# Determinants of Private Equity Investment in South Africa: An ARDL Bounds Testing Approach

A Dissertation

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by

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## ABSTRACT

The private sector in Africa is dominated by micro, small, and medium scale enterprises (MSMEs). This sector of the economy often finds it the most difficult to raise financing from the formal financial institutions. This funding problem is further exacerbated by the fact that financial services sector in the economy is very under developed; hence, there is limited sources of debt financing available to entrepreneurs. Private Equity Funding has played a pivotal role in providing capital to this sector and the African continent would benefit from a buoyant Private Equity market. This study, therefore, seeks to examine the determinants of the Private Equity activity in the South African environment, in order to make recommendations to policy makers as to the policies that they should implement in order to increase Private Equity fund raising activity.

This study explores the determinants of Private Equity in South Africa from 2002 to 2016. The autoregressive distributed lag (ARDL) bounds approach to co-integration (M. Hashem Pesaran, Shin, & Smith, 2001) is adopted to determine the relationship between economic, financial, and regulatory variables and growth in Private Equity Funds under management. For economic variables, this study looks at exchange rates, interest rates, GDP growth, the inflation rate, and the level of entrepreneurship in the country. Secondly, for financial variables, it looks at stock market development and the development of the financial sector in the country. Lastly, for regulatory variables, it looks at the effect the tax rate, the political environment, and the regulatory environment has on Private Equity activity.

The results of the study found no evidence to support a deterministic relationship between the variables macroeconomic environment, financial development, and the regulatory environment with growth in Private Equity Funds under management in the South African context. The findings of this study can be explained by the opportunistic nature of the Private Equity business. This means that investors look for opportunities in markets where they can make substantial returns, and those opportunities are not necessarily informed by the macroeconomic environment of the countries where the opportunities avail themselves.

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# CHAPTER ONE

# INTRODUCTION

## 1.1 Background of the Study

The African continent has been lagging behind other emerging markets when it comes to economic growth, with the continent growing at approximately 5.4% between 2000 and 2010 which reduced to 3.3% between 2010 and 2015 (Leke, 2016). This is far behind leading emerging economies, such as China, which has been growing at 10% over the last 10 years, and India growing at 7.24% (Open Government Data Forum India, 2015). However, having said that, a number of countries on the African continent have appeared in the list of the fastest growing economies in the world, namely Ethiopia, Ghana, and the Ivory Coast. These countries are projected to continue to grow at an annual growth rate of 8% (Kajuju & Chiwanza, 2015). The private sector could be instrumental in fostering economic growth on the continent, which is essential for job creation. This would have a multiplier impact on the socioeconomic conditions currently affecting the continent. The private sector in Africa is dominated by micro, small, and medium scale enterprises (MSMEs), which is a sector of the economy that often finds it the most difficult to raise financing from the formal financial institutions. This funding problem is further exacerbated by the fact that the financial services sector in the economy is very under developed; hence, there is limited sources of debt financing available to entrepreneurs. Therefore, this sector could benefit from a vibrant Private Equity market that is aimed at funding the private sector, therefore, increasing economic growth in the region.

Private Equity has played a very important role in providing capital to firms that would ordinarily find it very difficult to raise capital through either debt or equity. These typically private companies are not listed and, therefore, they are not able to raise equity from the public. Debt financing from financial institutions would place a huge financial burden on the company and, therefore, hinder its ability to grow. Private Equity can be explained as a form of financial intermediation where Funds are able to raise capital from institutional investors and other accredited investors who have wide access to capital, in order to invest in privately held companies. Private Equity investors realise value on their investments when they exit the investment, which is typically after a period of 5 to 10 years (Abor, 2011). Exits are done through either an Initial Public Offering (IPO) of the company, a merger and acquisition, or a leveraged buyout by management. Therefore, in order for investors to realise value upon

disposal of the investments, it is important for investors to invest in entities that show a growth potential and in companies where the investors are able to add value in order to realise capital growth. "The concept of modern venture capital is defined by (Megginson, 2011) as a professionally managed pool of money raised for the purpose of making equity investments in growing private companies with a well-defined exit strategy" (Wonglimpiyarat, 2005, p. 302).

Private Equity Venture capital firms are usually organised as a limited partnership made up of General Partners and Limited Partners. Limited Partners provide capital to the Fund and are often not involved in the management of the Fund. The capital contribution made by the General Partners is often limited, but they manage the capital of the Fund on behalf of the limited partners and shares in the profits of the Fund. A management agreement is often put in place, which sets out the investment mandate of the General Partners including, which industries the General Partners may invest in, limiting investments in a single venture, and restriction on use of profits made by the Fund. The reputation and the track record of the general partner is very important for fund raising purposes, as the Limited Partners need to be confident that the General Partner will be able to manage their capital appropriately and generate the required returns on their capital. It is important to note that the risk associated with Private Equity investment is higher than that associated with investing on a publicly listed entity. Therefore, this means that the return that would be required by a Limited Partner for investing in a Private Equity Fund would be higher than what he would require if he was investing in a publicly listed entity.

It is also important that we differentiate between Private Equity and Venture Capital. Venture Capital is a form of Private Equity where high net worth individuals invest equity in very risky innovative business ideas with a high growth potential. Venture capital financing is regarded as patient capital, since the venture capitalist usually is willing to invest in the enterprise for up to ten years. Venture capitalists invest in firms who at their stage of development might find it very difficult to access funds from capital markets or from the banking system. Venture capitalists therefore provide the needed financing to entrepreneurs with very innovative ideas and who can transform their ideas to form innovative products that can turn into great businesses (Abor, 2011).

This dissertation will focus on Private Equity investments in the South African context, but will examine literature for both Private Equity and Venture Capital, as there is limited literature on

Private Equity. There are also similarities in the way that funds are raised and managed, which makes literature on both disciples relevant to this study.

A number of benefits would flow to the investee company other than access to capital because of the private equity investment. The Private Equity partners are usually well known in the market; therefore, association with the Private Equity fund would add credibility to the investee company. Secondly, Private Equity investors usually play an active role in the running of the business. Therefore, they are able to influence the strategic direction of the business that benefits the entrepreneurs. Involvement of a 3rd party also improves Corporate Governance in a private company, as the owners of the company would be accountable to a third party. Private Equity investors also often invest in businesses in which they are experts. Therefore, the entrepreneurs are able to benefit from the Limited Partners' expertise and contacts in the particular industry in which they operate.

### 1. 2 Background on the Private Equity Sector

Private Equity has its origins in the early 1940s in the United States with the founding of two Private Equity firms, namely American Research and Development Corporation (ARDC) and JH Whitney & Company. ARDC was formed to invest in business ventures that were started by soldiers returning from the Second World War. This Fund was the first Fund that was created where institutional investors could invest in private business ventures. However, "the Private Equity movement would not be what it is today, if it weren't for the events of 1958. The US was in the grips of Cold War terror. In an effort to bump up technological advances against the Soviets, President Eisenhower enacted the Small Business Act of 1958. It allowed licensed venture capital firms, known as 'Small Business Investment Companies', or SBICs, to borrow money from the government at below-market interest rates. In turn, they had to invest in entrepreneurial ventures" (The Investment U Research Team, n.d., para. 9)

Between the 1950s and the 1960s, venture capital firms were more focused on starting and expanding companies. "These companies were exploiting breakthroughs in electronic, medical, or data-processing technology. As a result, venture capital came to be almost synonymous with technology finance." (Powers, 2012).The finance model that was followed during this time is pretty much the same model that is currently widely used. That is, a General Partner would raise funds from Limited Partners and the General Partner would be involved in the management of the funds with limited input from the Limited Partners.

Various legislative changes in the early 1980s, notably the decrease in capital gains tax, led to the first boom in the Private Equity industry. The 80s also gave birth to the Leveraged Buy Out (LBO) model, where Private Equity firms conducted hostile takeovers of much bigger entities in the market (Powers, 2012). The high leverage in the transactions that were concluded meant a number of deals had failed. However, capital continued to flow to the sector because of the attractive returns that were offered by the sector. The boom in the market saw the birth of a number of Private Equity companies, including Bain Capital, Chemical Venture Partners, Hellman & Friedman, Hicks & Haas, The Blackstone Group, Doughty Hanson, BC Partners, and The Carlyle Group (Powers, 2012). Unfortunately, a number of the transactions that were undertaken were not very constructive. A number of large and productive companies were acquired through a hostile takeover and would then be split into a number of functional business units. They would then be disposed of, which resulted in a destruction of a number of companies and in turn job losses in the economy. Therefore, in the 1980s the Private Equity industry was not very well perceived by the public. This caused a number of companies to adopt the poison pill method in order to avoid the hostile takeovers, which eventually resulted in a slowdown in Private Equity activity in the market. This, together with the failure a number of Private Equity deals, resulted in a halt in the sector in the late 1980s (Powers, 2012).

The second boom in the market, in the late 1990s, was driven by the boom in the internet industry. This phase saw a number of Private Equity funds funding innovation related to internet-based companies, which saw the birth of a number of technology companies, including Amazon.com, America Online, E-bay, and Yahoo! (Powers, 2012). This phase was ended by the crash in stock markets caused by the bursting of the Internet bubble, which resulted in a number of Private Equity funds incurring losses when valuations of technology-based stocks collapsed.

The third boom in the industry, also known as the Golden Age of Private Equity, came in the late 2000s (Powers, 2012). The surge in activity was driven by a combination of decreasing interest rates, loosening lending standards, and regulatory changes for publicly traded companies. This phase would see the biggest boom in the industry and the completion of 13 of the 15 largest leveraged buyout transactions in history, as well as the highest levels of investment activity. The increased regulations of listed entities and the cost associated with it made investors see Private Equity investments as an alternative to publicly listed entities.

Increased regulation, however, had the opposite effect on the venture capital industry. Increased costs resulting from increased bureaucracy made it difficult for Venture Capital Funds to exit investments through an IPO and, therefore, decreased the attractiveness of venture capital financing.

The Private Equity industry was not immune to the Global Financial crisis that gripped the world in 2007–2009. In 2008, Private Equity saw the first decline in fund raising activity since 2003. The decline was resulting from the drying up of liquidity in the market, and new buyout levels were at historically low levels (Powers, 2012). Post the crisis, Funds had to seek growth by investing in new markets. Today, the Private Equity market faces a different challenge. The world is flush with capital and the debt, and the equity markets are extremely liquid. In 2017 Private Equity firms raised in excess of $453bn globally, which is the highest amount that they have ever raised (Franklin, 2018). Therefore, the biggest challenge is finding suitable projects to deploy all that capital. Furthermore, other sources of capital in the form of equity markets, corporates, and other buyers offering cheaper sourcing of financing are proving to be challenging to the sector as a whole.

### 1.3 Private Equity in Africa

Private Equity activity in Africa can be traced back to the late 1980s. Particularity in South Africa, following the economic sanctions that were placed against the country, where a number of deals were concluded because of disinvestment of the rest of the world from South Africa. This is discussed further in chapter 2 of this dissertation. Sub-Saharan Africa has been getting a lot of attention lately from investors and we have seen a growth in Private Equity Fund raising from $150m in the early 2000s to $1.5bn by the end of the decade (Babarinde, 2012). Although these numbers show a tremendous growth in the sector, the Private Equity industry is still in its infancy stages in Africa when compared to the Private Equity industry in the rest of the world. Africa's shares of total Private Equity funds raised and invested were less than one percent per annum. Babarinde (2012) attributes a number of factors to the increased appetite to invest in Africa by Fund managers, which include the improved business environment on the continent, as well as political stability in the region. The African growth rate also exceeds that of the Western economies by far, therefore, providing investors with better returns on investments. The region has also seen a growth in domestic demand, which is driven by the rise of the middle

class and urbanisation, therefore, further increasing economic opportunities in the region (Babarinde, 2012).

Figure 1 shows the Global Private Equity Capital penetration as a percentage of GDP. The graph shows that although the Private Equity penetration ratio for Sub-Saharan Africa is low when compared to the developed economies, the penetration ratio does, however, compares well to other developing countries such as Brazil and China.

**Global Private Equity Capital Penetration**

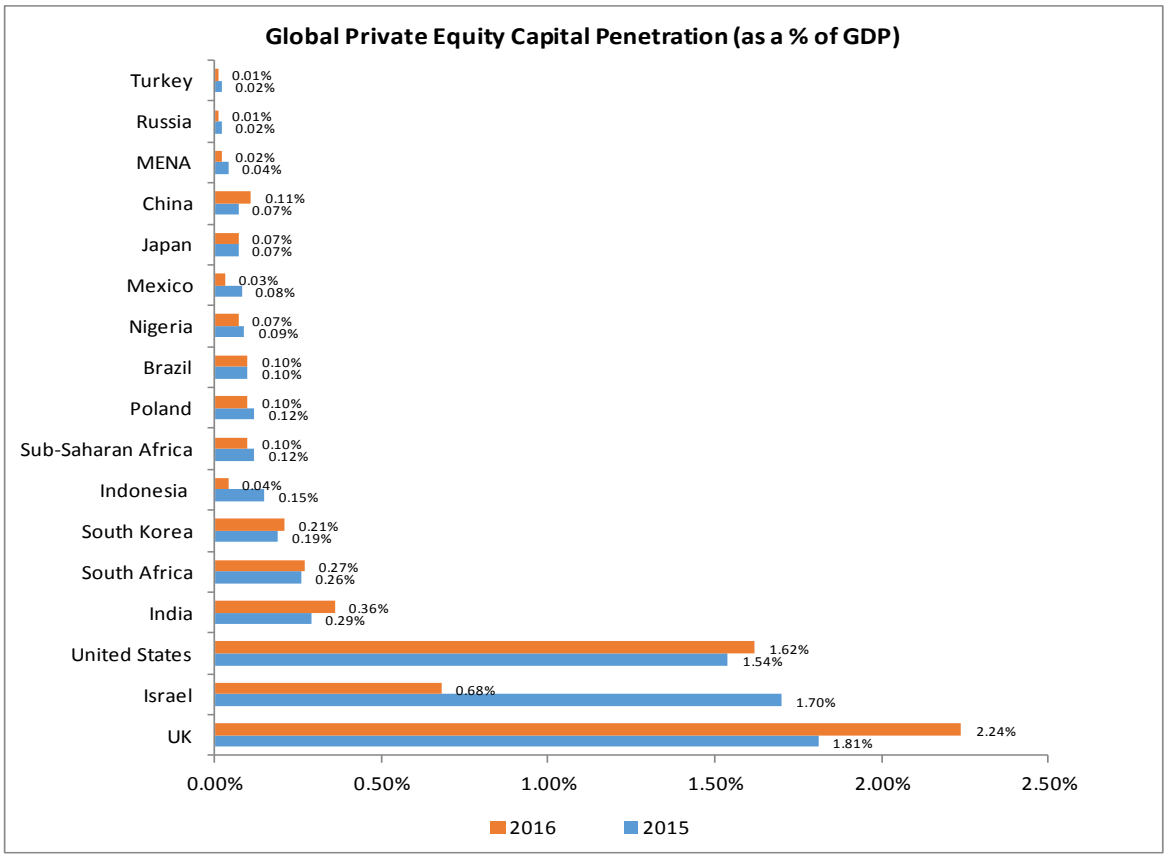



*Figure 1: Source, SAVCA-2017-Private-Equity-Industry-Survey*

## 1.4 Problem Statement

According to the United Nations Environment Programme Finance Initiative, micro, small, and medium-scale enterprises (MSMEs) represent 90% of businesses and account for about 63% of employment on the African continent, (Adongo, 2011). However, the MSMEs are skewed towards the micro-scale enterprises, which gives rise to a problem known as the "missing middle". According to the Centre for International Development at Harvard University,

developing countries have a large number of microenterprises and some large firms, but far fewer small and medium enterprises. In high-income countries, small and medium enterprises (SMEs) are responsible for over 50% of the GDP and over 60% of employment, but in low-income countries, they are less than half of that: 30% of employment and 17% of GDP ("Finance and the missing middle," n.d.). This SME gap is called the "missing middle". The microenterprises usually are domestically focused, whereas SMEs operate at a larger scale and do not service the local market, but can also compete internationally and thereby driving economic growth. Therefore, in a continent that continues to face high levels of unemployment, it is evident that the growing SME sector will go a long way in driving economic activity in the economy and in turn, reducing the levels of unemployment that are faced by the continent. Some researchers have highlighted that the biggest contributor to the missing middle problem in developing countries is access to funding; therefore, PE investors can grow the SME sector through equity investments.

*Finance and the missing middle*

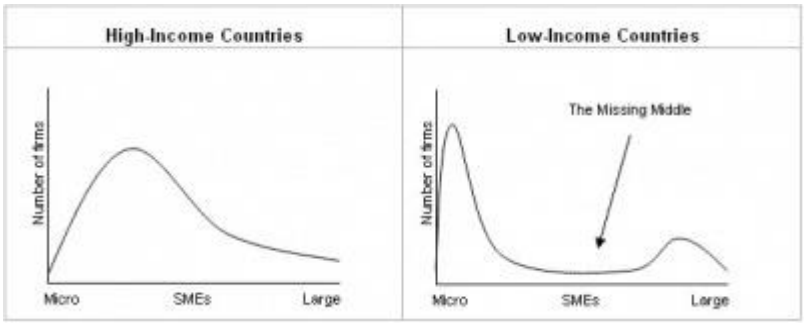



*Figure 2: ("Finance and the missing middle," n.d.)*

Limited research has been done on the determinants of PE investments in Africa, with most research focusing on the United States as well as Europe. The Private Equity market in Africa is limited with limited data available across the continent. Therefore, this study will focus on examining determinants of Private Equity activity in South Africa. South Africa is the biggest contributor to the Private Equity market in Africa. Therefore, understanding the South African environment will give insight to the key drivers of Private Equity activity on the continent. Therefore, this study is focused at applying the body of knowledge that has been accumulated internationally to the South African market.

The key research questions this research aim to address are as follows:

- What economic variables affect the level of PE activity?
- Does the maturity of the financial system of a country have an effect on the level of PE activity?
- Does the regulatory environment of the country have an effect on Private Equity activity?

### 1.5 Research Objectives

The objective of this study is to examine PE activities in South Africa, as well as to identify the determining factors of PE activity in the South African context.

### 1.6 Hypotheses

The main hypothesis in this dissertation is that macroeconomic, financial, and the regulatory environment are the key determinants of PE activity in South Africa. This study seeks to test the following hypotheses:

$H_1$: Macroeconomic environment has a significant impact on Private Equity investments in South Africa.

$H_2$: The development of the financial market has a significant positive effect on Private Equity activity in South Africa.

$H_3$: A strong regulatory environment is positively correlated to the level of PE investments in South Africa.

; $H_4$: Political instability is negatively correlated to the level of Private Equity Investment.

### 1.7 Justification of the Research

The main aim of this dissertation is to contribute to the literature on the determinants of Private Equity financing in the African context by identifying the determinants of Private Equity in South Africa. This study will focus on South Africa, as the country has the largest Private Equity Industry in Africa with R171.8bn (2016) funds under management (SAVCA, 2016). South Africa has a Private Equity Penetration Ratio of 0.27%, which is more than double that of Sub-Saharan Africa of 0.12% (refer to Figure 1). Therefore, understanding how South Africa

has managed to have a highly active Private Equity market will assist in understanding the economic reforms and regulatory changes that are required in the rest of the continent so that it could enjoy an active Private Equity Market as seen in South Africa. This dissertation studies data between 2001 and 2016 where the private equity industry grew from R36bn to R171bn to try understanding the drivers of the growth. Literature on the determinants of private equity investments that focuses solely on Africa remains limited. However, an in-depth analysis of the sector and its key drivers is crucial for influencing policy-making decisions so that policy makers are able to put in place policies that will positively influence the growth of PE investments on the continent (SAVCA, 2016).

Investment in PE is considered riskier than investment in the traditional form of investments, such as pension funds, hedge funds, and stock markets. Therefore, the investors in the market are cautious in ensuring that they invest their funds in markets where they are guaranteed compensation for their risk. Pension funds, as well as hedge funds, are also big investors in the PE market and they often have regulatory restrictions on which markets they can invest in. Therefore, the purpose of this study is to understand the key drivers that investors contemplate when making an investment in PE in order to influence policy makers in Africa to put in place policies that will drive the level of PE investment in Africa. Some literature has argued that investors have dedicated funds to investment in Africa. However, Africa is not ready to absorb those investments, meaning that there are limited opportunities for investment in Africa. This study, therefore, aims to identify if the level of entrepreneurship in the economy creates an opportunity for investors to invest, and therefore results in an increase in Private Equity activity.

### 1.8 Organisation of the Study

This dissertation is organised follows. The second section discusses the literature review, exploring existing literature on the determinants of private equity investments. The third section discusses the methodology that will be used when testing the data, which includes describing the data, and analysis of the data using the appropriate statistical method. Chapter 4 discusses the results from the empirical analysis, and the final section concludes the paper, and makes recommendations on future areas of study.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 Introduction

This section of the dissertation firstly discusses the role of private Equity in the economy. Thereafter, the Private Equity Sector in South Africa is investigated. Thirdly, the theoretical framework will be explored, and the next sections deal with existing empirical literature on the determinants of Private Equity Investments. The last section concludes the literature review.

## 2.2 The Role of Private Equity in the Economy

One of the obvious benefits of private equity funding is access to capital; however, the investee firm would benefit from various other benefits because of the investment. Private Equity investors play an active role in the company in which they invest. The company is, therefore, able to improve its corporate governance structures. Secondly, the investors normally invest in industries in which they are experts. They are, therefore, able to bring in advisory insight into the industry, and are able to tap into its networks to open up new markets, and therefore, enhance the performance of the company. In a study done for the European Venture Capital Association (EVCA), Private Equity can be directly linked to three areas that result in economic growth, namely innovation, internal competitiveness, and productivity in the economy. Private Equity grows the economy as more resources are allocated to research and development, as well as start-up companies, which lead to the development of new products and new industries in the economy. The involvement of a private equity partner in a company results in better management and allocation of resources, which results in efficiency and increased productivity. Lastly, increased innovation and increased productivity will result in increased competitiveness in the economy. Competitiveness results in efficiencies that open the economy to trade, therefore, the economy will benefit from increased exports and as a result, growth in GDP.

Furthermore, Gatauwa and Mwithiga (2014) evaluate the interrelationship between Private Equity, regulation, and economic growth and find that,

> "There seems to be agreement that a well-developed legal and regulatory framework would lead to increased financial activities in a country. There is the argument that high quality of an economy's legal system facilitates exits hence resulting to a more favorable legal environment that induces venture capitalists and Private Equity funds

to invest more often in the home country. The review of exogenous and endogenous growth models indicate that in order to sustain a positive growth rate of output per capita in the long-term, there should be continuous advancement in technical knowledge in the form of new products, processes and markets. Hence, increased Private Equity investment activity is expected to contribute to Private Equity investee firms enhancing their operating and financial capacities therefore inducing economic growth" (Gatauwa & Mwithiga, 2014, p. 7)

## 2.3 Overview of Private Equity in South Africa

The origins of PE in South Africa date back to the mid-80s when sanctions against the country saw many US-based and European-based companies dispose of their interest in South Africa. The promulgation of anti-apartheid legislation in 1986 in the US saw increased pressure on corporates to exit their investments in South Africa. As a result, most of the exits were done in haste, as the overseas-based investors did not want to have to explain their involvement with South Africa to their shareholders (SAVCA, 2015). Locally based deal-makers, particularly in the banking sector, saw an opportunity to buy the valuable businesses at a low cost, therefore, giving birth to Private Equity in the country.

The second phase of growth in the industry came in the early 90s, where a number of South African companies began to globalise and were therefore disposing of their non-core assets (SAVCA, 2015). This provided an opportunity for local private equity investors to acquire these attractive assets.

In the early 90s, there was also a move away from the traditional way in which deals were financed, such as from the banks' balance sheet to third party capital raising. Regulatory changes were raising concerns on the banks' capital demands on PE investments, which further drove third party capital raising. The PE structures were relatively new to the South African market; therefore, there was lack of appetite from the local investors for the asset class, which pushed the fund managers to raise the money offshore. This period coincided with the lifting of sanctions against South Africa, so there was renewed interested from the international community, which saw an increase in fund raising.

Post-democracy in the late 1990s, the renewed confidence in the South Africa economy, increased capital flows, and expectation for privatisation of the state assets led to another boom

in the industry. The BEE deals concluded post-1994 also gave the industry a new opportunity for growth. In the early 2000s, most of the deals that were closed were related to BEE deals. For the BEE deals, the leveraged model was adopted. This meant that appropriately geared structures were adopted, which allowed investors with limited capital to participate in the BEE deals (SAVCA, 2015).

The following period saw new, smaller Private Equity companies forming and entering the market. The smaller funds were more focused on the mid-market and entrepreneurial business, which is where the PE industry is needed the most to grow the economy. Although there have been a number of growth factors that have been driving growth of PE in the country, the industry was not immune to the world economic crisis in 2008. Tightening liquidity post the crises, resulted in muted M&A activity corporate space, which negatively affected the industry. Regulatory changes, namely Basel for banks, saw a number of banks exiting the PE sector, as it became increasingly expensive for banks to hold PE investments. The PE market is currently stable and slowly picking up. The current difficult and uncertain economic environment has made deal-makers cautious in executing new deals. However, having said that, the low interest rate environment has provided an opportunity for the Funds, as they are able to secure funding at a low cost. BEE deals remain a significant driver of Private Equity deals in the market (SAVCA, 2015).

By December 2016, the Private Equity industry had R171.8bn funds under management. This is a significant increase from R36bn in 2001 and translates to a compound growth of 11.9% since 1999. Sixty-one per cent (61%) of the funds were invested in the general sector in the economy, 8.7% invested in infrastructure, 7.5% in financial services, and 5.6% in real estate.

*Private Equity Sectorial Split*

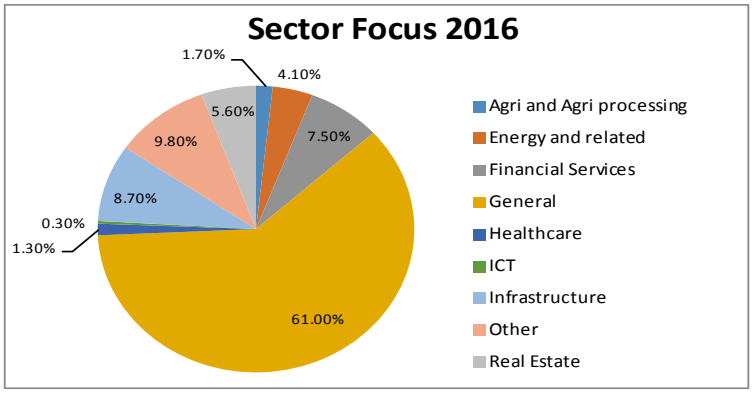



*Figure 3: Source, SAVCA-2017-Private-Equity-Industry-Survey*

The main source of the funds is from local investors, cumulatively, of the funds raised but not returned to investors: 54.7% was raised from South Africa, 20.7% from the UK, and 9.8% from the US. In 2015, in total, R29bn was raised of which 60% was raised from local sources. Pension and Endowment Funds were the source of 56.2% of all third party funds raised during 2015 (2014: 25.0%). Governments, aid agencies, and DFIs accounted for 24.4% in 2015 (2014: 57.7%) and private equity fund of funds made up 10.3% of funds raised in 2015 (2014: 4.4%) (SAVCA, 2016).

When looking at the size of the South African Private Equity market relative to other emerging markets, it appears that South Africa is lagging behind with a total FUM of $1.9bn. This is far behind China, which has the biggest Private Equity market in the emerging markets with FUM of $7.9bn, followed by India with FUM of $4.9bn. However, if you consider market penetration as a percentage of GDP, it becomes apparent that the South Africa Private Equity market is comparable to the rest of the emerging markets with a market penetration ration of 0.2%. India has a market penetration of 0.3% of GDP and China at 0.1% of GDP. The UK has the highest Private Equity market penetration with a penetration ratio of 1.95% of GDP, followed by the USA with a penetration ratio of 1.41% of GDP (KPMG, 2013).

It is important to note that although IPOs are the most common way of realising investment in the Private Equity industry, in South Africa management, buyouts have been the most common in terms of the number of deals concluded. Trades sales as well as sales of other Private Equity companies have been the most common exits by value. This indicates that stock market development is not a key driving factor in the Private Equity industry in South Africa.

*Proceeds from disposals made*

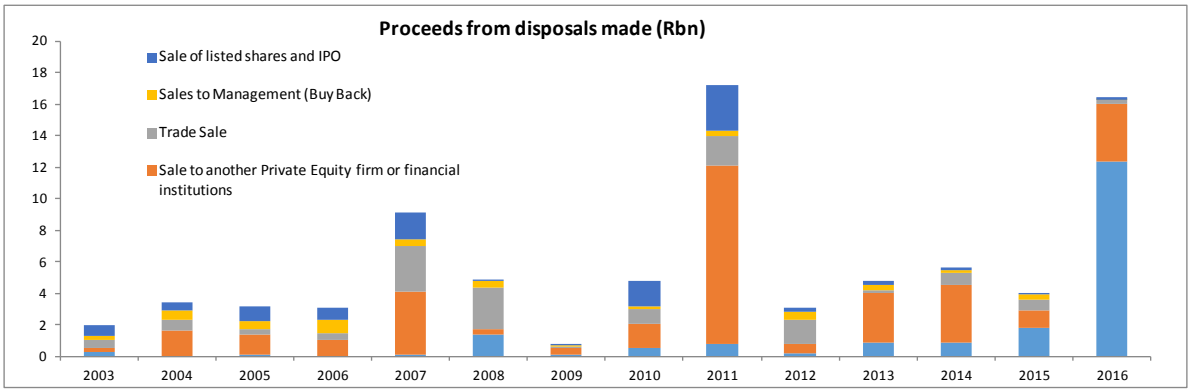



*Figure 4: Source, SAVCA-2017-Private-Equity-Industry-Survey*

**Number of disposals made**

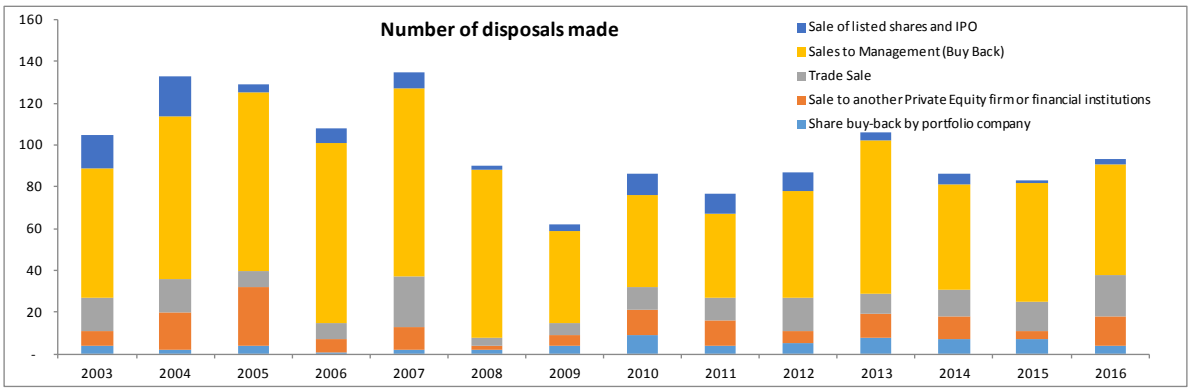



*Figure 5: Source, SAVCA-2017-Private-Equity-Industry-Survey*

## 2.4 Theoretical Framework

The main aim of a Private Equity Investment is for the investor to make a return at the end of the investment period through disposing of their investment. Exits are usually done through an IPO. An active equity market is extremely important in growing a private equity market, as it provides investors with a viable tool of realising their capital growth.

Another key factor that would drive the level of PE investment is the availability of projects to fund in the country. Availability of projects might be driven by various factors, such as innovation and economic growth. Innovation increases the level of entrepreneurial activity, which will in turn increase the number of opportunities in which PE investors can invest. However, it can also be argued that a lack of availability of PE funds leads to a diminished level

of innovation, as there are limited funds to finance new ventures. Economic growth can also lead to an increased level of entrepreneurial activity, which will attract PE investment.

Macro-economic variables such as inflation, exchange range fluctuations, commodity prices, and interest rates are also important in determining the level of PE activity (Jeng & Wells, 2000). A high level of inflation will have a negative effect on the level on investment because high inflation results in the erosion of the capital investment. Currency depreciations also lead to erosion of capital as well as return on investment, and therefore, would significantly increase risk appetite of international investors. In the African context, where most economies are resource based, fluctuations in commodity prices will have a huge impact on the level of investment.

A sound regulatory environment can also be argued to be a key determinant of the level of PE activity (Gompers & Lerner, 1998). PE funds source capital from a number of sources including pension funds, hedge funds, and international investors. Policies specific to capital flows are key to international investors. International investors always need to ensure capital mobility in order to retain the ability of deploying capital to the most efficient resources. Enforcement of property rights is also a very important factor, particularly for international investors, as they need to ensure that the legal and the regulatory environment allow enforcement of property rights.

Pension Funds are one the most important sources of institutional funding for Private Equity Funds. In the South African context, in 2015, 56% of funds raised were raised from Pension Funds and Endowment Funds, therefore, an active Pension Fund market is important for financing growth in Private Equity financing (SAVCA, 2016).

### 2.5 Empirical Literature Review

This section summarises the findings on the determinants of Private Equity Investments. A study that investigates pension fund assets allocation to private equity and venture capital in the United States and in Canada, finds that the size of the pension fund is a key determinant on the decision to invest in PE. The study looks at pension funds' assets under management in the US and in Canada in 2001 to determine the portion of funds allocated to PE and VC. Canadian pension funds invested a significantly smaller fraction of their assets in private equity than their American counterparts do, with 4.9% and 1.9% of the total funds invested in PE and VC

respectively in the US and only 2.4% and 1.3% in Canada. The study found that a number of small funds decreased their private equity investment because they thought that they could not allocate enough resources to private equity investment (Chemla, 2004). Chelma (2004) also confirms that liquidity was the main problem that restricted PE investment and that an active IPO market is a big driver of PE investments.

"The concept of modern venture capital is defined by (Megginson, 2011) as a professionally managed pool of money raised for the purpose of making equity investments in growing private companies with a well-defined exit strategy" (Wonglimpiyarat, 2005, p. 302). An initial public offering (IPO) is one of the most common methods of exiting a private equity investment, and therefore, a well-developed equity market is hypothesised to be one of the key determinants in private equity investments.

Jeng and Wells (2000) use regression analysis to understand the determinants of venture capital funding across 21 countries. The study considers the importance of IPOs, GDP growth, market capitalisation growth, labour market rigidities, accounting standards, private pension funds, and government programs on venture capital financing. The study found that IPO activity was the biggest driver for venture capital investment. Private pension fund penetration was also found to be a strong driver, but not in all the countries. Government policies and the regulatory environment were also considered to have a strong impact. The study also showed that the different drivers have different effects on the different types of venture capital. For example, the IPO activity is a big driver for late stage venture capital financing but has no impact on early stage financing (Jeng & Wells, 2000).

Bernoth and Colavecchio (2014) completed a study that investigates the macroeconomic determinants of PE investment in Europe, focusing on a comparison between Central and Eastern European ("CEE") and Western European countries. The study looked at data from 13 Western countries and 3 CEE countries. It tested whether the economic environment, financial market circumstances, labour market conditions, and the political, legal, and social environment of a country are driving forces of PE activity, as well as to what extent such forces differ in Eastern and Western countries. The first finding of the study was that the PE industry is cyclical in its nature and the faster the country is growing (where growth is measured by GDP) the more PE investment is attracted, as a fast-growing economy is more likely to provide opportunities for entrepreneurs. Furthermore, the study found that in Western Europe, the level of PE

investments is likely to be affected by the size of equity market capitalisation, and therefore, the results place emphasis on the fact that a well-developed financial market is a key driver of PE investments. The study also found that the degree of employment protection has no significant impact on PE investments in both Western and CEE countries, whereas the unemployment rate in Western Europe appears to play a positive and strong role in PE investment decision. However, annual growth rate of unit labour costs negatively affects the attractiveness of PE investments to Western Europe. Lastly, it was observed that there were more PE investments in politically unstable countries with a weak regulatory quality. The explanation for this could be that PE investments in these countries are the safest and most convenient way of entering their business landscape (Bernoth & Colavecchio, 2014).

Poterba (1986) introduced the concept of capital gains tax being a key determinant of venture capital investment, by investigating the efficiency of lowering individual capital gains tax rates as a device for subsidising ventures funded through the venture capital process. The study found that it is simply not credible to argue that a substantial fraction of the growth in organised venture capital markets, since the late 1070s, is the result of lower capital gains tax on investors. This is because most of the funds come from investors who do not face personal capital gains tax i.e. pension funds and that a reduction of the capital gains tax would have little impact on venture capital activity.

Adongo (2011) tested the hypothesis that macroeconomic, financial, and regulatory factors cannot explain venture capital activity in Africa. The study identified the determinants of venture capital activity in Africa by applying the OLS regression technique to a semi-logarithmic model consisting of a cross-sectional data set for 36 African countries. The study found that macroeconomic, financial, and regulatory factors could not explain venture capital activity in Africa. The study's findings indicate that institutional environment affecting financial factors and regulatory factors explain venture capital activity in Africa. Based on its results, "the paper argues that if private sector development actors wish to increase the potency of the venture capital instrument in a 'missing middle' reduction toolkit, they should focus on these factors to stimulate venture capital activity on the continent" (Adongo, 2011, p 14).

Gompers and Lerner (1998) examined the forces that affected fundraising by independent venture capital organisations from 1972 through 1994. The study found that regulatory changes

affecting pension funds, capital gains tax rates, overall economic growth, and research and development expenditures, as well as firm-specific performance and reputation, are main drivers of VC fundraising. The study also found that the demand side (measured by the GDP growth rate as well as increases in the RD spending) for VC funding is critical for VC fund raising. Therefore, in order to drive VP investment, policy makers need to focus on promoting good quality start-ups, which will in turn drive the availability of VC funds. Capital gains tax rate is also a main driver. However, the capital gains tax rate seems to drive the demand for VC funds, and a lower tax rate makes it more attractive for an entrepreneur to embark on a new venture. Lastly, the study found that fund performance is an important determinant of the ability of venture organisations to raise new capital. Firms that hold larger equity stakes in companies that have recently gone public, raise larger funds with greater probability (Gompers & Lerner, 1998)

A study undertaken in New Zealand (NZ) aimed to identify challenges the VC industry in New Zealand faces when sourcing new capital. The study found that a lack of observable proven historical returns from NZ domiciled VC funds is a significant impediment to raising new equity capital. Fund managers and intermediaries also note there is a lack of domestic entities in NZ that have the capacity and current appetite to invest in VC. In part, this may indicate that VC investors are unwilling to invest further capital in NZ VC funds until the current funds realise their existing investments (Kalidas, Kelly, & Marsden, 2014).

In a study done by Wonglimpiyarat (2005), where it was researched how capital market laws affect the development of venture capital industry, it was found that if venture capitalists are able to get a return because of successful exits through IPOs, it would help stimulate the new venture capitalists to enter the VC market (Wonglimpiyarat, 2005). Therefore, policy regulators should aim to implement policies that promote IPO activities.

Adongo (2012) explores the impact of the legal environment on VC and PE in Africa. The study looks at 50 African countries between 2004 and 2010. The study confirms that a letter legal environment increases market entry by investors and entrepreneurs. However, a contrasting view that is found by the study is that both VC and PE venture capital and private equity increase where the strength of property rights is weaker. These findings suggest that venture capital substitutes for debt financing from other sources e.g. banks, in weaker legal environments (Adongo, 2012).

In a study by Martí and Balboa, they investigate fundraising by means of variables directly related to the venture capital process rather than microeconomic ones. The study looks at data from 17 European countries during the period 1987–2000, with the aim of determining whether the volume of investments and divestments made affects the volume of funds raised. The results of the study show that the investment activity of the previous period has a positive and significant impact on fundraising. Exits through stock markets have a positive and significant effect on funds raised and lastly, the study finds that macroeconomic variables with the exception of GDP do not have a significant effect on fund raising (Balboa & Martí, 2001).

The literature review is summarised in the Table 2.1.

*Table2.1: Summary of Supportive Literature*

| Supporting Literature | | | |
|---|---|---|---|
| **Independent Variable** | **Positive** | **Negative** | **Not Significant** |
| Exchange rates | | | |
| Real Interest Rates | | | Marina Balboa, 2004 |
| | | | Jonathan Adongo, 2011 |
| GDP | Marina Balboa, 2004 | | Jonathan Adongo, 2011 |
| | Gompers and Lerner (1998) | | Jeng and Wells, 2000 |
| Tax | | Jonathan Adongo, 2011 | |
| | | Gompers and Lerner (1998) | |
| Stock Market Development | Marina Balboa, 2004 | | Jeng and Wells, 2000 |
| | Jonathan Adongo, 2011 | | |
| | Jarunee Wonglimpiyarat, 2005 | | |
| | Bernoth and Colavecchio (2014) | | |
| Financial Development | Jonathan Adongo, 2011 | | |
| Regulatory Environment | | Jonathan Adongo, 2012 | |
| | | Bernoth and Colavecchio (2014) | |
| Political environment | | Bernoth and Colavecchio (2014) | |
| Entrepreneurship | Gompers and Lerner (1998) | | |

## 2.6 Chapter Summary

Based on the literature review presented above, the researcher hypothesises that financial macroeconomic environment is a key driver in determining the PE equity environment in an economy. The development of the financial markets provides an opportunity for PE investors to exit the investment, as well as make a return from their investment. Therefore, it is hypothesised that the development of the financial markets is positively correlated to the development of the PE equity market. Lastly, a strong regulatory environment is important for the development of the PE industry. The PE investors need assurance that their investment is protected. In addition, the regulatory environment needs to promote entrepreneurial activity, which is key to attracting PE investments.

# CHAPTER THREE

# RESEARCH METHODOLOGY

## 3.1 Introduction

This section starts by examining the data and the various sources of data that this study employs to identify the determinants of Private Equity Investments in South Africa. It then discusses the methodology that was adopted to test the hypothesis and the limitations of the study. This study will adopts a quantitative approach to testing the hypothesis and uses secondary data, which are grouped into three main categories, namely macroeconomic variables, financial variables, and regulatory variables.

## 3.2 Sample and Data

To determine the drivers of Private Equity Investments in South Africa, the researcher aims to explore Private Equity activity for the period between 2001 and 2016. The period selected was informed by availability of data for Private Equity in South Africa. The data to determine the size of the market was be obtained from KPMG and SAVCA Venture Capital, and Private Equity Industry Performance Survey of South Africa for the year 2017. The KPMG/SAVCA survey was conducted through questionnaires and supplemented by information sources, such as interviews and international reports. The survey questionnaire was developed jointly by KPMG in South Africa and a specially constituted SAVCA sub-committee. The guidelines for participation in the survey are as follows: Participants must:

- Include investments if they are made in South Africa, regardless from where they are managed;
- Have as their principal business the management of funds (third-party and/or proprietary capital) for the provision of capital (equity or quasi-equity) primarily to unlisted companies;
- Employ professionals dedicated to the management of the capital and the investments made using the capital (and capital from other providers); and
- Aim to generate returns mainly through medium to long-term returns on the sale of investments and/or social development returns. (KPMG, 2013)

### 3.3 Variables and description

This section examines the variables that were be included in the regression analysis in order to determine how they affect the size of the Private Equity market.

#### 3.3.1 Macroeconomic variables

To determine the effect that macroeconomic variables have on the development of the Private Equity market, the researcher considers the following variables: GDP growth rate, interest rates, inflation rate, currency volatility, and lastly, the level of entrepreneurial activity in the economy.

GDP growth rate

The GDP growth rate is expected to be positively correlated to the level of Private Equity activity in the economy. Growth in the economy increases opportunities in which investors invest. This view is contrary to the findings of a study by Jeng and Wells (2000), who found that the effect of the GDP growth rate is not significant to the level of Private Equity in the economy. However, is it supported by a study done by Bernoth and Colavecchio (2014), who found that the faster the country is growing (where growth is measured by GDP) the more PE investment is attracted. The GDP growth rate for South Africa was obtained from the World Bank. It is measured as the annual percentage growth rate of GDP at market prices based on constant local currency. GDP is the sum of gross value added by all resident producers in the economy, plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources (The World Bank Group, n.d.-a).

Interest rates

It is hypothesised that increased interest rates would be negatively correlated to the level of Private Equity investments for two main reasons. Private Equity deals are often structured leveraged buyouts, which mean that the deals are financed mostly with debt. Therefore, an increase in interest rates would increase the cost of the executing structures, and therefore, decrease the levels of deals concluded. Secondly, rising interest rates would have the effect of increasing operating costs of the investee companies, which would affect profitability of the companies, and therefore, attractiveness as a possible acquisition. Historical interest rates for the period of observation were obtained from the World Bank. They are measured as the lending

interest rate adjusted for inflation as measured by the GDP deflator (The World Bank Group, n.d.-e). This hypothesis is contrary to the findings of Balboa (2004) and Adongo (2011), who found that interest rates do not explain Private Equity activity.

Inflation rate

Inflation has the effect of eroding the value of the initial investment, therefore, it is expected that the inflation rate would be negatively correlated to Private Equity investment. Historical inflation rates were obtained from The World Bank. They are measured by "the consumer price index, which reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly" (The World Bank Group, n.d.-c).

Currency volatility

Macroeconomic instability is often reflected in the currency volatility, which means that there is uncertainty about the general health of the economy, as well as the businesses operating in that economy. Therefore, it is hypothesised that currency volatility would be inversely correlated to the level of Private Equity investment. Currency volatility also brings uncertainty on the returns that are generated by Foreign Investors, which would make it less attractive for investors to want to invest in a particular country. Currency volatility is determined by looking at the volatility of the Rand against the US dollar. The data were obtained from The World Bank (The World Bank Group, n.d.-d).

Entrepreneurship

Similar to GDP growth rate, a high level of entrepreneurship provides opportunities for investors to invest. Therefore, it is hypothesised that entrepreneurship is positively correlated to the level of Private Equity investment. This view is supported by the findings of a study done by Gompers and Lerner (1998). The level of entrepreneurship is measured using Total Early-Stage Entrepreneurial Activity (TEA) Rate. The TEA rate is defined as the "prevalence rate of individuals in the working age population who are actively involved in business start-ups, either in the phase of starting a new firm (nascent entrepreneurs), or in the phase spanning 42 months after the birth of the firm (owner-manager of new firms)" (IGI Global Disseminator of Knowlegde, n.d.). This rate was obtained from the Global Entrepreneurship Monitor South Africa Report 2016/2017 (Herrington, Key, & Alesimo, 2017).

### 3.3.2 Financial Variables

To determine the effect of financial variables on Private Equity development, the researcher considered the following variables: the development of the stock market and the development of the financial services sector.

Development of the stock market

The development of the stock market is essential for the growth of the Private Equity industry, as they provide means for investors to realise their investments. For the purposes of this study, the development of the stock market was measured by the value of domestic shares traded divided by their market capitalisation (turnover ratio). The value is annualised by multiplying the monthly average by 12. This ratio measures the liquidity of the stock market. It is hypothesised that the level of development of the stock market is positively correlated to the level of Private Equity Investments and this is supported by the findings of Gompers and Lerner (1998), Jeng and Wells (2000), and Wonglimpiyarat (2005). The stock market development ratio was obtained from the Global Financial Development Database, (The World Bank Group, n.d.-b).

Financial development

For financial development that was measured by the development of the banking sector is hypothesised to be positively correlated to the level of Private Equity investment. As previously mentioned, a number of Private Equity deals are structured leveraged buyout deals, which means that deals are funded by equity as well as debt. In a country where the banking sector is not well developed, it would be difficult for the Private Equity investors to raise debt to finance the leveraged transactions; therefore, the development of the banking sector is important for the industry. This view is supported by the findings of Adongo (2011), who found that the institutional environment affecting financial factors are important for Private Equity Investment in Africa. Financial development, which was obtained from the Global Financial Development Database, is measured as "total assets held by deposit money banks as a share of GDP. Assets include claims on domestic real nonfinancial sector, which includes central, state and local governments, nonfinancial public enterprises and private sector. Deposit money banks comprise commercial banks and other financial institutions that accept transferable deposits, such as demand deposits" (Trading Economics, n.d.-b).

### 3.3.3 Regulatory variables

The researcher further examines the effect that the regulatory variables would have on the PE equity variables i.e. the effect that the taxation dispensation that is adopted by a particular country would have on PE activity. The researcher also studies factors such as how the country is perceived in terms of how the weak regulatory environment has an effect on the PE environment.

Tax dispensation

In a study by Gompers and Lerner (1998), it was found that lower tax rates promote entrepreneurial activity, and therefore, promotes PE investments. Lower tax rates, such as the capital gains tax, would also have the effect of increasing the return on investment for the investors and would therefore encourage fundraising activities. The South African tax rate was obtained from Trading Economics website (Trading Economics, n.d.-a).

Legal and regulatory environment

It is hypothesised that a weak legal environment and regulatory environment would have a negative effect on fund raising activities. A strong legal environment provides protection for investors wishing to invest in a particular country. This is contrary to the findings of Adongo (2012), who found more Private Equity activity in countries with a weaker regulatory environment, as Private Equity funding provides an alternative to funding from formal financial institutions. However, a study by Jeng and Wells (2000) supports the view that a strong regulatory environment provides an enabling environment for fund raising activities. For the purposes of this study, the strength of the legal and regulatory environment was be obtained from the Worldwide Governance Indicators (WGI). WGI defines regulatory quality as "perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development" (The World Bank Group, n.d.-f). The estimate of this indicator ranges from approximately −2.5 (weak) to 2.5 (strong) governance performance.

Political stability

Lastly, the researcher explores the effect that political instability has on the level of private equity investment. Political instability would result in most of the macroeconomic variables

that are negatively correlated to the level of investment, such as inflation, high interest rates, and volatile exchange rates. Therefore, the researcher expects political instability to be negatively correlated to the level of Private Equity investment. However, similarly to the legal and regulatory environment above, this view is contrary to the findings of Adongo (2012), who observed that there was more PE investment in politically unstable countries with a weak regulatory environment. Adongo's findings are also similar to those of Bernoth and Colavecchio (2014), who found more Private Equity activity in politically unstable countries, "and the explanation for this could be that that PE investment in these countries is the safest and most convenient of entering their business landscape" (Bernoth & Colavecchio, 2014). For the purposes of this study, political stability is obtained from The World Bank where it is measured as Political Stability and Absence of Violence/Terrorism. The World Bank measures political stability as "perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism" (The World Bank Group, n.d.-f). The estimate of political stability ranges from approximately −2.5 (weak) to 2.5 (strong) governance performance. A summary of the variables and the different sources of data are presented in Table 3.1.

*Table 3.1: Description of Variables*

| Variables | Acronyms | Description | Sources |
|---|---|---|---|
| **Dependent Variable** | | | |
| ;Size of Private Equity | FUM | Funds under management as a percentage of GDP | KPMG Survey & AVCA Surveys |
| **Independent Variable** | | | |
| **Macro-economic** | | | |
| GDP growth rate | GPD | Growth of GDP per capita | The World Bank |
| Entrepreneurial activity | ENT | Entrepreneurial activity | Global Entrepreneurship Monitor |
| **Financial Variables** | | | |
| Financial Development | FIN | Market capitalization of the banking sector | Financial Development Database |
| **Regulatory Variables** | | | |
| Tax structure | TAX | Corporate tax rates | Central Bank |
| Regulatory environment | REG | Regulatory quality | The World Bank |
| **Political stability** | POL | Political stability | The World Bank |

*Source: Research Data, 2017*

### 3.4 Empirical Model

This paper uses a linear time-series model to test the relationship between the level of Private Equity investment and the selected independent variables. A number of studies in this area use panel regression techniques and this is mainly because the studies test the determinants of Private Equity investments over a number of regions, and therefore, making the method more appropriate. Due to data paucity in the African region, and the fact South Africa has the biggest Private Equity Industry in Africa, this study is limited to testing the determinants in the South African context, and therefore, the linear time-series model was considered more appropriate.

### 3.5 Estimation Approach

In line with time series modelling, this study first examines the unit roots of the selected independent variables. The Augmented Dickey-Fulley test is used to perform the unit root test. It then conducts the test for co-integration between the variables and use the autoregressive distributed lag "ARDL" bounds approach to test for co-integration. Lastly, the researcher examines a causal relationship between the growth in FUM and the independent variables using the Granger causality test. Refer below for a detailed discussion on each test.

Unit Root Testing

In order to investigate the relationship between growth in Private Equity Funds under Managements and the independent variables, a unit root test is performed to ascertain whether the variables have unit roots (such as not stationary). A unit root is a stochastic trend in a time series and if a time series has a unit root, it shows a systematic pattern that is unpredictable. This result in spurious regression whose ordinary least square estimates are invalid and as such, cannot be used to investigate relationships. The unit root test was performed using the Augmented Dickey Fuller test (ADF). The ADF test is the most popular test for stationarity.It tests the null hypothesis that a unit root is present in a time series sample.

Co-integration

The co-integration test investigates correlations among several time series variables in the long-term. The term co-integration was first introduced by Engle and Granger (1987). It identifies a situation where two or more non-stationary time series are bound together in such a way that they cannot deviate from some equilibrium in the long term (Engle & Granger, 1987). In other

words, when co-integration exists, there would be a stable relationship between the variables in the long-term, where the means and the variances of the variables remain stable in the long-term.

There are a number of methods to test for co-integration, which includes the Engle and Granger (1987) approach, Stock and Watson (1988); the Johansen test; as well as the autoregressive distributed lag "ARDL" bounds approach. This study has elected to use the ARDL bounds testing approach to test for co-integration given the limited number of observations in the sample being tested. The ARDL model was developed by Pesaran, Shin and Smith (2001). This approach can be performed by using the F-statistics or Wald test to check the significance of the lagged coefficient in the unrestricted error correction model (UECM). The ARDL bounds approach is the most appropriate to use when working with small sample sizes. The ARDL bounds testing approach tests the null hypothesis of whether a long-term relationship exists. ARDL co-integration technique does not require pre-tests for unit roots unlike other techniques. The approach consists of three main steps detailed below.

- The first step is to determine the long-term co-integration among the variables in the equation. The test for co-integration can be performed using either the joint F-statistic or the Wald test. The Wald test is performed by equating all the coefficients of the lag variables to zero (Faisal, 2014). The test is presented in the equations below.

$$\Delta \ln FUM_t = \beta_0 + \sum_{i=1}^{n} \partial_{1i} \Delta \ln FUM_{t-1} + \sum_{i=1}^{n} \gamma_i \Delta \ln GDP_{t-i} + \sum_{i=1}^{n} \pi_i \Delta \ln ENT_{t-i} + \sum_{i=1}^{n} \rho_i \Delta \ln FIN_{t-i} + \sum_{i=1}^{n} \sigma_i \Delta \ln STO_{t-i} + \sum_{i=1}^{n} \tau_i \Delta \ln TAX_{t-i} + \sum_{i=1}^{n} \varphi_i \Delta \ln REG_{t-i} + \sum_{i=1}^{n4} \omega_i \Delta \ln POL_{t-1} \quad \lambda_1 \Delta \ln FUM_{t-1} + \lambda_2 \Delta \ln GDP_{t-1} + \lambda_3 \Delta \ln ENT_{t-1} + \lambda_4 \Delta \ln FIN_{t-1} + \lambda_5 \Delta \ln TAX_{t-1} + \lambda_6 \Delta \ln REG_{t-1} + \lambda_7 \Delta \ln POL_{t-1} + \varepsilon_t \qquad (1)$$

- The estimated F-statistic is then compared with the bounds critical values in the table created by Pesaran et al. (2001) at significance levels of 1%, 5%, and 10%. The Pesaran et al. (2001) critical values are comprised of the upper and the lower bounds values. If the calculated F-statistics value is greater than both the upper and lower bounds critical values, then the null hypothesis of no co-integration can be rejected. This means that the variables in the model do have long-term co-integration. If the calculated F-statistics value lies between the upper and lower bounds critical values, then the decision is inconclusive. If the calculated F-statistic lies below the upper and lower bounds critical

values, then it suggests the evidence of no co-integration among the estimated variables in the model (Faisal, 2014). The hypothesis is presented as follows:

- H0: no long-term relationship exists, i.e. F-stat < Critical Values
- H1: long-term relationship exists, i.e. F-stat ≥ Critical Values

- The next step is to estimate the elasticity of the long-term relationship in order to determine its impact on the dependent variable. The long-term estimates of the effect of the independent variables on growth in FUM is examined with the regression model presented below:

$$\ln(\text{FUM})_t = \alpha_0 + \sum_{t=1}^{o} \emptyset 1_i \ln(\text{FUM})_{t-i} + \sum_{t=0}^{p} \emptyset 1_1 \ln(\text{GDP})_{t-j} + \sum_{t=0}^{q} \emptyset 1_2 \ln(\text{ENT})_{t-n} + \sum_{t=0}^{r} \emptyset 1_3 \ln(\text{FIN})_{t-o} + \sum_{t=0}^{s} \emptyset 1_4 \ln(\text{TAX})_{t-q} + \sum_{t=0}^{t} \emptyset 1_5 \ln(\text{REG})_{t-r} + \sum_{t=0}^{u} \emptyset 1_6 \ln(\text{POL})_{t-s} + \mu_t \quad (2)$$

- Lastly, we estimate the short-term the elasticity of the short-term relationship using the short-term coefficients of the variables using the equation below:

$$\Delta \text{FUM}_t = \alpha_0 + \sum_{t=1}^{o} \emptyset 1 \Delta \ln \text{FUM}_{t-i} + \sum_{t=1}^{p} \emptyset 2 \Delta \ln \text{GDP}_{t-j} \sum_{t=1}^{q} \emptyset 3 \Delta \ln \text{ENT}_{t-n} + \sum_{t=1}^{r} \emptyset 4 \Delta \ln \text{FIN}_{t-o} + \sum_{t=1}^{s} \emptyset 5 \Delta \ln \text{TAX}_{t-q} + \sum_{t=1}^{t} \emptyset 6 \Delta \ln \text{REG}_{t-r} + \sum_{t=1}^{u} \emptyset 7 \Delta \ln \text{POL}_{t-s} + \psi ECT_{t-1} + \sigma_t \quad (3)$$

The ECM Granger Causality test

In the next step, the researcher employs the Granger Causality test (Engle & Granger, 1987) to test for causality between the variables. The Granger Causality test is the most popular method of testing for causality, as it accommodates both large and small samples. The null hypothesis in the Granger Causality test is that the dependent variable in the first regression does not cause the independent variable in the second regression. The critical value used in the F-test is 3.84 and this value has been globally verified. Therefore, if the test statistic is less than 3.84 and the *p*-value is greater than 0.05, the null hypothesis is accepted.

- H0: X1 does not cause X2, i.e. F-stat < 3.84;
- H1: X1 causes X2, i.e. F-stat ≥ 3.84

### 3.6 Limitations of Study

Earliest Private Equity deals were first observed in South Africa in the late 1980s. However, due to limited data available in the sector, this study was limited to the period between 2001 and 2016, the period that we could obtain reliable data. This study was also limited to South Africa, therefore, it is considered necessary to expand the study to the rest of the African continent where there is Private Equity activity. This study was focused to determining the effect that the macroeconomic, financial, and the political environment has on the level of Private Equity environment. One important aspect that the study did not explore is the level of Pension Fund investment in the country as a determinant for Private Equity activity. In the South African context, Pension and Endowment Funds are the biggest investors in Private Equity, and therefore, exploring the impact of Pension Fund investments on Private Equity would add great value to the body of knowledge.

# CHAPTER FOUR

# RESEARCH FINDINGS AND DISCUSSION

## 4.1 Introduction

This chapter focuses on the data analysis, presentation, and interpretation of the findings resulting from the study. The results of the research are presented by means of tables, graphs, and charts. The presentation of the results begins with the descriptive statistics, which provide means and standard deviations of the time series data. This is followed by the normal distribution tests, then the unit root tests to establish stationarity, which is followed by testing for long and short-term relationships using the vector error correction models and lastly, the Granger causality test.

## 4.2 Results

### 4.2.1 Descriptive Statistics

Descriptive statistics for the variables being measured are summarised in Table 4.1. The average growth in Private Equity Funds under management was 11.82% per annum with the funds under management having grown from R34.5bn in 2001 to R171.8m in 2016. There was a decreasing trend in the South African Corporate Tax Rate with the tax rate having decreased from 37.8% in 2001 to 28% in 2016, with an average tax rate of 34.22% over the period. The average Regulatory Quality was rated at 0.48, which indicates the regulatory quality was perceived as average. Political Stability was at −0.08, which also indicates that political stability was perceived as average over the review period. The level of entrepreneurship was relatively low with an average South African ENT rate of 7.09% during the review period. Financial Development remained stable over the period and Bank deposit as a percentage of GDP was on average 76.70% with a standard deviation of 5.9%.

*Table 4.1: Descriptive Statistics*

| Variable | Mean | Standard Deviation | Min | Max | Pr (Skewness) | Pr (Kurtosis) | Obs |
|---|---|---|---|---|---|---|---|
| FUM | 11.82% | 14.66% | −3.66% | 45.78% | 0.020 | 0.259 | 15 |
| GDP | 2.89% | 1.96% | −1.54% | 5.60% | 0.254 | 0.406 | 15 |
| ENT | 7.05 | 1.78 | 4.3 | 10.6 | 0.302 | 1.952 | 15 |
| FINDEV | 76.79% | 6.12% | 66.55% | 87.68% | 0.855 | 0.913 | 14 |
| TAX | 33.982 | 3.964 | 28 | 37.8 | 0.122 | 0.392 | 15 |
| REG | 0.48 | 0.18 | 0.21 | 0.8 | 0.564 | 0.293 | 15 |
| POL | −0.08 | 0.14 | -0.31 | 0.22 | 0.480 | 0.600 | 15 |

*Note: FUM= Growth in Private Equity Funds under management (annual %); GDP= GDP growth (annual %); ENT= SA's TEA rate (Entrepreneurial Activity; FINDEV= Financial Development (Deposit money banks' assets to GDP (%)); TAX= South Africa Corporate Tax Rate; REG= Regulatory Quality; POL= Political Stability and Absence of Violence/Terrorism; Source: Research Data, 2017*

### 4.2.2 Test for Normal Distribution

Tests for normality calculate the probability that the sample was drawn from a normal population. When testing for normality, probabilities > 0.05 mean the data are normal, while probabilities < 0.05 mean the data are not normal. A data series that does not 'look' normal could lead to misinterpretation of regression analysis. Table 4.1 above provides the summary results of the normality test using the Shapiro-Wilk test.

The Shapiro-Wilk test provides evidence not to reject the null hypothesis of normality for the unconditional distribution of all the data series, except for three variables, growth in funds ($p > 0.05$), real interest ($p > 0.05$), and exchange rate (%) ($p > 0.05$). These variables seem to be normally distributed. This could imply that most of the time series of these variables are normally distributed. These could lead to misinterpretation of the general trend of the data; hence, it is important to then interpret inferential models with caution. Graphical presentation of the Shapiro-Wilk test is presented in annexure 2.

### 4.2.3 Trend Analysis

Trend analysis plots the independent variables against Growth in Funds Under Management against time. This reveals important features of the data (e.g., stationarity, trends, structural breaks, etc.). The results are of the trend analysis are displayed in annexure 1.

Macro-economic variables

Figure 6 illustrates how the variables GDP growth and Growth in FUM has trended relative to each other between 2002 and 2016. The trend per the graph does not indicate correlation between the two variables. The period between 2007 and 2009 saw a significant decrease in growth in FUM, as well as GDP growth. This period was the period of the Global economic crisis, which saw drying up of liquidity in the market and hence a decrease in GDP growth as well as growth in FUM.

Figure 7 and 8 show how the variables Real Interest Rates and Inflation have trended with Growth in FUM during the review period. Interest rates have been on a declining trend but remained relatively stable over the review period. In the first 5 years of the study, the average interest rate was 5.4%, which declined to 3.3% in the later years. Inflation has also remained stable, owing to the fact that since 2002 the South African Reserve Bank has adopted inflation targeting as a macroeconomic policy in order to ensure that inflation remains between 3% and 6%. In 2003, inflation shot up to 9.2% resulting from the weakening of the Rand following the 9/11 attacks in the United States. The strengthening of the Rand in the years that followed brought inflation within the targeted band. The spike in inflation between 2007 and 2008 was again due to the depreciation of the Rand because of the Global Financial Crisis. The graphs do not indicate any correlation between the independent variables and growth in FUM.

Figure 9 depicts how variables exchange rates and Growth in FUM have trended relative to each, but does not show any correlation between the two variables. The South African Rand is one of the most traded emerging market currencies, therefore making it highly volatile. As stated previously, the Rand lost most of its value around 2002 following the 9/11 attacks and again between 2007 and 2009, when the world went into recession following the world financial crisis. Depreciation of the Rand continued from 2012 to 2016 with the Rand depreciating to R7.26/$ in 2011 to R14.71/$ in 2016. The decline was because of a number of internal and external factors. Domestic factors affecting the Rand include political instability that has affected the country in the recent years, which has had significant impact on investor confidence. This ultimately resulted in a decrease in foreign investment in the country and in turn, resulted in a decreased demand for the Rand. Poor economic performance, evidenced by the declining trend in GDP growth, has also deterred foreign investment from the country. As previously mentioned, the South African Reserve Bank has embarked on inflation targeting,

which has meant keeping interest low, resulting in the country being less attractive to foreign investors, as investors earn a low return on investment on South African assets. The current account deficit has been growing in the recent years, which means that the South African government has had to borrow capital from foreign markets, and the demand for foreign currency has resulted in the depreciation of the South African Rand. The Rand has also not been immune to external forces, which include loss of investor confidence in emerging markets, which has resulted in disinvestment in emerging markets and funds being channeled to more stable developed markets.

Lastly, Figure 10 illustrates how the variables entrepreneurship and Growth in FUM have trended relative to each other between 2002 and 2016. The trend per the graph does not indicate correlation between the two variables.

Financial variables

Figure 11 and 12 show the relationship between growth in FUM and financial variances, namely stock market development and financial development respectively. There has been growth in stock market development over the review period with the stock turnover ratio increasing from 21% in 2002 to 38% in 2016. There appears to be a positive correlation between stock market development and growth in capitalisation of the Private Equity sector. However, there seems to be a lag with growth in FUM, driving the fluctuations in the stock turnover ratio. Financial development was on an increasing trend until the Global Economic crises. The decrease in capitalisation of the Banking sector post the financial crisis is reflecting of the loss in investor confidence in the Banking sector, as the financial crisis originated in the Banking sector. The graph does not indicate a relationship between financial development and growth in FUM.

Regulatory variables

The South African Corporate tax rate has been on a declining trend over the review period, which was to mainly stimulate economic investment in the South African economy. From the graph presented in Figure 13, there does not seem to be a direct relationship between the decreasing tax rate and Private Equity FUM.

Figure 14 depicts the relationship between regulatory quality and FUM. Regularly quality has been on a declining trend over the review period and the declining trend does not appear to

have had an impact on growth in FUM. Lastly, Figure 15 depicts a positive correlation between political stability and growth in FUM during the review period.

### 4.2.3 Autocorrelation

When examining the relationship between two continuous variables, always look at the scatterplot to see visually the pattern of the relationship between them and look for outliers (observations lying away from the main body of points). Scatterplots should be produced for each independent with the dependent to see if the relationship is linear (scatter forms a rough line) (Sasieni & Royston, 1994).

Portmanteau test for white noise

White noise refers to the fact that a variable does not have autocorrelation. Refer to annexure 2 for the graphs on the portmanteau test for white noise. Growth in funds figure shows all values appear inside the confidence band, indicating no white noise processes within the data series. It has autocorrelations between different periods.

Interest rates and GDP – all the values appear inside the confidence bands, indicating strict white noise processes within the data series. The test statistic (*p*-value) for all variables is greater than 0.05; hence, the null hypothesis of no autocorrelation is not rejected.

Financials development and stock market developments – not all the values appear inside the confidence bands for financial development, indicating strict white noise processes within the data series. The test statistic (*p*-value) is lower than 0.05. The null hypothesis that there is no serial correlation is rejected, meaning the series have autocorrelations between different periods. Stocks traded figure shows all values appear inside the confidence band, indicating no white noise processes within the data series. It has autocorrelations between different periods.

For Corporate Tax, Regulatory Quality and Political Stability most of the values appear outside the confidence bands for South corporate rate, indicating no strict white noise processes within the data series. The test statistic (*p*-value) is always lower than 0.05. The null hypothesis of no autocorrelation is rejected, as there are autocorrelations in this time series data. The same applies to regulatory quality, as there is a presence of autocorrelation. Political stability demonstrates non-presence of autocorrelations, as the values all appear inside the bands and the *p*-value is greater than 0.05. Because of this white noise presence in some variables, further

tests are done to check for stationarity of the data. Data has to be stationary for a good model (has to have a trend).

### 4.2.4 The ADF Test

The results for the Augmented Dickey-Fulley tests for all the variables are shown in Table 4.2.

*Table 4.1: Augmented Dickey-Fulley test*

| | Test Statistic | | 1% Critical Value | 5% Critical Value | 10% Critical Value | Outcome at 5% Significant Level | |
|---|---|---|---|---|---|---|---|
| | I (0) | I (1) | | | | I (0) | I (1) |
| **FUM** | (2.728) | (3.000) | (4.058) | (3.120) | (2.701) | Reject | Reject |
| **GDP** | (1.859) | (4.001) | (4.058) | (3.120) | (2.701) | Reject | FTR |
| **ENT** | (0.705) | (3.546) | (4.058) | (3.120) | (2.701) | Reject | FTR |
| **FINDEV** | (2.871) | (2.227) | (4.058) | (3.120) | (2.701) | Reject | Reject |
| **TAX** | (0.390) | (3.964) | (4.058) | (3.120) | (2.701) | Reject | FTR |
| **REG** | (0.514) | (2.679) | (4.058) | (3.120) | (2.701) | Reject | Reject |
| **POL** | (2.962) | (4.764) | (4.058) | (3.120) | (2.701) | Reject | FTR |

*Note: FUM= Growth in Private Equity Funds under management (annual %); GDP= GDP growth (annual %); ENT= SA's TEA rate (Entrepreneurial Activity FINDEV= Financial Development (Deposit money banks' assets to GDP (%)); TAX= South Africa Corporate Tax Rate; REG= Regulatory Quality; POL= Political Stability and Absence of Violence/Terrorism; Source: Research Data, 2017; Note: Fail To Reject ("FTR") = unit root; Reject = no unit root*

The null hypothesis of the ADF test is that a time series has a unit root (such as the data is not stationary) and this is evidenced by a test statistic that is less than the critical value.

The requirement for the application of ARDL is that the variables should be stationary at level I (0) or at first difference I (1) or a mixture of at level or at first difference. ARDL does not require variables that are neither stationary at level nor at first difference. Variables Real interest rate and Inflation were neither stationary at level nor at first difference and thus were excluded from the model.

### 4.2.5 ARDL Models

Given the fact that all of the variables under consideration are stationary at level I (0) or at first difference I (1) or a mixture of at level or at first difference, long-term equilibrium relationships are investigated using the bounds test for co-integration within ARDL modelling approach. When one co-integrating vector exists, (Pesaran & Shin, 1995) propose the Autoregressive Distributed Lag (ARDL) approach to co-integration or bound procedure for a long-term relationship, irrespective of whether the underlying variables are I(0), I(1) or a combination of

both. In this section, the number of observations is less than 30 hence, the ARDL error correction model with lag (0) and lag (1) is applied.

The ARDL bounds estimation tests the null hypothesis that no long-term relationship exits. The rule of thumb is that when the computed F-statistic is greater than the upper bound critical value, then the H0 is rejected (the variables are co-integrated). If the F-statistic is below the lower bound critical value, then the H0 cannot be rejected (there is no co-integration among the variables). Variables Stock Market Development and Exchange Rate were excluded from the model, as the VIF of the two variables was 20.5 and 20.0 respectively, which indicates multi-collinearity between these two variables and other variables included in the model, which could result in the model generating unreliable results.

*Table 4.3: Bounds Test Results*

| **Bounds test result** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | CV1% | | | CV5% | | | CV10% | | |
| | F-Statistic | I(0) | I(1) | | I(0) | I(1) | | I(0) | I(1) | |
| Model 1 | 6.355042 | 2.88 | 3.99 | FTR | 2.27 | 3.28 | Reject | 1.99 | 2.94 | Reject |

The results of the bounds test are presented in Table 4.3. The F-statistic is greater than the upper bound critical value at a 1%, 5% and 10% confidence interval; therefore, we reject the hypothesis of no co-integration. This indicates the existence of a long-term relationship between the dependent variable Growth in Funds Private Equity under Management and the selected independent variables.

### 4.2.6 Regression Results

Long-term estimates

The long-term estimates of each variable under consideration are presented in the Table 4.4. The model shows positive correlation between Growth in Private Equity Funds under Management and variables GDP, REG, POL, and FINDEV. However, the *p*-values indicates that the relationship is only significant for GDP. The finding on GDP growth is supported by the findings of Bernoth and Colavecchio (2014), who found that the faster the country is growing (where growth is measured by GDP), the more PE investment is attracted. However, this result is contrary to the findings of Adongo (2011), and Jeng and Wells (2000), who found

that the GDP growth rate does not have a significant impact on the Private Equity Activity. The finding on the quality of the regulatory environment and political stability is contrary to the findings of Bernoth and Colavecchio (2014), who observed that there was more PE investment in politically unstable countries with a weak regulatory quality. Lastly, the finding on financial development is supported by a study by Adongo (2011), who found that the institutional environment affecting financial factors and regulatory factors explain venture capital activity in Africa.

*Table 4.4: ARDL Long-term Co-integration*

| Levels Equation | | | | |
|---|---|---|---|---|
| Case 2: Restricted Constant and No Trend | | | | |
| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
| GDP | 0.062335 | 0.02916 | 2.137668 | 0.0993* |
| ENT | -0.046709 | 0.022377 | -2.087367 | 0.1051 |
| TAX | -0.046814 | 0.013509 | -3.465467 | 0.0257** |
| REG | 0.606325 | 0.318041 | 1.906434 | 0.1293 |
| POL | 0.273169 | 0.449302 | 0.607986 | 0.5760 |
| FINDEV | 0.018769 | 0.009281 | 2.02218 | 0.1132 |
| C | 0.125852 | 0.977402 | 0.128761 | 0.9038 |

*Note: FUM= Growth in Private Equity Funds under management (annual %); GDP= GDP growth (annual %); INT= Real interest rate (%); INF= Inflation, consumer prices (annual %); EXC= Official exchange rate (LCU per US$, period average); ENT= SA's TEA rate (Entrepreneurial Activity; STO= Stocks traded, turnover ratio of domestic shares (%); FINDEV= Financial Development (Deposit money banks' assets to GDP (%)); TAX= South Africa Corporate Tax Rate; REG= Regulatory Quality; POL= Political Stability and Absence of Violence/Terrorism; ** and * denotes significance at 5% and 10% respectively. Source: Research Data, 2017*

The model shows that Growth in Private Equity Funds under Management is inversely related to the level of entrepreneurship, as well as growth in the tax rate. The inverse relationship between entrepreneurial activity and growth in FUM is contrary to the finding of Gompers and Lerner (1998b), who found that the demand for venture capital or private equity financing attracts the flow of funds into the sector. The finding on variable tax rate is in line with the expectations of this study and is supported by the study done by Adongo (2011), and Gompers and Lerner (1998), who found a negative relationship between the dependant variable and growth in the tax rate.

Short-term estimates

Long-term causality is determined by the error correction term, whereby if it is significant, then it indicates evidence of long-term causality from the explanatory variable to the dependent

variable. Short-term dynamics that might fluctuate around this long-term relationship can also be established. The short-term dynamics are presented in Table 4.5.

*Table 4.5: ARDL Short-term Co-integration*

| Conditional Error Correction Regression | | | | |
|---|---|---|---|---|
| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
| C | 0.126382 | 0.970030 | 0.130287 | 0.9026 |
| FUM(-1)* | -1.004213 | 0.233750 | -4.296105 | 0.0127** |
| GDP** | 0.062598 | 0.027228 | 2.299020 | 0.0830* |
| ENT** | -0.046906 | 0.021932 | 2.138695 | 0.0992* |
| TAX** | -0.047011 | 0.012992 | -3.618471 | 0.0224** |
| REG** | 0.608879 | 0.345435 | 1.762646 | 0.1527 |
| POL** | 0.274320 | 0.437182 | 0.627474 | 0.5644 |
| FINDEV** | 0.018848 | 0.01118 | 1.685803 | 0.1671 |
| ConintEq(-1)* | -1.004213 | 0.084929 | -11.82417 | 0.0003*** |
| R-Squared | 0.927027 | | | |
| Adjusted R-squared | 0.927027 | | | |
| DW | 2.264568 | | | |

*Note: FUM= Growth in Private Equity Funds under management (annual %); GDP= GDP growth (annual %); INT= Real interest rate (%); INF= Inflation, consumer prices (annual %); EXC= Official exchange rate (LCU per US$, period average); ENT= SA's TEA rate (Entrepreneurial Activity; STO= Stocks traded, turnover ratio of domestic shares (%); FINDEV= Financial Development (Deposit money banks' assets to GDP (%)); TAX= South Africa Corporate Tax Rate; REG= Regulatory Quality; POL= Political Stability and Absence of Violence/Terrorism; ***, ** and * denotes significance at 1%, 5% and 10% respectively. Source: Research Data, 2017*

The cointEq coefficient is considered significant when it is negative in value and its *t*-ratio and *p*-value are significant. The cointEq coefficient indicates the speed at which the long-term disequilibrium is corrected in the short-term. The results tabled above show a cointEq coefficient of −1.00, which indicate that 100% of deviations from the long-term disequilibrium are corrected with the next period of the deviation. This also indicates that any deviations from equilibrium are corrected immediately, such as within the same period. Variables GDP, REG and POL, and FINDEV are positively correlated with the dependant variable in the short-term and variables ENT and TAX have an inverse relationship with tax in the short-term. The Regulatory environment is the most significant relationship as evidenced by a coefficient of 0.608, which means that 1% improvement in the regulatory environments results in a 0.608% increase in Private Equity Funds under Management.

### 4.2.7 Model diagnostics

The validity of the results produced by the model is confirmed by performing diagnostic tests. To test the validity of the model, the Breusch-Godfrey serial correlation LM test was performed.

The null hypothesis is that there is no serial correlation of the residuals. The results presented in Table 4.6 show a Chi-Square variable of 0.0687, which is greater than 0.05; therefore, it fails to reject the null hypothesis of no serial correlation, therefore the model is considered valid.

*Table 4.6: Breusch-Godfrey Serial Correlation LM Test*

| **Breusch-Godfrey Serial Correlation LM Test:** | | | |
|---|---|---|---|
| F-Statistic | 0.806021 | Prob. > F(2,2) | 0.5537 |
| Obs*R-squared | 5.355559 | Prob. > $\chi^2$ | 0.0687 |

"To check the stability of the long-term of the coefficient of the estimated variables in the model, the cumulative sum (CUSUM) tests are used. The CUSUM are plotted against the plotted lines at 5% level of significance. If the plot of the CUSUM lies inside the critical bounds at 5% level of significance, it indicates that the regression model is stable", (Faisal, 2014, p. 13) . As presented in the diagram on annexure 4, the CUSUM lies inside the critical bounds, which indicates that the model is stable. The next section is the granger test, which tests causality between the independent variables and growth in funds (dependent variable).

#### *4.2.7.1 Granger Causality Test*

The following section runs an ordinary least square model in order to determine the unidirectional causality of the variables. The *p*-values for the selected independent variables is greater than 0.05; therefore, the null hypothesis of causality between independent variables and growth in funds management is rejected. A conclusion can be made that although there may be short-term relationships between the variables, in the long-term, there is no relationship between growth in private equity funds under management and all the selected independent variables. In conclusion, GDP, entrepreneurial activity, the tax dispensation, regulatory environment, political environment, and the development of the financial services system does not granger cause growth in Private Equity Funds under Management.

*Table 4.7: Granger Causality Test*

| Null Hypothesis | Obs | F-Statistic | Prob | Decision |
|---|---|---|---|---|
| GDP does not Granger Cause FUM | 13 | 1.96707 | 0.20190 | FTR |
| FUM does not Granger Cause GDP | | 2.44686 | 1.14820 | FTR |
| ENT does not Granger Cause FUM | 10 | 0.22930 | 0.80300 | FTR |
| FUM does not Granger Cause ENT | | 0.33717 | 0.72880 | FTR |
| TAX does not Granger Cause FUM | 13 | 0.27367 | 0.76740 | FTR |
| FUM does not Granger Cause TAX | | 0.03354 | 0.96720 | FTR |
| REG does not Granger Cause FUM | 13 | 0.53618 | 0.60460 | FTR |
| FUM does not Granger Cause REG | | 2.54629 | 0.13940 | FTR |
| POL does not Granger Cause FUM | 13 | 0.04121 | 0.95980 | FTR |
| FUM does not Granger Cause POL | | 0.28197 | 0.76150 | FTR |
| FINDEV does not Granger Cause FUM | 12 | 2.86050 | 0.12360 | FTR |
| FUM does not Granger Cause FINDEV | | 7.00588** | 0.02130 | Reject |

*Note: FUM= Growth in Private Equity Funds under management (annual %); GDP= GDP growth (annual %); INT= Real interest rate (%); INF= Inflation, consumer prices (annual %); EXC= Official exchange rate (LCU per US$, period average); ENT= SA's TEA rate (Entrepreneurial Activity; STO= Stocks traded, turnover ratio of domestic shares (%); FINDEV= Financial Development (Deposit money banks' assets to GDP (%)); TAX= South Africa Corporate Tax Rate; REG= Regulatory Quality; POL= Political Stability and Absence of Violence/Terrorism; ** denotes significance at 5%. Source: Research Data, 2017*

## 4.3 Conclusion

Based on the findings of this study, we reject the hypothesis that macroeconomic, financial, and regulatory factors have an effect on the level of Private Equity investment in the South African context. The findings of this study can be explained by the opportunistic nature of the Private Equity business. This means that investors look for opportunities in markets where they could make substantial returns, and those opportunities are not necessarily informed by the macroeconomic environment of the countries where the opportunities avail themselves. As observed in the growth of Private Equity business in South Africa, the opportunistic nature of the business is quite evident. The first Private Equity deals were observed in the late 1980s, which was one of the most economically and politically unstable times in the South African history where sanctions were imposed and the average GDP growth was as low as 1.5%, (South Africa Data Portal, n.d.) and the average inflation rate was as high as 15.4%. However, investors saw an opportunity to generate exponential returns, as the assets were being disposed at significantly discounted values. The second boom in the sector came in the early 90s when the sanctions against the country were lifted and investors had renewed confidence in the country. Again, this time happens to be one of the most politically unstable times in the history of the country, as there was uncertainty as to the direction the country would take post-democracy.

During this time, the country was in recession with an average growth rate of c. −0.5% and the average inflation rate was c. 13%. However, investors saw an opportunity to make a return, which resulted in a boom in the Private Equity industry. Lastly, another boom in the industry came in the late 1990s to fund the privatisation of state assets, as well as to fund BEE deals. During this time, the interest rates in the country were as high as 13% (1998); however, since the source of funding was mainly offshore funds, they were immune to the high domestic interest rates.

# CHAPTER FIVE

# RESEARCH CONCLUSIONS

## 5.1 Introduction

This section of the paper summarises the study and the results of the empirical analysis and makes policy recommendations based on the results.

## 5.2 Summary of the Study

This study explored the determinants of Private Equity activity in South Africa with the aim of informing policy decisions in order to increase capitalisation of the Private Equity industry in South Africa. In line with the study of Bernoth and Colavecchio (2014), this study explored the macroeconomic determinants of Private Equity. Similar to Jeng and Wells (2000), the study also investigated the effect that financial development has on funds under management. Lastly, the study investigated the effect of the country regulatory environment on Private Equity FUM.

Given that Private Equity is a new industry in South Africa and that there is limited data on the industry, ARDL was considered the most appropriate method of testing the causal relationship between the independent variance and the growth in Private Equity FUM. The results of the study show that there is no causal relationship between growth in FUM and the macroeconomic, financial, as well as the regulatory variables.

The study did however find that in the long run there is a significant relationship between FUM and GDP as well as FUM and TAX. The study found that in the longrun FUM was positively correlated to GDP growth, and it also found that in the longrun growth in FUM is negatively correlated to increases in the TAX rate. This finding is consistent with the findings of Gompers and Lerner (1998) which found that the lower the capital gains tax the higher the demand for venture capital funding and that the higher the GDP growth rate, the higher the demand for venture capital funding. The findings of Gompers and Lerner on GDP and TAX suggest that growth in GPD and the decrease in the TAX rate promotes demand for Private Equity funding such that a growing economy provides entrepreneurs with opportunities to start new ventures and therefore drive the demand for Private Equity funding. Similarly a decrease in the TAX rate provide entrepreneurs with an incentive to invest in new ventures as a lower TAX rate would mean higher return for an entrepreneur. This finding supports the school of thought that suggests that the level of Private Equity penetration is demand driven and that a high level of

entrepreneurial activity in an economy will result in a high level of private equity investment in the economy.

### 5.3 Policy Recommendations

The study did not find a causal relationship between Private Equity activity and macroeconomic activity, financial environment, and the regulatory environment. However given the significant longrun relationship between growth in GDP and growth in FUM as well as the inverse relationship between growth the TAX rate and growth in FUM, policy changes that influence GDP growth and the reduction in the TAX rate would influence the level of Private Equity investment in the economy. Therefore, the government should focus on providing tax incentives to Private Equity investors as well as to privately owned companies in order to increase the level of Private Equity investment. Based on the results of this study, there are limited policy changes that could be implemented for other macroeconomic, financial and regulatory variables used in this study that would increase capitalisation of the Private Equity industry in South Africa.

### 5.4 Recommendations for Future Studies

It is noted that in the South African context, Pension Funds are the biggest investor in Private Equity and in 2016, they make up 56% of Private Equity Funds under management. Therefore, a study exploring the relationship between growth in Pension Fund penetration and growth in Private Equity Funds Under Management could provide further clarity on the topic.

Secondly, Pension Funds are restricted in terms of the types of assets in which they can invest funds under management; therefore, investigating the effect that regulation restricting Pension Funds from investing in this asset class could be meaningful. Lastly, investing the effect that Pension Funds investment policy has on Private Equity activity could be beneficial.

## REFERENCES


Abor, J. (2011). Masters in Development Finance-Micro-Enterprises Finance. *Africa Growth Intsitute*, 141.

Adongo, J. (2011). *Determinants of venture capital in Africa: Cross section evidence*. (AERC Research Paper 237) African Economic Research Consortium, Nairobi, August. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.661.958&rep=rep1&type=pdf

Adongo, J. (2012). *The impact of the legal environment on venture capital & private equity in Africa: Empirical evidence*. (Unpublished paper) Department of Economics and Fiance, Middle Tennessee State University, Murfreesboro, TN. Retrieved from https://www.afdb.org/en/

Babarinde, O. (2012). The private equity market in Africa: Trends, opportunities, challenges, and impact. *The Journal of Private Equity*, *16*, 56–73. http://doi.org/10.3905/jpe.2012.16.1.056

Balboa, M., & Martí, J. (2001). Determinants of Private Equity Fundraising in Western Europe. *SSRN Electronic Journal*, (April 2001). http://doi.org/10.2139/ssrn.269789

Bernoth, K., & Colavecchio, R. (2014). The macroeconomic determinants of private equity investment: A European comparison. *Applied Economics*, *46*(11), 1170–1183. http://doi.org/10.1080/00036846.2013.866306

Chemla, G. (2004). The Determinants of Investment in Private Equity and Venture Capital: Evidence from American and Canadian Pension Funds. *SSRN Electronic Journal*, 1–18. http://doi.org/10.2139/ssrn.556421

Engle, R. F., & Granger, C. W. J. (1987). Co-Integration and Error Correction: Representation, Estimation, and Testing. *Econometrica*, *55*(2), 251. http://doi.org/10.2307/1913236

Faisal, F. (2014). Causality between stock price and GDP in Turkey: An ARDL Bounds testing approach. *Energy Economics Letters*, *9*(1), 25–31. http://doi.org/10.1080/15567241003681882

Finance and the missing middle. (n.d.). Retrieved July 21, 2018, from https://sites.hks.harvard.edu/cid/efl/finance.html

Franklin, J. (2018). Global private equity funds raise record $453 billion in 2017: Preqin | Reuters. Retrieved July 22, 2018, from https://www.reuters.com/article/us-privateequity-fundraising/global-private-equity-funds-raise-record-453-billion-in-2017-preqin-idUSKBN1ET23L

Gatauwa, J., & Mwithiga, A. (2014). Private equity and economic growth: a critical review of the literature. *European Journal of Business and Innovation Research*, *2*(3), 1–10. Retrieved from http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:No+Title#0%5Cnhttp://www.eajournals.org/wp-content/uploads/Private-Equity-and-Economic-Growth-A-Critical-Review-of-the-Literature.pdf

Gompers, P. A., & Lerner, J. (1998). What drives venture capital fundraising? *Brookings Papers on Economic Activity: Microeconomics*, 149–204. http://doi.org/10.2139/ssrn.57935

Herrington, M., Key, P. M., & Alesimo. (2017). South Africa Report2016/2017 Can small businesses survive in South Africa? Retrieved from http://www.healthdata.org/south-africa

IGI Global Disseminator of Knowlegde. (n.d.). What is Total Early-Stage Entrepreneurial Activity (TEA) Rate | IGI Global. Retrieved July 21, 2018, from https://www.igi-global.com/dictionary/total-early-stage-entrepreneurial-activity-tea-rate/47105

Jeng, L. A., & Wells, P. C. (2000). The determinants of venture capital funding: Evidence across countries. *Journal of Corporate Finance*, *6*(3), 241–289. http://doi.org/10.1016/S0929-1199(00)00003-1

Kajuju, M., & Chiwanza, T. H. (2015). The 6 Fastest Growing Economies in Africa, 2018 | The African Exponent. Retrieved July 19, 2018, from https://www.africanexponent.com/post/the-6-fastest-growing-economies-in-africa-36

Kalidas, S., Kelly, A., & Marsden, A. (2014). *New Zealand venture capital funds and access to new financing: an exploratory study*. *Pacific Accounting Review* (Vol. 26). http://doi.org/10.1108/PAR-04-2013-0024

KPMG. (2013). KPMG Africa Funds and Fund Management Survey, (November). Retrieved from http://www.kpmg.com/ZA/en/IssuesAndInsights/ArticlesPublications/Financial-Services/Documents/KPMG Africa Funds and Fund Management Survey.pdf

Leke, A. (2016). What's the future of economic growth in Africa? | World Economic Forum. Retrieved July 19, 2018, from https://www.weforum.org/agenda/2016/05/what-s-the-future-of-economic-growth-in-africa/

Megginson, W. L. (2011). Towards a Global Model of Venture Capital? *Advanced Materials Research*, *16*(1), 89–107. http://doi.org/10.1111/j.1745-6622.2004.tb00599.x

Open Government Data Forum India. (2015). GDP Growth Rate of India (Constant Prices) during 2001-02 to 2013-14 | Open Government Data Platform India Blog. Retrieved July 18, 2018, from https://community.data.gov.in/gdp-growth-rate-of-india-constant-prices-during-2001-02-to-2013-14/

Pesaran, M. H., & Shin, Y. (1995). An autoregressive distributed lag modelling approach to cointegration analysis. *Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium.*, (March 3-5, 1995), 1–31. http://doi.org/10.1017/CCOL521633230

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, *16*(3), 289–326. http://doi.org/10.1002/jae.616

Poterba, J. M. (1986). Lifetime incidence and the distibutional burden of excide tax. *NBER Working Paper Series*, *93*(1–2), 35–47. http://doi.org/10.1155/1986/93154

Powers, J. (2012). The History Of Private Equity & Venture Capital. Retrieved July 19, 2018, from http://www.corporatelivewire.com/top-story.html?id=the-history-of-private-equity-venture-capital

Sasieni, P. D., & Royston, P. (1994). An Analysis of Transformations Author ( s ): G . E . P . Box and D . R . Cox Published by : Wiley for the Royal Statistical Society Stable URL : http://www.jstor.org/stable/2984418. *Journal of the Royal Statistical Society*, *45*(2), 211–252.

SAVCA. (2015). Three decades. *THREE DECADES An Account of the Rise and Establishment of South African Private Equity*. Retrieved from http://www.savca.co.za/wp-content/uploads/2015/02/Three-Decades-Magazine-2015.pdf

SAVCA. (2016). Private equity industry survey. Retrieved from http://www.savca.co.za/research-and-resources/savca-kpmg-private-equity-industry-survey/

South Africa Data Portal. (n.d.). GDP by Country | Statistics from IMF, 1980-2022 - South Africa Data Portal. Retrieved July 22, 2018, from http://southafrica.opendataforafrica.org/tbocwag/gdp-by-country-statistics-from-imf-1980-2022?country=South Africa

The Investment U Research Team. (n.d.). The History of Private Equity - Investment U. Retrieved July 19, 2018, from https://www.investmentu.com/content/detail/private-equity-history

The World Bank Group. (n.d.-a). GDP growth (annual %) | Data. Retrieved July 19, 2018, from https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?end=2017&locations=CN&start=1961&view=chart

The World Bank Group. (n.d.-b). Global Financial Development Database (GFDD). Retrieved July 22, 2018, from https://www.worldbank.org/en/publication/gfdr/data/global-financial-development-database

The World Bank Group. (n.d.-c). Inflation, consumer prices (annual %) | Data. Retrieved July 22, 2018, from https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?locations=ZA&view=chart

The World Bank Group. (n.d.-d). Official exchange rate (LCU per US$, period average) | Data. Retrieved July 22, 2018, from https://data.worldbank.org/indicator/PA.NUS.FCRF?locations=ZA

The World Bank Group. (n.d.-e). Real interest rate (%) | Data. Retrieved July 21, 2018, from https://data.worldbank.org/indicator/FR.INR.RINR?locations=ZA

The World Bank Group. (n.d.-f). World Governance Indicators. Retrieved July 21, 2018, from http://info.worldbank.org/governance/wgi/#home

Trading Economics. (n.d.-a). South Africa Corporate Tax Rate | 2001-2018 | Data | Chart | Calendar. Retrieved July 21, 2018, from https://tradingeconomics.com/south-africa/corporate-tax-rate

Trading Economics. (n.d.-b). South Africa Financial System Deposits To Gdp Percent. Retrieved July 21, 2018, from https://tradingeconomics.com/south-africa/financial-system-deposits-to-gdp-percent-wb-data.html

Wonglimpiyarat, J. (2005). How the capital market laws affect the development of venture capital industry. *Journal of Financial Regulation and Compliance*, *13*(4), 301–312. http://doi.org/10.1108/13581980510635537

# ANNEXURE 1 – TREND ANALYSIS

## Macroeconomic variables

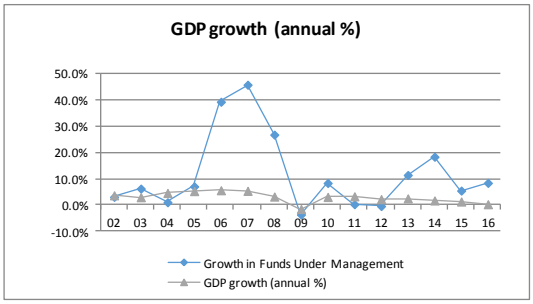



*Figure 6*

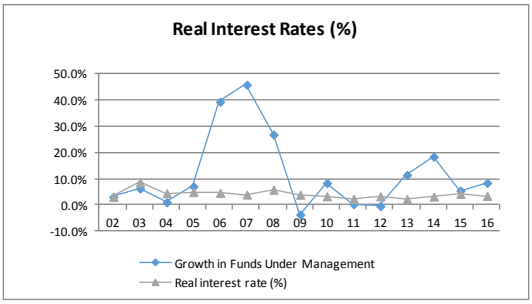



*Figure 7*

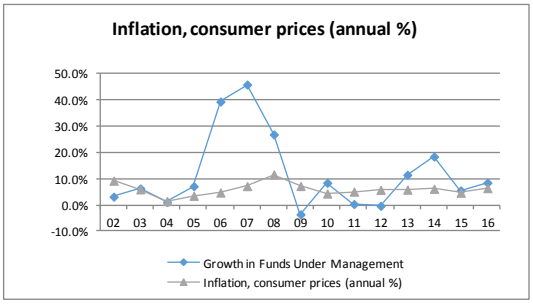



*Figure 8*

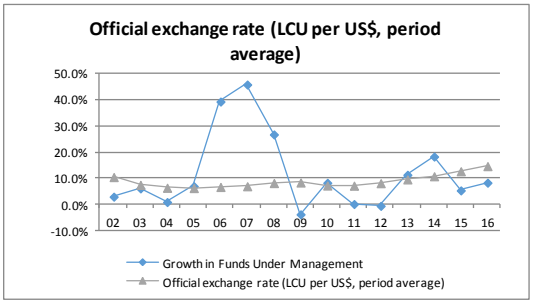



*Figure 9*

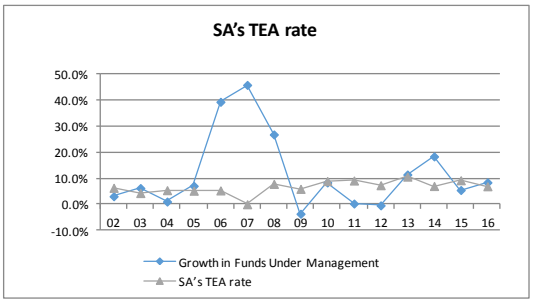



*Figure 10*

## Financial variables

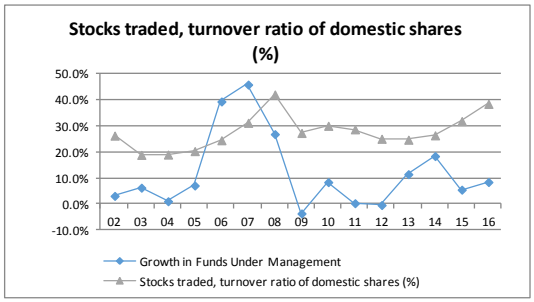



*Figure 11*

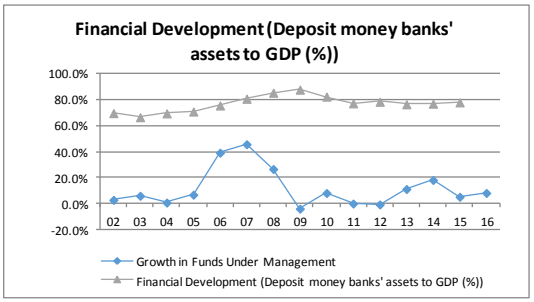



*Figure 12*

## Regulatory variables

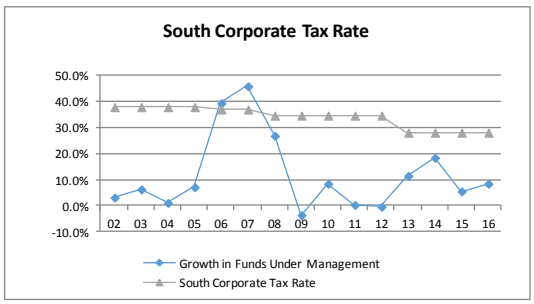



*Figure 13*

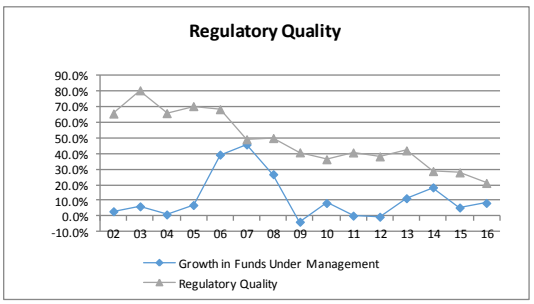



*Figure 14*

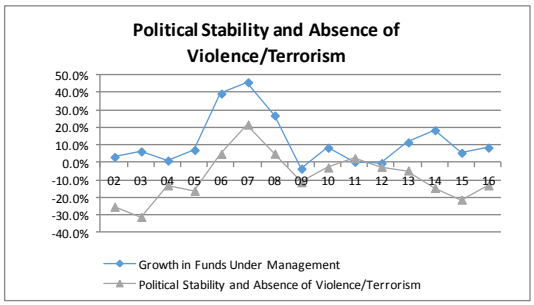
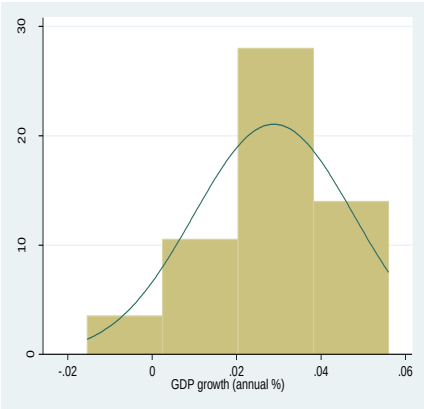


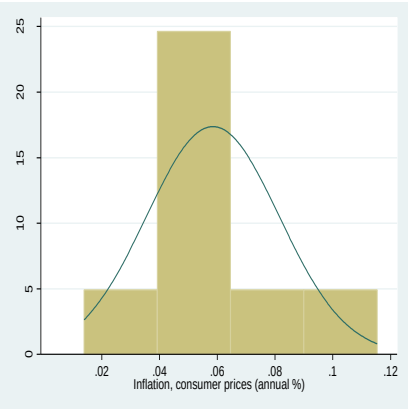

*Figure 15*

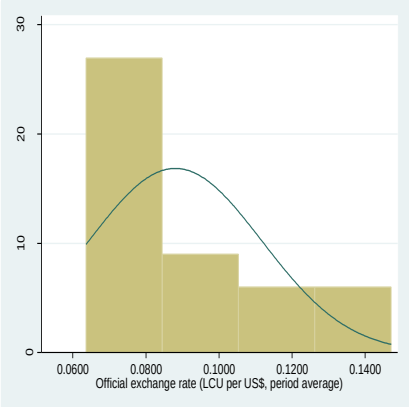
## ANNEXURE 2 - THE SHAPIRO-WILK TEST

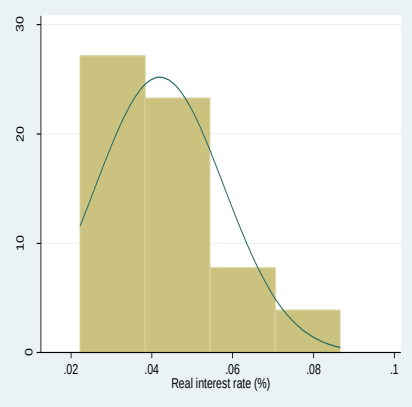
Below are graphical representations portraying a normal (near symmetric bell shape) and non-normal distribution.

Macroeconomic

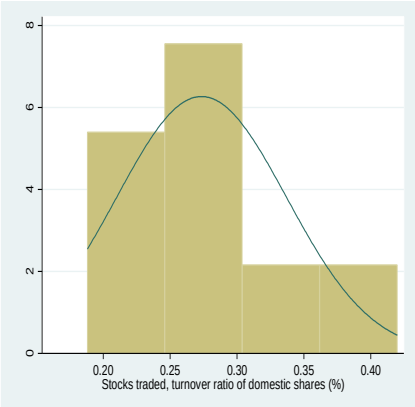


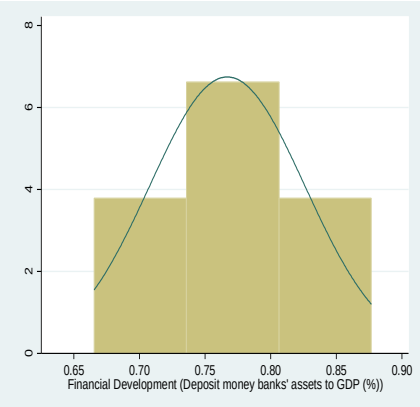



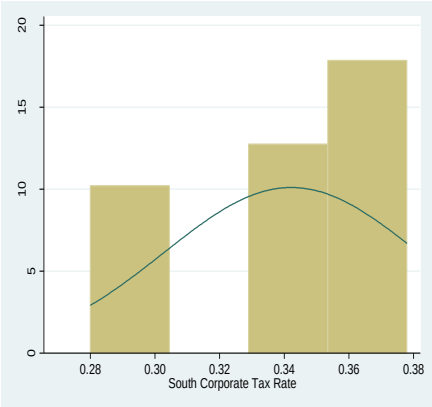



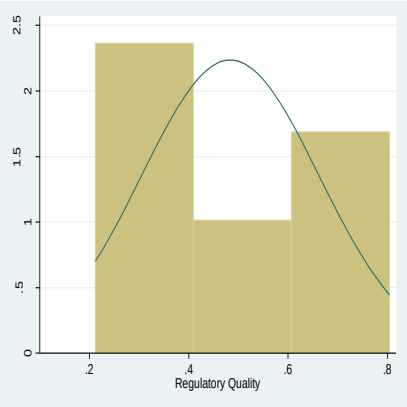

Financial

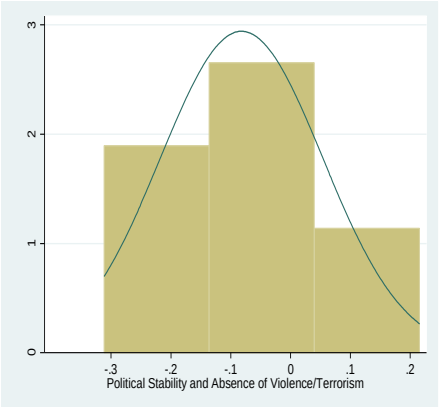


## Regulatory

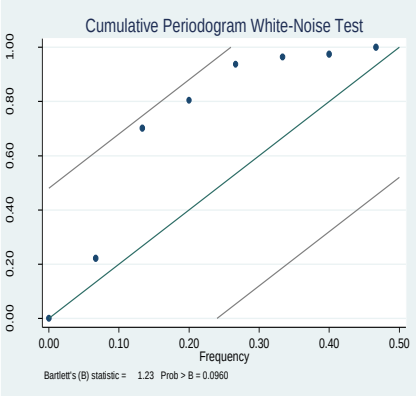

0
5
10
15
20
0.28
0.30
0.32
0.34
0.36
0.38
South Corporate Tax Rate


0
.5
1
1.5
2
2.5
.2
.4
.6
.8
Regulatory Quality

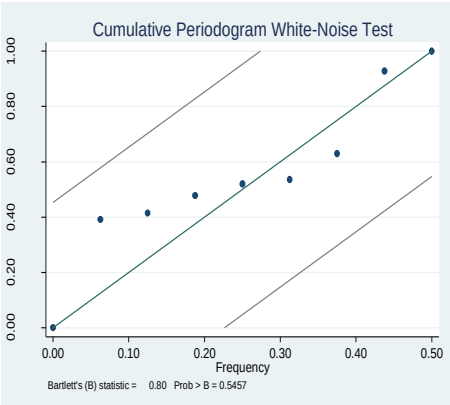

0
1
2
3
-.3
-.2
-.1
0
.1
.2
Political Stability and Absence of Violence/Terrorism

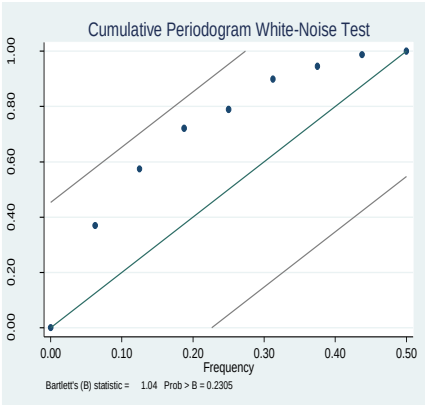
## ANNEXURE 2 – PORTMANTEAU TEST

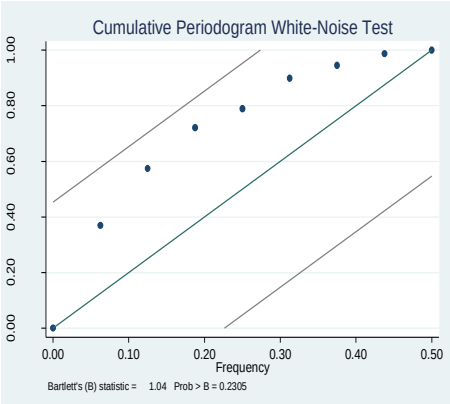
White noise refers to the fact that a variable does not have autocorrelation.

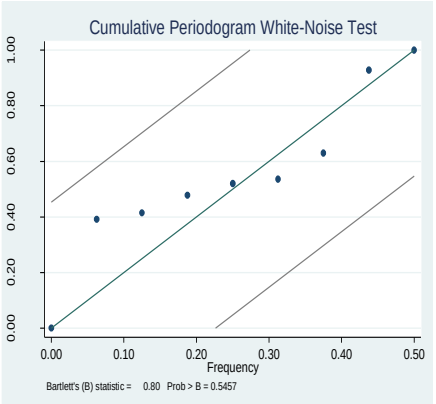



Growth in funds figure shows all values appear inside the confidence band, indicating no white noise processes within the data series. It has autocorrelations between different periods.

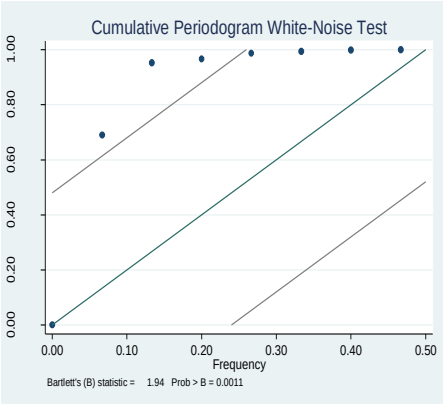


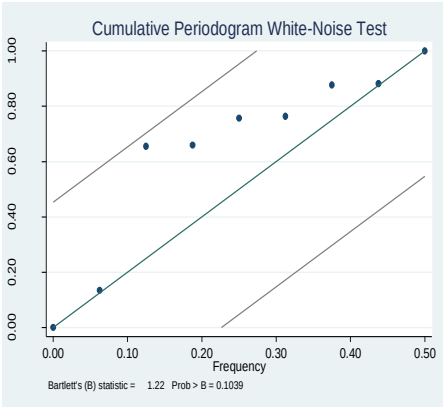



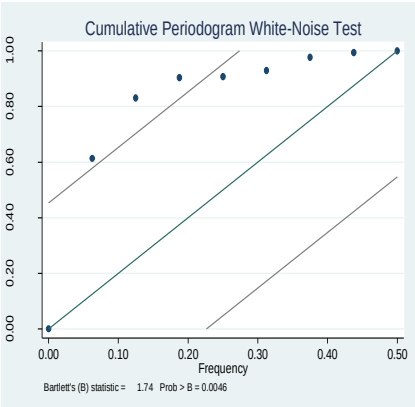



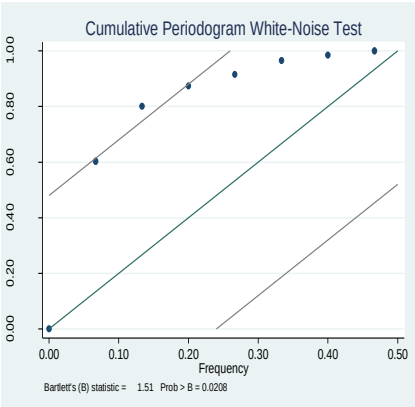
In the 4 graphs above, all the values appear inside the confidence bands, indicating strict white noise processes within the data series. The test statistic (*p*-value) for all variables is greater than 0.05; hence, the null hypothesis of no autocorrelation is not rejected.

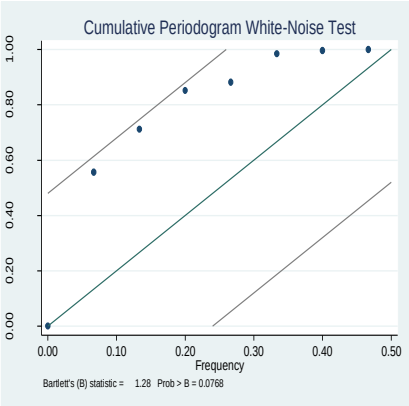



In the 2 graphs presented above, not all the values appear inside the confidence bands for financial development, indicating strict white noise processes within the data series. The test statistic (*p*-value) is lower than 0.05. The null hypothesis that there is no serial correlation is rejected, meaning the series have autocorrelations between different periods. Stocks traded figure shows all values appear inside the confidence band, indicating no white noise processes within the data series. It has autocorrelations between different periods.






In the graphs, most of the values appear outside the confidence bands for South corporate rate, indicating no strict white noise processes within the data series. The test statistic (*p*-value) is always lower than 0.05. The null hypothesis of no autocorrelation is rejected, as there are autocorrelations in this time series data. The same applies to regulatory quality with the presence of autocorrelation. Political stability demonstrates non-presence of autocorrelations, the values all appear inside the bands and the *p*-value is greater than 0.05. Because of this white noise presence in some variables, further tests are done to check for stationarity of the data. Data has to be stationary for a good model (has to have a trend).

# ANNEXURE 3 – ADF TEST

## The ADF Test

Null Hypothesis: FUM has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -2.728209 | 0.0957 |
| Test critical values: | 1% level | -4.057910 | |
| | 5% level | -3.119910 | |
| | 10% level | -2.701103 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 13

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(FUM)
Method: Least Squares
Date: 07/07/18 Time: 14:44
Sample (adjusted): 2004 2016
Included observations: 13 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| FUM(-1) | -0.763448 | 0.279835 | -2.728209 | 0.0213 |
| D(FUM(-1)) | 0.476570 | 0.275299 | 1.731102 | 0.1141 |
| C | 0.098194 | 0.050680 | 1.937532 | 0.0814 |

| | | | |
|---|---|---|---|
| R-squared | 0.432438 | Mean dependent var | 0.001673 |
| Adjusted R-squared | 0.318926 | S.D. dependent var | 0.158239 |
| S.E. of regression | 0.130590 | Akaike info criterion | -1.034327 |
| Sum squared resid | 0.170539 | Schwarz criterion | -0.903954 |
| Log likelihood | 9.723124 | Hannan-Quinn criter. | -1.061124 |
| F-statistic | 3.809610 | Durbin-Watson stat | 1.978950 |
| Prob(F-statistic) | 0.058893 | | |

Null Hypothesis: D(FUM) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -3.000771 | 0.0611 |
| Test critical values: | 1% level | -4.057910 | |
| | 5% level | -3.119910 | |
| | 10% level | -2.701103 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 13

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(FUM,2)
Method: Least Squares
Date: 07/07/18 Time: 14:46
Sample (adjusted): 2004 2016
Included observations: 13 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(FUM(-1)) | -0.900048 | 0.299939 | -3.000771 | 0.0121 |
| C | 0.001489 | 0.045613 | 0.032648 | 0.9745 |

| | | | |
|---|---|---|---|
| R-squared | 0.450127 | Mean dependent var | -0.000167 |
| Adjusted R-squared | 0.400139 | S.D. dependent var | 0.212325 |
| S.E. of regression | 0.164448 | Akaike info criterion | -0.631813 |
| Sum squared resid | 0.297473 | Schwarz criterion | -0.544897 |
| Log likelihood | 6.106781 | Hannan-Quinn criter. | -0.649678 |
| F-statistic | 9.004629 | Durbin-Watson stat | 1.892965 |
| Prob(F-statistic) | 0.012063 | | |

Null Hypothesis: GDP has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -1.859172 | 0.3396 |
| Test critical values: | 1% level | -4.004425 | |
| | 5% level | -3.098896 | |
| | 10% level | -2.690439 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 14

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP)
Method: Least Squares
Date: 07/07/18 Time: 14:49
Sample (adjusted): 2003 2016
Included observations: 14 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| GDP(-1) | -0.510092 | 0.274365 | -1.859172 | 0.0877 |
| C | 1.327980 | 0.981387 | 1.353167 | 0.2009 |

| | | | |
|---|---|---|---|
| R-squared | 0.223629 | Mean dependent var | -0.242031 |
| Adjusted R-squared | 0.158931 | S.D. dependent var | 2.039919 |
| S.E. of regression | 1.870806 | Akaike info criterion | 4.222179 |
| Sum squared resid | 41.99898 | Schwarz criterion | 4.313473 |
| Log likelihood | -27.55526 | Hannan-Quinn criter. | 4.213729 |
| F-statistic | 3.456521 | Durbin-Watson stat | 1.827851 |
| Prob(F-statistic) | 0.087687 | | |

Null Hypothesis: D(GDP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -4.001381 | 0.0110 |
| Test critical values: | 1% level | -4.057910 | |
| | 5% level | -3.119910 | |
| | 10% level | -2.701103 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 13

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP,2)
Method: Least Squares
Date: 07/07/18 Time: 14:51
Sample (adjusted): 2004 2016
Included observations: 13 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(GDP(-1)) | -1.189307 | 0.297224 | -4.001381 | 0.0021 |
| C | -0.239860 | 0.605083 | -0.396408 | 0.6994 |

| | | | |
|---|---|---|---|
| R-squared | 0.592759 | Mean dependent var | -0.023137 |
| Adjusted R-squared | 0.555737 | S.D. dependent var | 3.260018 |
| S.E. of regression | 2.172901 | Akaike info criterion | 4.530641 |
| Sum squared resid | 51.93647 | Schwarz criterion | 4.617557 |
| Log likelihood | -27.44917 | Hannan-Quinn criter. | 4.512776 |
| F-statistic | 16.01105 | Durbin-Watson stat | 2.018300 |
| Prob(F-statistic) | 0.002081 | | |

Null Hypothesis: INT has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -3.155339 | 0.0453 |
| Test critical values: | 1% level | -4.004425 | |
| | 5% level | -3.098896 | |
| | 10% level | -2.690439 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 14

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INT)
Method: Least Squares
Date: 07/07/18 Time: 15:16
Sample (adjusted): 2003 2016
Included observations: 14 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| INT(-1) | -0.899196 | 0.284976 | -3.155339 | 0.0083 |
| C | 3.743043 | 1.261652 | 2.966778 | 0.0118 |

| | | | |
|---|---|---|---|
| R-squared | 0.453456 | Mean dependent var | 0.021739 |
| Adjusted R-squared | 0.407911 | S.D. dependent var | 2.179295 |
| S.E. of regression | 1.676909 | Akaike info criterion | 4.003345 |
| Sum squared resid | 33.74427 | Schwarz criterion | 4.094639 |
| Log likelihood | -26.02341 | Hannan-Quinn criter. | 3.994894 |
| F-statistic | 9.956162 | Durbin-Watson stat | 1.122742 |
| Prob(F-statistic) | 0.008292 | | |

Null Hypothesis: D(INT) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -10.30716 | 0.0000 |
| Test critical values: | 1% level | -4.057910 | |
| | 5% level | -3.119910 | |
| | 10% level | -2.701103 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 13

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INT,2)
Method: Least Squares
Date: 07/07/18 Time: 15:17
Sample (adjusted): 2004 2016
Included observations: 13 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(INT(-1)) | -1.493839 | 0.144932 | -10.30716 | 0.0000 |
| C | -0.361210 | 0.314302 | -1.149245 | 0.2748 |

| | | | |
|---|---|---|---|
| R-squared | 0.906173 | Mean dependent var | -0.485950 |
| Adjusted R-squared | 0.897644 | S.D. dependent var | 3.539479 |
| S.E. of regression | 1.132391 | Akaike info criterion | 3.227178 |
| Sum squared resid | 14.10541 | Schwarz criterion | 3.314093 |
| Log likelihood | -18.97666 | Hannan-Quinn criter. | 3.209313 |
| F-statistic | 106.2376 | Durbin-Watson stat | 1.736559 |
| Prob(F-statistic) | 0.000001 | | |

Null Hypothesis: INF has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -3.506896 | 0.0297 |
| Test critical values: | 1% level | -4.200056 | |
| | 5% level | -3.175352 | |
| | 10% level | -2.728985 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 11

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INF)
Method: Least Squares
Date: 07/07/18 Time: 15:11
Sample (adjusted): 2006 2016
Included observations: 11 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| INF(-1) | -1.798610 | 0.512878 | -3.506896 | 0.0127 |
| D(INF(-1)) | 0.959304 | 0.363926 | 2.635986 | 0.0387 |
| D(INF(-2)) | 0.507836 | 0.290095 | 1.750585 | 0.1306 |
| D(INF(-3)) | 0.505895 | 0.274192 | 1.845040 | 0.1146 |
| C | 10.78256 | 3.053622 | 3.531073 | 0.0124 |

| | | | |
|---|---|---|---|
| R-squared | 0.721135 | Mean dependent var | 0.266088 |
| Adjusted R-squared | 0.535226 | S.D. dependent var | 2.458878 |
| S.E. of regression | 1.676325 | Akaike info criterion | 4.174039 |
| Sum squared resid | 16.86038 | Schwarz criterion | 4.354901 |
| Log likelihood | -17.95722 | Hannan-Quinn criter. | 4.060032 |
| F-statistic | 3.878954 | Durbin-Watson stat | 1.829504 |
| Prob(F-statistic) | 0.068602 | | |

Null Hypothesis: D(INF) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -3.650477 | 0.0260 |
| Test critical values: | 1% level | -4.297073 | |
| | 5% level | -3.212696 | |
| | 10% level | -2.747676 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 10

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INF,2)
Method: Least Squares
Date: 07/07/18 Time: 15:10
Sample (adjusted): 2007 2016
Included observations: 10 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(INF(-1)) | -2.479904 | 0.679337 | -3.650477 | 0.0147 |
| D(INF(-1),2) | 1.340442 | 0.530540 | 2.526561 | 0.0528 |
| D(INF(-2),2) | 0.738552 | 0.355808 | 2.075705 | 0.0926 |
| D(INF(-3),2) | 0.606739 | 0.263721 | 2.300685 | 0.0697 |
| C | 0.252430 | 0.715512 | 0.352797 | 0.7386 |

| | | | |
|---|---|---|---|
| R-squared | 0.782143 | Mean dependent var | 0.049567 |
| Adjusted R-squared | 0.607858 | S.D. dependent var | 3.542738 |
| S.E. of regression | 2.218507 | Akaike info criterion | 4.738399 |
| Sum squared resid | 24.60887 | Schwarz criterion | 4.889691 |
| Log likelihood | -18.69199 | Hannan-Quinn criter. | 4.572431 |
| F-statistic | 4.487716 | Durbin-Watson stat | 1.894267 |
| Prob(F-statistic) | 0.065469 | | |

Null Hypothesis: EXC has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | 0.536426 | 0.9813 |
| Test critical values: | 1% level | -4.004425 | |
| | 5% level | -3.098896 | |
| | 10% level | -2.690439 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 14

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXC)
Method: Least Squares
Date: 07/07/18 Time: 15:18
Sample (adjusted): 2003 2016
Included observations: 14 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| EXC(-1) | 0.109138 | 0.203453 | 0.536426 | 0.6015 |
| C | -0.618476 | 1.748112 | -0.353797 | 0.7296 |

| | | | |
|---|---|---|---|
| R-squared | 0.023418 | Mean dependent var | 0.297776 |
| Adjusted R-squared | -0.057964 | S.D. dependent var | 1.353297 |
| S.E. of regression | 1.391965 | Akaike info criterion | 3.630874 |
| Sum squared resid | 23.25081 | Schwarz criterion | 3.722168 |
| Log likelihood | -23.41612 | Hannan-Quinn criter. | 3.622423 |
| F-statistic | 0.287753 | Durbin-Watson stat | 0.586608 |
| Prob(F-statistic) | 0.601467 | | |

Null Hypothesis: D(EXC) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -2.785690 | 0.0871 |
| Test critical values: | 1% level | -4.057910 | |
| | 5% level | -3.119910 | |
| | 10% level | -2.701103 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 13

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXC,2)
Method: Least Squares
Date: 07/07/18 Time: 15:19
Sample (adjusted): 2004 2016
Included observations: 13 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(EXC(-1)) | -0.438619 | 0.157454 | -2.785690 | 0.0177 |
| C | 0.453817 | 0.201283 | 2.254619 | 0.0455 |

| | | | |
|---|---|---|---|
| R-squared | 0.413648 | Mean dependent var | 0.378975 |
| Adjusted R-squared | 0.360343 | S.D. dependent var | 0.899294 |
| S.E. of regression | 0.719242 | Akaike info criterion | 2.319402 |
| Sum squared resid | 5.690406 | Schwarz criterion | 2.406317 |
| Log likelihood | -13.07611 | Hannan-Quinn criter. | 2.301537 |
| F-statistic | 7.760069 | Durbin-Watson stat | 1.573272 |
| Prob(F-statistic) | 0.017723 | | |

Null Hypothesis: ENT has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=2)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -0.705375 | 0.8012 |
| Test critical values: | 1% level | -4.297073 | |
| | 5% level | -3.212696 | |
| | 10% level | -2.747676 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 10

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(ENT)
Method: Least Squares
Date: 07/07/18 Time: 15:20
Sample (adjusted): 2004 2016
Included observations: 10 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| ENT(-1) | -0.219864 | 0.311698 | -0.705375 | 0.5034 |
| D(ENT(-1)) | -0.653082 | 0.277080 | -2.357017 | 0.0506 |
| C | 1.822401 | 2.316344 | 0.786757 | 0.4572 |

| | | | |
|---|---|---|---|
| R-squared | 0.663849 | Mean dependent var | 0.200000 |
| Adjusted R-squared | 0.567806 | S.D. dependent var | 2.288134 |
| S.E. of regression | 1.504253 | Akaike info criterion | 3.897795 |
| Sum squared resid | 15.83944 | Schwarz criterion | 3.988571 |
| Log likelihood | -16.48898 | Hannan-Quinn criter. | 3.798214 |
| F-statistic | 6.911984 | Durbin-Watson stat | 2.572363 |
| Prob(F-statistic) | 0.022023 | | |

Null Hypothesis: D(ENT) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=2)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -3.546460 | 0.0372 |
| Test critical values: | 1% level | -4.582648 | |
| | 5% level | -3.320969 | |
| | 10% level | -2.801384 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 8

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(ENT,2)
Method: Least Squares
Date: 07/07/18 Time: 15:21
Sample (adjusted): 2005 2016
Included observations: 8 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(ENT(-1)) | -2.489370 | 0.701931 | -3.546460 | 0.0164 |
| D(ENT(-1),2) | 0.411034 | 0.362473 | 1.133973 | 0.3082 |
| C | 0.216282 | 0.561246 | 0.385360 | 0.7158 |

| | | | |
|---|---|---|---|
| R-squared | 0.914022 | Mean dependent var | -0.787500 |
| Adjusted R-squared | 0.879631 | S.D. dependent var | 4.410519 |
| S.E. of regression | 1.530199 | Akaike info criterion | 3.968669 |
| Sum squared resid | 11.70754 | Schwarz criterion | 3.998460 |
| Log likelihood | -12.87468 | Hannan-Quinn criter. | 3.767744 |
| F-statistic | 26.57714 | Durbin-Watson stat | 1.814890 |
| Prob(F-statistic) | 0.002168 | | |

Null Hypothesis: STO has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -1.582420 | 0.4648 |
| Test critical values: | 1% level | -4.004425 | |
| | 5% level | -3.098896 | |
| | 10% level | -2.690439 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 14

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(STO)
Method: Least Squares
Date: 07/07/18 Time: 15:26
Sample (adjusted): 2003 2016
Included observations: 14 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| STO(-1) | -0.446285 | 0.282027 | -1.582420 | 0.1395 |
| C | 12.83199 | 7.734568 | 1.659044 | 0.1230 |

| | | | |
|---|---|---|---|
| R-squared | 0.172645 | Mean dependent var | 0.869035 |
| Adjusted R-squared | 0.103699 | S.D. dependent var | 6.459459 |
| S.E. of regression | 6.115376 | Akaike info criterion | 6.591053 |
| Sum squared resid | 448.7738 | Schwarz criterion | 6.682347 |
| Log likelihood | -44.13737 | Hannan-Quinn criter. | 6.582602 |
| F-statistic | 2.504053 | Durbin-Watson stat | 1.578092 |
| Prob(F-statistic) | 0.139539 | | |

Null Hypothesis: D(STO) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -3.861294 | 0.0140 |
| Test critical values: | 1% level | -4.057910 | |
| | 5% level | -3.119910 | |
| | 10% level | -2.701103 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 13

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(STO,2)
Method: Least Squares
Date: 07/07/18 Time: 15:26
Sample (adjusted): 2004 2016
Included observations: 13 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(STO(-1)) | -1.111763 | 0.287925 | -3.861294 | 0.0026 |
| C | 1.552192 | 1.803012 | 0.860888 | 0.4077 |

| | | | |
|---|---|---|---|
| R-squared | 0.575447 | Mean dependent var | 1.073899 |
| Adjusted R-squared | 0.536851 | S.D. dependent var | 9.529777 |
| S.E. of regression | 6.485494 | Akaike info criterion | 6.717651 |
| Sum squared resid | 462.6780 | Schwarz criterion | 6.804567 |
| Log likelihood | -41.66473 | Hannan-Quinn criter. | 6.699786 |
| F-statistic | 14.90959 | Durbin-Watson stat | 2.017567 |
| Prob(F-statistic) | 0.002647 | | |

Null Hypothesis: FINDEV has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=2)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -2.871570 | 0.0778 |
| Test critical values: | 1% level | -4.121990 | |
| | 5% level | -3.144920 | |
| | 10% level | -2.713751 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 12

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(FINDEV)
Method: Least Squares
Date: 07/07/18 Time: 15:27
Sample (adjusted): 2004 2015
Included observations: 12 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| FINDEV(-1) | -0.361145 | 0.125766 | -2.871570 | 0.0184 |
| D(FINDEV(-1)) | 0.507634 | 0.212209 | 2.392138 | 0.0404 |
| C | 28.55111 | 9.724568 | 2.935977 | 0.0166 |

| | | | |
|---|---|---|---|
| R-squared | 0.566625 | Mean dependent var | 0.946667 |
| Adjusted R-squared | 0.470320 | S.D. dependent var | 3.527078 |
| S.E. of regression | 2.566976 | Akaike info criterion | 4.935652 |
| Sum squared resid | 59.30430 | Schwarz criterion | 5.056879 |
| Log likelihood | -26.61391 | Hannan-Quinn criter. | 4.890770 |
| F-statistic | 5.883629 | Durbin-Watson stat | 2.333599 |
| Prob(F-statistic) | 0.023221 | | |

Null Hypothesis: D(FINDEV) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=2)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -2.227189 | 0.2073 |
| Test critical values: | 1% level | -4.121990 | |
| | 5% level | -3.144920 | |
| | 10% level | -2.713751 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 12

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(FINDEV,2)
Method: Least Squares
Date: 07/07/18 Time: 15:28
Sample (adjusted): 2004 2015
Included observations: 12 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(FINDEV(-1)) | -0.609167 | 0.273514 | -2.227189 | 0.0501 |
| C | 0.709887 | 0.987145 | 0.719132 | 0.4885 |

| | | | |
|---|---|---|---|
| R-squared | 0.331567 | Mean dependent var | 0.340833 |
| Adjusted R-squared | 0.264724 | S.D. dependent var | 3.931332 |
| S.E. of regression | 3.371048 | Akaike info criterion | 5.419336 |
| Sum squared resid | 113.6396 | Schwarz criterion | 5.500154 |
| Log likelihood | -30.51602 | Hannan-Quinn criter. | 5.389414 |
| F-statistic | 4.960370 | Durbin-Watson stat | 1.562492 |
| Prob(F-statistic) | 0.050081 | | |

Null Hypothesis: TAX has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -0.390018 | 0.8861 |
| Test critical values: | 1% level | -4.004425 | |
| | 5% level | -3.098896 | |
| | 10% level | -2.690439 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 14

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(TAX)
Method: Least Squares
Date: 07/07/18 Time: 15:30
Sample (adjusted): 2003 2016
Included observations: 14 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| TAX(-1) | -0.054022 | 0.138511 | -0.390018 | 0.7034 |
| C | 1.158859 | 4.792122 | 0.241826 | 0.8130 |

| | | | |
|---|---|---|---|
| R-squared | 0.012518 | Mean dependent var | -0.700000 |
| Adjusted R-squared | -0.069773 | S.D. dependent var | 1.804827 |
| S.E. of regression | 1.866729 | Akaike info criterion | 4.217816 |
| Sum squared resid | 41.81613 | Schwarz criterion | 4.309110 |
| Log likelihood | -27.52471 | Hannan-Quinn criter. | 4.209365 |
| F-statistic | 0.152114 | Durbin-Watson stat | 2.229751 |
| Prob(F-statistic) | 0.703357 | | |

Null Hypothesis: D(TAX) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -3.964903 | 0.0117 |
| Test critical values: | 1% level | -4.057910 | |
| | 5% level | -3.119910 | |
| | 10% level | -2.701103 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 13

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(TAX,2)
Method: Least Squares
Date: 07/07/18 Time: 15:30
Sample (adjusted): 2004 2016
Included observations: 13 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(TAX(-1)) | -1.176661 | 0.296769 | -3.964903 | 0.0022 |
| C | -0.887021 | 0.577374 | -1.536304 | 0.1527 |

| | | | |
|---|---|---|---|
| R-squared | 0.588330 | Mean dependent var | 0.000000 |
| Adjusted R-squared | 0.550906 | S.D. dependent var | 2.863745 |
| S.E. of regression | 1.919124 | Akaike info criterion | 4.282253 |
| Sum squared resid | 40.51339 | Schwarz criterion | 4.369168 |
| Log likelihood | -25.83464 | Hannan-Quinn criter. | 4.264388 |
| F-statistic | 15.72046 | Durbin-Watson stat | 2.057240 |
| Prob(F-statistic) | 0.002215 | | |

Null Hypothesis: REG has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -0.514688 | 0.8608 |
| Test critical values: | 1% level | -4.004425 | |
| | 5% level | -3.098896 | |
| | 10% level | -2.690439 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 14

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(REG)
Method: Least Squares
Date: 07/07/18 Time: 15:31
Sample (adjusted): 2003 2016
Included observations: 14 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| REG(-1) | -0.078693 | 0.152895 | -0.514688 | 0.6161 |
| C | 0.007872 | 0.080782 | 0.097450 | 0.9240 |

| | | | |
|---|---|---|---|
| R-squared | 0.021599 | Mean dependent var | -0.031706 |
| Adjusted R-squared | -0.059935 | S.D. dependent var | 0.089934 |
| S.E. of regression | 0.092590 | Akaike info criterion | -1.789716 |
| Sum squared resid | 0.102874 | Schwarz criterion | -1.698422 |
| Log likelihood | 14.52801 | Hannan-Quinn criter. | -1.798167 |
| F-statistic | 0.264904 | Durbin-Watson stat | 2.442556 |
| Prob(F-statistic) | 0.616119 | | |

Null Hypothesis: D(REG) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -2.679853 | 0.1105 |
| Test critical values: | 1% level | -4.297073 | |
| | 5% level | -3.212696 | |
| | 10% level | -2.747676 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 10

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(REG,2)
Method: Least Squares
Date: 07/07/18 Time: 15:32
Sample (adjusted): 2007 2016
Included observations: 10 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(REG(-1)) | -1.991705 | 0.743214 | -2.679853 | 0.0438 |
| D(REG(-1),2) | 0.784237 | 0.643022 | 1.219612 | 0.2770 |
| D(REG(-2),2) | 0.775010 | 0.492043 | 1.575086 | 0.1761 |
| D(REG(-3),2) | 0.602550 | 0.251986 | 2.391204 | 0.0623 |
| C | -0.079431 | 0.033872 | -2.345005 | 0.0660 |

| | | | |
|---|---|---|---|
| R-squared | 0.873527 | Mean dependent var | -0.004793 |
| Adjusted R-squared | 0.772349 | S.D. dependent var | 0.127300 |
| S.E. of regression | 0.060738 | Akaike info criterion | -2.457629 |
| Sum squared resid | 0.018446 | Schwarz criterion | -2.306337 |
| Log likelihood | 17.28815 | Hannan-Quinn criter. | -2.623597 |
| F-statistic | 8.633556 | Durbin-Watson stat | 2.270928 |
| Prob(F-statistic) | 0.018111 | | |

Null Hypothesis: POL has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -2.962184 | 0.0652 |
| Test critical values: | 1% level | -4.057910 | |
| | 5% level | -3.119910 | |
| | 10% level | -2.701103 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 13

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(POL)
Method: Least Squares
Date: 07/07/18 Time: 15:36
Sample (adjusted): 2004 2016
Included observations: 13 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| POL(-1) | -0.704183 | 0.237724 | -2.962184 | 0.0142 |
| D(POL(-1)) | 0.347156 | 0.256281 | 1.354593 | 0.2054 |
| C | -0.032813 | 0.032138 | -1.020995 | 0.3313 |

| | | | |
|---|---|---|---|
| R-squared | 0.467579 | Mean dependent var | 0.013867 |
| Adjusted R-squared | 0.361095 | S.D. dependent var | 0.126358 |
| S.E. of regression | 0.101000 | Akaike info criterion | -1.548225 |
| Sum squared resid | 0.102009 | Schwarz criterion | -1.417852 |
| Log likelihood | 13.06346 | Hannan-Quinn criter. | -1.575022 |
| F-statistic | 4.391063 | Durbin-Watson stat | 1.941791 |
| Prob(F-statistic) | 0.042783 | | |

Null Hypothesis: D(POL) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -4.764850 | 0.0052 |
| Test critical values: | 1% level | -4.297073 | |
| | 5% level | -3.212696 | |
| | 10% level | -2.747676 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 10

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(POL,2)
Method: Least Squares
Date: 07/07/18 Time: 15:37
Sample (adjusted): 2007 2016
Included observations: 10 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(POL(-1)) | -1.465024 | 0.307465 | -4.764850 | 0.0050 |
| D(POL(-1),2) | 0.860283 | 0.264120 | 3.257167 | 0.0225 |
| D(POL(-2),2) | 0.023500 | 0.198414 | 0.118438 | 0.9103 |
| D(POL(-3),2) | 0.285976 | 0.139828 | 2.045196 | 0.0962 |
| C | -0.017673 | 0.017967 | -0.983622 | 0.3705 |

| | | | |
|---|---|---|---|
| R-squared | 0.929996 | Mean dependent var | -0.012929 |
| Adjusted R-squared | 0.873994 | S.D. dependent var | 0.154272 |
| S.E. of regression | 0.054762 | Akaike info criterion | -2.664774 |
| Sum squared resid | 0.014995 | Schwarz criterion | -2.513482 |
| Log likelihood | 18.32387 | Hannan-Quinn criter. | -2.830742 |
| F-statistic | 16.60622 | Durbin-Watson stat | 1.885938 |
| Prob(F-statistic) | 0.004311 | | |

# ANNEXURE 4 – ARDL MODELS

## ARDL Models

Dependent Variable: FUM
Method: ARDL
Date: 07/09/18 Time: 18:00
Sample (adjusted): 2003 2015
Included observations: 12 after adjustments
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (0 lag, automatic): GDP ENT TAX REG POL FINDEV

Fixed regressors: C
Number of models evalulated: 2
Selected Model: ARDL(1, 0, 0, 0, 0, 0, 0)
Note: final equation sample is larger than selection sample

| Variable | Coefficient | Std. Error | t-Statistic | Prob.* |
|---|---|---|---|---|
| FUM(-1) | -0.004213 | 0.233750 | -0.018023 | 0.9865 |
| GDP | 0.062598 | 0.027228 | 2.299020 | 0.0830 |
| ENT | -0.046906 | 0.021932 | -2.138694 | 0.0992 |
| TAX | -0.047011 | 0.012992 | -3.618471 | 0.0224 |
| REG | 0.608879 | 0.345435 | 1.762646 | 0.1527 |
| POL | 0.274320 | 0.437182 | 0.627474 | 0.5644 |
| FINDEV | 0.018848 | 0.011180 | 1.685803 | 0.1671 |
| C | 0.126382 | 0.970030 | 0.130287 | 0.9026 |

| | | | |
|---|---|---|---|
| R-squared | 0.874887 | Mean dependent var | 0.100061 |
| Adjusted R-squared | 0.655938 | S.D. dependent var | 0.125343 |
| S.E. of regression | 0.073522 | Akaike info criterion | -2.147733 |
| Sum squared resid | 0.021622 | Schwarz criterion | -1.824462 |
| Log likelihood | 20.88640 | Hannan-Quinn criter. | -2.267420 |
| F-statistic | 3.995860 | Durbin-Watson stat | 2.264568 |
| Prob(F-statistic) | 0.099344 | | |

*Note: p-values and any subsequent tests do not account for model selection.

Variance Inflation Factors
Date: 07/09/18 Time: 18:02
Sample: 2002 2016
Included observations: 12

| Variable | Coefficient Variance | Uncentered VIF | Centered VIF |
|---|---|---|---|
| FUM(-1) | 0.054639 | 3.498151 | 2.199559 |
| GDP | 0.000741 | 18.78046 | 5.520031 |
| ENT | 0.000481 | 58.70783 | 3.862599 |
| TAX | 0.000169 | 436.1585 | 5.030714 |
| REG | 0.119325 | 71.45590 | 7.541166 |
| POL | 0.191128 | 8.116068 | 4.820755 |
| FINDEV | 0.000125 | 1657.284 | 9.723984 |
| C | 0.940959 | 2088.878 | NA |

ARDL Long Run Form and Bounds Test
Dependent Variable: D(FUM)
Selected Model: ARDL(1, 0, 0, 0, 0, 0, 0)
Case 2: Restricted Constant and No Trend
Date: 07/09/18 Time: 18:03
Sample: 2002 2016
Included observations: 12

Conditional Error Correction Regression

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.126382 | 0.970030 | 0.130287 | 0.9026 |
| FUM(-1)* | -1.004213 | 0.233750 | -4.296105 | 0.0127 |
| GDP** | 0.062598 | 0.027228 | 2.299020 | 0.0830 |
| ENT** | -0.046906 | 0.021932 | -2.138694 | 0.0992 |
| TAX** | -0.047011 | 0.012992 | -3.618471 | 0.0224 |
| REG** | 0.608879 | 0.345435 | 1.762646 | 0.1527 |
| POL** | 0.274320 | 0.437182 | 0.627474 | 0.5644 |
| FINDEV** | 0.018848 | 0.011180 | 1.685803 | 0.1671 |

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 2: Restricted Constant and No Trend

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| GDP | 0.062335 | 0.029160 | 2.137668 | 0.0993 |
| ENT | -0.046709 | 0.022377 | -2.087367 | 0.1051 |
| TAX | -0.046814 | 0.013509 | -3.465467 | 0.0257 |
| REG | 0.606325 | 0.318041 | 1.906434 | 0.1293 |
| POL | 0.273169 | 0.449302 | 0.607986 | 0.5760 |
| FINDEV | 0.018769 | 0.009281 | 2.022180 | 0.1132 |
| C | 0.125852 | 0.977402 | 0.128761 | 0.9038 |

EC = FUM - (0.0623*GDP -0.0467*ENT -0.0468*TAX + 0.6063*REG + 0.2732 *POL + 0.0188*FINDEV + 0.1259 )

F-Bounds Test — Null Hypothesis: No levels relationship

| Test Statistic | Value | Signif. | I(0) | I(1) |
|---|---|---|---|---|
| F-statistic | 6.355042 | 10% | 1.99 | 2.94 |
| k | 6 | 5% | 2.27 | 3.28 |
| | | 2.5% | 2.55 | 3.61 |
| | | 1% | 2.88 | 3.99 |

ARDL Error Correction Regression
Dependent Variable: D(FUM)
Selected Model: ARDL(1, 0, 0, 0, 0, 0, 0)
Case 2: Restricted Constant and No Trend
Date: 07/09/18 Time: 18:06
Sample: 2002 2016
Included observations: 12

ECM Regression
Case 2: Restricted Constant and No Trend

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| CointEq(-1)* | -1.004213 | 0.084929 | -11.82417 | 0.0003 |

| | | | |
|---|---|---|---|
| R-squared | 0.927027 | Mean dependent var | -0.003409 |
| Adjusted R-squared | 0.927027 | S.D. dependent var | 0.164124 |
| S.E. of regression | 0.044336 | Akaike info criterion | -3.314400 |
| Sum squared resid | 0.021622 | Schwarz criterion | -3.273991 |
| Log likelihood | 20.88640 | Hannan-Quinn criter. | -3.329361 |
| Durbin-Watson stat | 2.264568 | | |

* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

| Test Statistic | Value | Signif. | I(0) | I(1) |
|---|---|---|---|---|
| F-statistic | 6.355042 | 10% | 1.99 | 2.94 |
| k | 6 | 5% | 2.27 | 3.28 |
| | | 2.5% | 2.55 | 3.61 |
| | | 1% | 2.88 | 3.99 |

Breusch-Godfrey Serial Correlation LM Test:

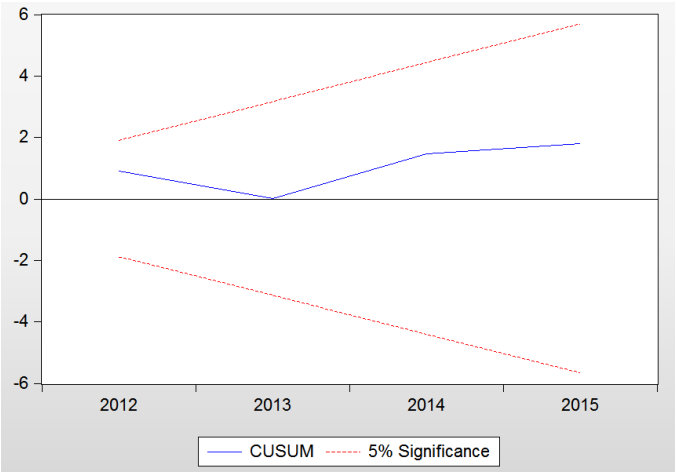
| | | | |
|---|---|---|---|
| F-statistic | 0.806021 | Prob. F(2,2) | 0.5537 |
| Obs*R-squared | 5.355559 | Prob. Chi-Square(2) | 0.0687 |

Test Equation:
Dependent Variable: RESID
Method: ARDL
Date: 07/09/18 Time: 18:08
Sample: 2003 2015
Included observations: 12
Presample and interior missing value lagged residuals set to zero.

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| FUM(-1) | 0.303249 | 0.444876 | 0.681648 | 0.5658 |
| GDP | -0.028493 | 0.050001 | -0.569858 | 0.6263 |
| ENT | 0.027588 | 0.037006 | 0.745496 | 0.5337 |
| TAX | 0.022498 | 0.027513 | 0.817731 | 0.4994 |
| REG | -0.268582 | 0.502450 | -0.534545 | 0.6464 |
| POL | 0.110237 | 0.552810 | 0.199413 | 0.8604 |
| FINDEV | -0.015398 | 0.024942 | -0.617343 | 0.5999 |
| C | 0.413375 | 1.421561 | 0.290789 | 0.7986 |
| RESID(-1) | -1.280012 | 1.455655 | -0.879338 | 0.4720 |
| RESID(-2) | -0.658270 | 0.729549 | -0.902297 | 0.4621 |

| | | | |
|---|---|---|---|
| R-squared | 0.446297 | Mean dependent var | 6.53E-17 |
| Adjusted R-squared | -2.045369 | S.D. dependent var | 0.044336 |
| S.E. of regression | 0.077370 | Akaike info criterion | -2.405526 |
| Sum squared resid | 0.011972 | Schwarz criterion | -2.001437 |
| Log likelihood | 24.43316 | Hannan-Quinn criter. | -2.555134 |
| F-statistic | 0.179116 | Durbin-Watson stat | 2.653711 |
| Prob(F-statistic) | 0.973496 | | |

Cumulative sum (CUSUM) tests



Pairwise Granger Causality Tests
Date: 07/18/18 Time: 08:53
Sample: 2002 2016
Lags: 2

| Null Hypothesis: | Obs | F-Statistic | Prob. |
|---|---|---|---|
| GDP does not Granger Cause FUM | 13 | 1.96707 | 0.2019 |
| FUM does not Granger Cause GDP | | 2.44686 | 0.1482 |
| ENT does not Granger Cause FUM | 10 | 0.22930 | 0.8030 |
| FUM does not Granger Cause ENT | | 0.33717 | 0.7288 |
| TAX does not Granger Cause FUM | 13 | 0.27367 | 0.7674 |
| FUM does not Granger Cause TAX | | 0.03354 | 0.9672 |
| REG does not Granger Cause FUM | 13 | 0.53618 | 0.6046 |
| FUM does not Granger Cause REG | | 2.54629 | 0.1394 |
| POL does not Granger Cause FUM | 13 | 0.04121 | 0.9598 |
| FUM does not Granger Cause POL | | 0.28197 | 0.7615 |
| FINDEV does not Granger Cause FUM | 12 | 2.86050 | 0.1236 |
| FUM does not Granger Cause FINDEV | | 7.00588 | 0.0213 |
| ENT does not Granger Cause GDP | 10 | 8.21255 | 0.0263 |
| GDP does not Granger Cause ENT | | 2.05476 | 0.2232 |
| TAX does not Granger Cause GDP | 13 | 2.54517 | 0.1395 |
| GDP does not Granger Cause TAX | | 0.10458 | 0.9019 |
| REG does not Granger Cause GDP | 13 | 5.83578 | 0.0274 |
| GDP does not Granger Cause REG | | 0.90304 | 0.4430 |
| POL does not Granger Cause GDP | 13 | 4.52262 | 0.0485 |
| GDP does not Granger Cause POL | | 0.17785 | 0.8403 |
| FINDEV does not Granger Cause GDP | 12 | 1.84631 | 0.2270 |
| GDP does not Granger Cause FINDEV | | 15.5264 | 0.0027 |
| TAX does not Granger Cause ENT | 10 | 0.33667 | 0.7292 |
| ENT does not Granger Cause TAX | | 0.71737 | 0.5322 |
| REG does not Granger Cause ENT | 10 | 1.52829 | 0.3034 |
| ENT does not Granger Cause REG | | 0.05386 | 0.9481 |
| POL does not Granger Cause ENT | 10 | 1.04850 | 0.4166 |
| ENT does not Granger Cause POL | | 2.52781 | 0.1743 |
| FINDEV does not Granger Cause ENT | 9 | 2.17856 | 0.2291 |
| ENT does not Granger Cause FINDEV | | 0.71128 | 0.5441 |
| REG does not Granger Cause TAX | 13 | 0.74825 | 0.5036 |
| TAX does not Granger Cause REG | | 2.25226 | 0.1675 |
| POL does not Granger Cause TAX | 13 | 0.58514 | 0.5792 |
| TAX does not Granger Cause POL | | 1.00447 | 0.4081 |
| FINDEV does not Granger Cause TAX | 12 | 0.15553 | 0.8588 |
| TAX does not Granger Cause FINDEV | | 0.21552 | 0.8113 |
| POL does not Granger Cause REG | 13 | 0.16691 | 0.8491 |
| REG does not Granger Cause POL | | 0.89395 | 0.4463 |
| FINDEV does not Granger Cause REG | 12 | 1.03618 | 0.4035 |
| REG does not Granger Cause FINDEV | | 0.42084 | 0.6721 |
| FINDEV does not Granger Cause POL | 12 | 0.21787 | 0.8095 |
| POL does not Granger Cause FINDEV | | 4.79211 | 0.0489 |