schwarz criterion	-7.421962
Log likelihood	798.4809	Hannan-Quinn criter.	-7.450172
F-statistic	0.022285	Durbin-Watson stat	2.000063
Prob(F-statistic)	0.977964		

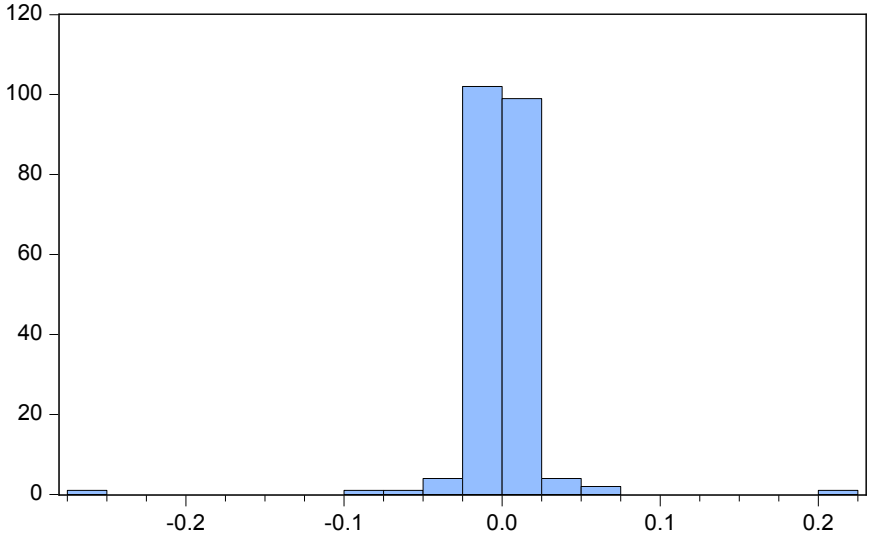
Heteroskedasticity Test: ARCH

F-statistic	0.042889	Prob. F(1,212)	0.8361
Obs*R-squared	0.043285	Prob. Chi-Square(1)	0.8352

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/23/18 Time: 07:16
Sample (adjusted): 2000M03 2017M12
Included observations: 214 after adjustments

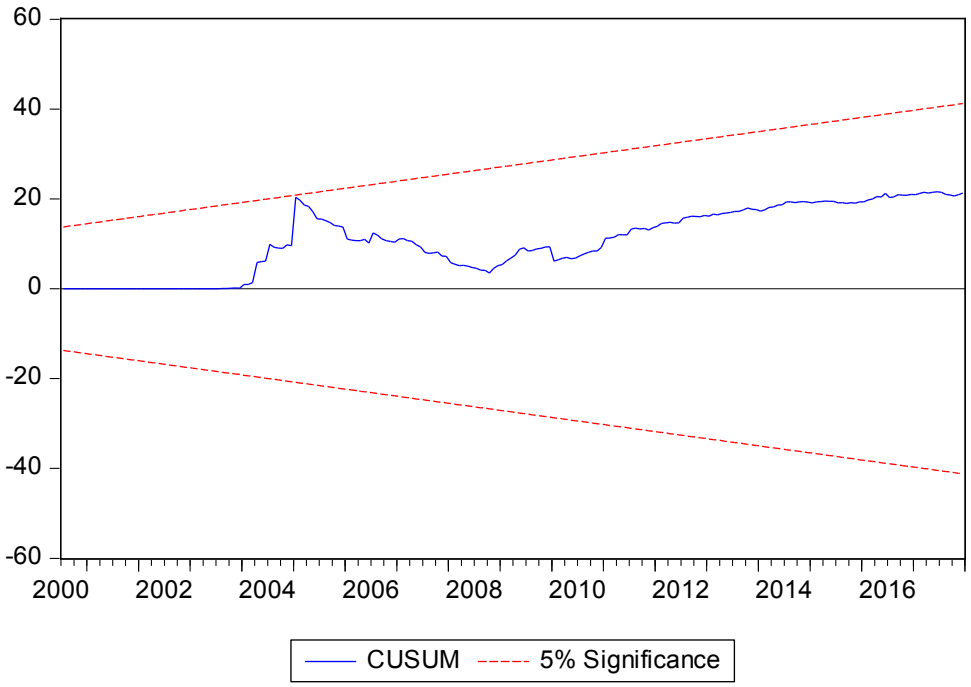
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000716	0.000393	1.821021	0.0700
RESID^2(-1)	-0.014222	0.068673	-0.207098	0.8361

R-squared	0.000202	Mean dependent var	0.000706
Adjusted R-squared	-0.004514	S.D. dependent var	0.005699
S.E. of regression	0.005711	Akaike info criterion	-7.483398
Sum squared resid	0.006915	Schwarz criterion	-7.451940
Log likelihood	802.7236	Hannan-Quinn criter.	-7.470686
F-statistic	0.042889	Durbin-Watson stat	2.000081
Prob(F-statistic)	0.836132		



Series: Residuals
Sample 2000M02 2017M12
Observations 215

Mean	-3.49e-18
Median	-0.000280
Maximum	0.200898
Minimum	-0.269882
Std. Dev.	0.026586
Skewness	-2.973098
Kurtosis	66.00324
Jarque-Bera	35876.02
Probability	0.000000



Granger Causality Tests for Botswana

Pairwise Granger Causality Tests
Date: 12/23/18 Time: 07:21
Sample: 2000M01 2017M12
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LIQ does not Granger Cause INV	213	0.34382	0.0095
INV does not Granger Cause LIQ		0.88900	0.0126
RET does not Granger Cause INV	213	0.53822	0.0846
INV does not Granger Cause RET		0.03039	0.0001
RET_SIZE does not Granger Cause INV	213	0.06050	0.0413
INV does not Granger Cause RET_SIZE		0.16266	0.8500
RET does not Granger Cause LIQ	213	0.44908	0.0388
LIQ does not Granger Cause RET		2.15811	0.0181
RET_SIZE does not Granger Cause LIQ	213	0.49807	0.6084
LIQ does not Granger Cause RET_SIZE		0.23111	0.7939
RET_SIZE does not Granger Cause RET	213	0.05397	0.0475
RET does not Granger Cause RET_SIZE		0.76352	0.4673

Appendix 4(b): Ghana Regressions and diagnostics

Dependent Variable: INV
Method: Least Squares
Date: 12/23/18 Time: 07:25
Sample (adjusted): 2000M02 2017M12
Included observations: 215 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.004684	0.006546	0.715446	0.4751
LIQ	0.045273	0.005581	8.111682	0.0000
RET	0.049263	0.043480	1.133009	0.2585
RET_SIZE	0.723415	0.025352	28.53520	0.0000

R-squared	0.605160	Mean dependent var	0.017834
Adjusted R-squared	0.602390	S.D. dependent var	0.215182
S.E. of regression	0.095655	Akaike info criterion	-1.837698
Sum squared resid	1.930644	Schwarz criterion	-1.774988
Log likelihood	201.5525	Hannan-Quinn criter.	-1.812360
F-statistic	290.6475	Durbin-Watson stat	2.742046
Prob(F-statistic)	0.000000		

Appendix 5: Panel Regressions

Dependent Variable: INV
Method: Panel Least Squares
Date: 12/23/18 Time: 07:55
Sample (adjusted): 2000M02 2017M12
Periods included: 215
Cross-sections included: 6
Total panel (balanced) observations: 1290

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0037854	0.006115	0.61904	0.5360
LIQ	0.0304491	0.008780	3.46801	0.0450
RET	0.2591208	0.043335	5.97948	0.0211
SIZE	0.0496222	0.018462	2.68780	0.0103

R-squared	0.342217	Mean dependent var	0.009951
Adjusted R-squared	0.340683	S.D. dependent var	0.270098
S.E. of regression	0.019315	Akaike info criterion	-0.193519
Sum squared resid	61.85541	Schwarz criterion	-0.177512
Log likelihood	128.8200	Hannan-Quinn criter.	-0.187511
F-statistic	3.017410	Durbin-Watson stat	2.390873
Prob(F-statistic)	0.021100		

System: UNTITLED
Estimation Method: Least Squares
Date: 12/23/18 Time: 07:54
Sample: 2000M02 2017M12
Included observations: 1290
Total system (balanced) observations 5160

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.0099510	0.007520	1.323185	0.1858
C(2)	0.0304491	0.008780	3.46801	0.0450
C(3)	0.2591208	0.043335	5.97948	0.0211
C(4)	0.0496222	0.018462	2.68780	0.0103

Determinant residual covariance	5.05E-05

Equation: INV = C(1)
Observations: 1290

R-squared	0.000000	Mean dependent var	0.009951
Adjusted R-squared	0.000000	S.D. dependent var	0.270098
S.E. of regression	0.270098	Sum squared resid	94.03620
Durbin-Watson stat	2.297347		

Equation: LIQ = C(2)
Observations: 1290

R-squared	0.000000	Mean dependent var	0.002030
Adjusted R-squared	0.000000	S.D. dependent var	0.696205
S.E. of regression	0.696205	Sum squared resid	624.7800
Durbin-Watson stat	2.829722		

Equation: RET = C(3)
Observations: 1290

R-squared	0.000000	Mean dependent var	0.003268
Adjusted R-squared	0.000000	S.D. dependent var	0.141176
S.E. of regression	0.141176	Sum squared resid	25.69057
Durbin-Watson stat	1.899500		

Equation: SIZE = C(4)
Observations: 1290

R-squared	0.000000	Mean dependent var	0.016301
Adjusted R-squared	0.000000	S.D. dependent var	0.331256
S.E. of regression	0.331256	Sum squared resid	141.4427
Durbin-Watson stat	2.463740		

Dependent Variable: INV
Method: Panel Least Squares
Date: 12/23/18 Time: 07:58
Sample (adjusted): 2000M02 2017M12
Periods included: 215
Cross-sections included: 6
Total panel (balanced) observations: 1290

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0037180	0.006006	0.61904	0.5360
LIQ	0.0304491	0.008780	3.46801	0.0450
RET	0.2591208	0.043335	5.97948	0.0211
SIZE	0.0496222	0.018462	2.68780	0.0103

Effects Specification

Period fixed (dummy variables)

R-squared	0.471346	Mean dependent var	0.009951
Adjusted R-squared	0.364333	S.D. dependent var	0.270098
S.E. of regression	0.215345	Akaike info criterion	-0.080278
Sum squared resid	49.71258	Schwarz criterion	0.792127
Log likelihood	269.7792	Hannan-Quinn criter.	0.247177
F-statistic	4.404574	Durbin-Watson stat	2.394613
Prob(F-statistic)	0.000000		

Dependent Variable: INV
Method: Panel EGLS (Period random effects)
Date: 12/23/18 Time: 07:58
Sample (adjusted): 2000M02 2017M12
Periods included: 215
Cross-sections included: 6
Total panel (balanced) observations: 1290
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.003288	0.006538	0.502894	0.6151
LIQ	0.110773	0.008738	12.67707	0.0450
RET	0.747033	0.043168	17.30526	0.0211
SIZE	0.245156	0.018436	13.29781	0.0103

Effects Specification

	S.D.	Rho
Period random	0.037941	0.0301
Idiosyncratic random	0.215345	0.9699

Weighted Statistics

R-squared	0.340526	Mean dependent var	0.009136
Adjusted R-squared	0.338988	S.D. dependent var	0.265595
S.E. of regression	0.215936	Sum squared resid	59.96397
F-statistic	221.3464	Durbin-Watson stat	2.391429

Prob(F-statistic)	0.000000		

Unweighted Statistics			
R-squared	0.342193	Mean dependent var	0.009951
Sum squared resid	61.85770	Durbin-Watson stat	2.389740

Correlated Random Effects - Hausman Test
Equation: Untitled
Test period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Period random	10.060506	3	0.0181

Period random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
LIQ	0.108452	0.110773	0.000013	0.5211
RET	0.751387	0.747033	0.000348	0.8153
SIZE	0.218186	0.245156	0.000077	0.0021

Period random effects test equation:
Dependent Variable: INV
Method: Panel Least Squares
Date: 12/23/18 Time: 07:59
Sample (adjusted): 2000M02 2017M12
Periods included: 215
Cross-sections included: 6
Total panel (balanced) observations: 1290

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.003718	0.006006	0.619041	0.5360
LIQ	0.108452	0.009457	11.46801	0.0450
RET	0.751387	0.047022	15.97948	0.0211
SIZE	0.218186	0.020414	10.68780	0.0103

Effects Specification			
Period fixed (dummy variables)			
R-squared	0.471346	Mean dependent var	0.009951
Adjusted R-squared	0.364333	S.D. dependent var	0.270098
S.E. of regression	0.215345	Akaike info criterion	-0.080278
Sum squared resid	49.71258	Schwarz criterion	0.792127
Log likelihood	269.7792	Hannan-Quinn criter.	0.247177
F-statistic	4.404574	Durbin-Watson stat	2.394613
Prob(F-statistic)	0.000000		

Dependent Variable: INV
Method: Panel GMM EGLS (Period random effects)
Date: 12/23/18 Time: 08:00
Sample (adjusted): 2000M03 2017M12
Periods included: 214
Cross-sections included: 6
Total panel (balanced) observations: 1284
2SLS instrument weighting matrix
Swamy and Arora estimator of component variances
Instrument specification: C LIQ(-1) RET(-1) SIZE(-1)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.005561	0.006560	0.847690	0.3968
LIQ	0.064283	0.022088	2.910310	0.0037
RET	1.144232	0.711179	1.608924	0.1079
SIZE	0.046418	0.252760	0.183645	0.8543

Effects Specification		
	S.D.	Rho
Period random	0.000000	0.0000
Idiosyncratic random	0.223100	1.0000

Weighted Statistics			
R-squared	0.229794	Mean dependent var	0.010325
Adjusted R-squared	0.227988	S.D. dependent var	0.270539
S.E. of regression	0.237707	Sum squared resid	72.32573
Durbin-Watson stat	1.985494	J-statistic	1.28E-29
Instrument rank	4		

Unweighted Statistics			
R-squared	0.229794	Mean dependent var	0.010325
Sum squared resid	72.32573	Durbin-Watson stat	1.985494

Appendix 6: Robustness test using Vector Autoregression Estimates

Vector Autoregression Estimates
Date: 09/04/19 Time: 19:26
Sample (adjusted): 2000M03 2017M12
Included observations: 1284 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	INV	LIQ	LRET	SIZE
INV(-1)	1.002144	-1.62E-26	1.15E-27	7.42E-28
	(0.00160)	(4.6E-26)	(3.8E-27)	(5.7E-27)
	[7.1561]	[-0.34992]	[0.30227]	[0.12942]
LIQ(-1)	-17370.90	2.87E-19	-3.89E-19	2.34E-19
	(534467.)	(1.5E-17)	(1.3E-18)	(1.9E-18)
	[-0.03250]	[0.01858]	[-0.30566]	[0.12207]
LRET(-1)	-294737.3	1.16E-17	-6.08E-19	4.14E-18
	(2407291)	(7.0E-17)	(5.7E-18)	(8.6E-18)
	[-0.12244]	[0.16735]	[-0.10599]	[0.47912]
SIZE(-1)	792509.0	-3.45E-18	2.35E-18	-8.32E-18
	(1068960)	(3.1E-17)	(2.5E-18)	(3.8E-18)
	[0.74138]	[-0.11174]	[0.92275]	[-2.16836]
C	89928.88	5.96E-18	-8.88E-19	1.62E-18
	(378630.)	(1.1E-17)	(9.0E-19)	(1.4E-18)
	[0.23751]	[0.54451]	[-0.98430]	[1.19337]
LRET	45871396	1.49E-18	1.000000	-5.49E-18
	(0.00246)	(7.1E-17)	(5.8E-18)	(8.8E-18)
	[5.7531]	[0.02107]	[1.7e+17]	[-0.62566]
SIZE	4897762.	-6.53E-18	-3.16E-19	1.000000
	(0.00105	(3.0E-17)	(2.5E-18)	(3.8E-18)
	[4.66418]	[-0.21535]	[-0.12617]	[2.7e+17]
LIQ	-170479.5	1.000000	-1.56E-19	3.04E-20
	(533978.)	(1.5E-17)	(1.3E-18)	(1.9E-18)
	[-0.31926]	[6.5e+16]	[-0.12231]	[0.01586]
R-squared	0.496770	1.000000	1.000000	1.000000
Adj. R-squared	0.476752	1.000000	1.000000	1.000000
Sum sq. resids	1.89E+17	1.57E-28	1.07E-30	2.43E-30
S.E. equation	12154724	3.51E-16	2.90E-17	4.36E-17
F-statistic	56252.13	7.23E+32	4.37E+33	1.06E+34
Log likelihood	-22764.09			
Akaike AIC	35.47055			
Schwarz SC	35.50268			
Mean dependent	1.04E+08	0.002349	0.003364	0.016474
S.D. dependent	2.13E+08	0.697761	0.141417	0.332019
Determinant resid covariance (dof adj.)		2.74E-83		
Determinant resid covariance		2.67E-83		
Log likelihood		114776.9		
Akaike information criterion		-178.7304		
Schwarz criterion		-178.6018		
Number of coefficients		32		

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