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The impact of capital flows on South African GDP growth and JSE ALSI return

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RESEARCH THESIS

THE IMPACT OF CAPITAL FLOWS ON SOUTH AFRICAN GDP GROWTH AND JSE ALSI RETURN

PROGRAM: MASTERS OF MANAGEMENT IN FINANCE AND INVESTMENT

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Abstract

South African policymakers have extensively invested in capital market liberalisation making the country one of the most integrated economies within emerging markets. This study analysed the impact that overall capital flows, foreign direct investment and foreign portfolio flows into and out of South Africa had on GDP and the Johannesburg Stock Exchange using quarterly data between 1995 and 2016. The study found that the Johannesburg All Share Index (ALSI) and South African gross domestic product (GDP) were both influenced by capital flows in the form of FDI and FPI as suggested by the cointegration tests. Further, it was observed that JSE returns were mostly affected by both FDI and FPI in the short-run whilst GDP was mostly affected by capital flows in the long-run. The Markov switching model suggested that economic growth as measured by GDP was more responsive to both positive and negative economic cycles compared to ALSI returns.

Keywords:

Acronyms and Abbreviations

D.M.	Developed Markets
E.M.	Emerging Market
FOMC	Federal Open Market Committee
TCF	Total Capital Flows
FDI	Foreign Direct Investments
FPI	Foreign Portfolio Investments
GDP	Gross Domestic Product
JSE ALSI	Johannesburg Stock Exchange All Share Index
IMF	International Monetary Fund
UIP	Uncovered Interest Parity
U.K.	United Kingdom
U.S.A.	United States of America
S.A.	South Africa
VECM	Vector Error Correction Model

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1. INTRODUCTION

1.1 Background to the Study

South Africa follows a liberal economic policy that seeks to attract international capital flows to spur economic growth and development (Sandrey, 2013). This policy helps South Africa enjoy the benefits of globalisation because a liberalised economic policy can lure investment and portfolio flows into the domestic capital market because international investors can enter and exit the market with relative ease. Theoretically, foreign capital inflows should prop up capital markets such as stock markets by increasing the demand of stocks thereby, availing investment which directly impacts on economic growth (Adams and Klobodu, 2018 and Li, Su, Chang and and Ma, 2018). Proponents of liberalisation policies argue that capital flows should positively affect South African stocks by increasing their liquidity and reducing cost of capital thereby, promoting gross domestic product (GDP) when the capital inflows are used to pursue value creating projects (Owiredu, Oppong and Asomaning, 2016).

The importance of economic growth arising from foreign direct investment (FDI) for emerging market economies such as South Africa, is evidenced by the study by le Cluss-Rossouw and Viviers (2015) who found that approximately 53% of the variance in Southern African Development Community (SADC) exports to BRIC countries could be explained by BRIC FDI. On the other hand, Olayiwola and Okodua (2013) had similar conclusions after establishing unidirectional causality ran from FDI to non-oil exports in Nigeria. In an earlier study, Funke, Ahmed and Arezki (2005) noted that foreign portfolio inflows (FPI) had tended to dominate foreign investment into South Africa compared to FDI between 1994 and 2002; with FPI averaging 3.5% of GDP per annum compared to an average of 1.5% of GDP per annum for FDI. There is a need to analyse the current investment inflows into South Africa to ascertain their impact on economic growth considering that the country finds itself in a low growth scenario (Fedderke and Mengisteab, 2017)

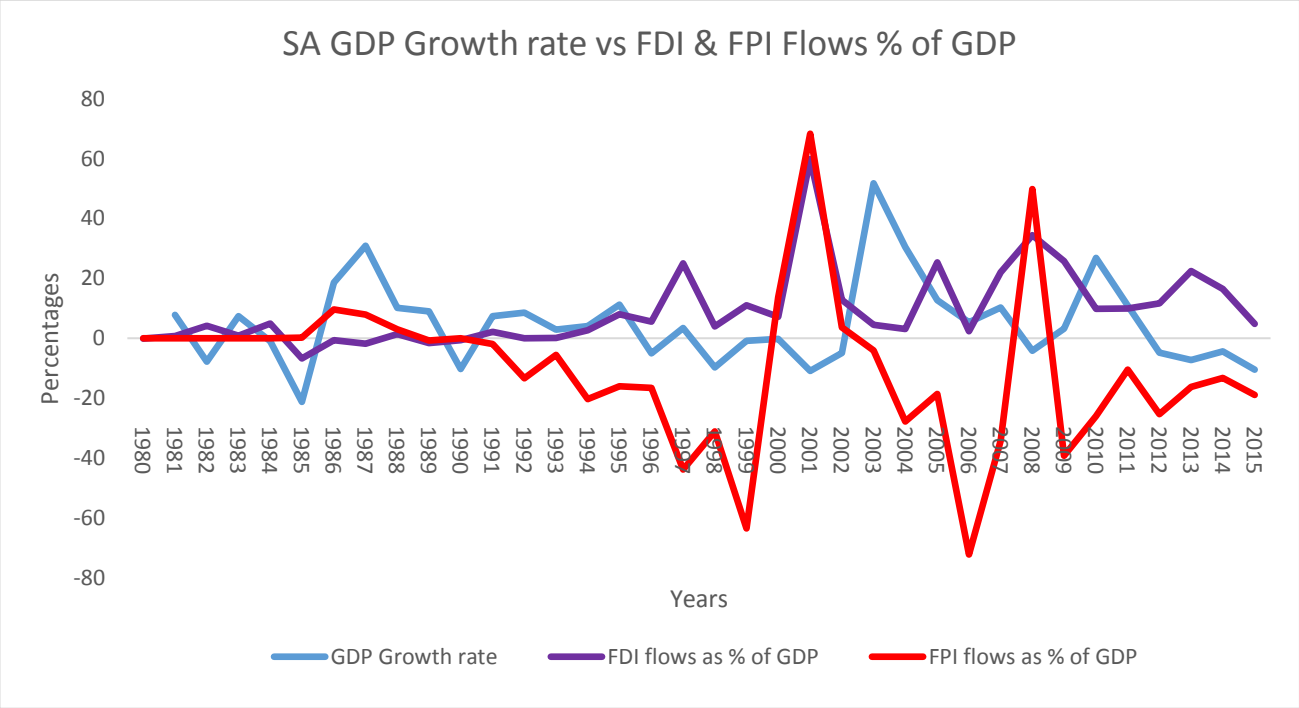
Given the likely significance that foreign capital flows may have on economic growth, multiple economic theories have linked capital flows to economic growth and financial market returns. Neoclassical and neoliberal theories argue that free-flowing capital across borders increases efficiency and grows the global economy faster, but, Keynesian macroeconomic, neo-Walrasian and neo-Marxian theories argue against free capital mobility. The neoclassical model predicts that capital should, on net, flow from developed markets to emerging markets where the capital will be used to finance economic development (Sandrey, 2013).

Emerging market economies are those that generally grow the fastest as they close the development gap between their economies and those of developed market economies hence, they have more profitable investment opportunities and should thus, attract capital that fuels their growth (Prasad, Rajan and Subramanian, 2007). Since South Africa is an emerging market economy with a liberalised financial market, one would imagine that it has the ingredients necessary for higher economic growth. As such, the results from these neo-liberal propositions need to be investigated in the South African context.

Figure 1.1 shows South African GDP growth, FDI and FPI (both as a percentage of GDP). The figure shows that the three variables have largely trended together, however, as time progressed, their volatility increased. This observation warranted a closer inspection of these series to better understand their behaviour over the period of study. FDI as a percentage of GDP and FPI as a percentage of GDP tended to trend together, with the latter experiencing more pronounced variability especially after 1998. It is notable that the volatility increased in the time after the South Africa liberalised the financial markets and adopted a fully floating exchange rate regime. In addition, the easier international portfolio flows may be credited with the increased volatility as investors' ability to liquidate holdings increased. On the other hand, FDI comprises other investments that may not easily

be withdrawn (such as greenfield investments and mergers and acquisitions), hence the lower volatility. The two variables, FDI as a percentage of GDP and FPI as a percentage of GDP, tended to lead GDP for both upswings and downturns especially around 2000 and between 2007 and 2008 during the unravelling of the global financial crisis. This may be attributable to the fact that FPI and FDI having a financial economic aspect, will tend to lead the real economic variables which dominate the GDP variable.

Figure 1.1 *The relationship between GDP Growth rates versus FDI Flows and FPI Flows as a percentage of GDP (FDI flow & FPI Flow percentages are scaled up by multiplying by 10 to make comparing easier)*



The observations in Figure 1.1 which suggested that FDI flows were steadier and less volatile than the FPI point to the idea that when for instance, international investors anticipated a downturn in South African economic growth, they would adjust their portfolio holdings. Figure 1.1 has suggested that there is a likely relationship amongst the GDP, FDI and FPI variables and this relationship seem to be

positive. However, this relationship ought to be tested empirically to understand it better and properly evaluate it.

The next important relationships to be tested are that of the capital flows (FDI and FPI) and Johannesburg Stock Exchange All Share Index (JSE ALSI) returns. Figure 1.2 below plots the graph of capital flows and JSE ALSI returns between 2003 and 2015.

Figure 0.12: *The relationship between JSE ALSI simple returns Vs FDI Flows and FPI Flows as a percentage of GDP (FDI flow & FPI Flow percentages are scaled up by multiplying by 10 to make comparing easier)*

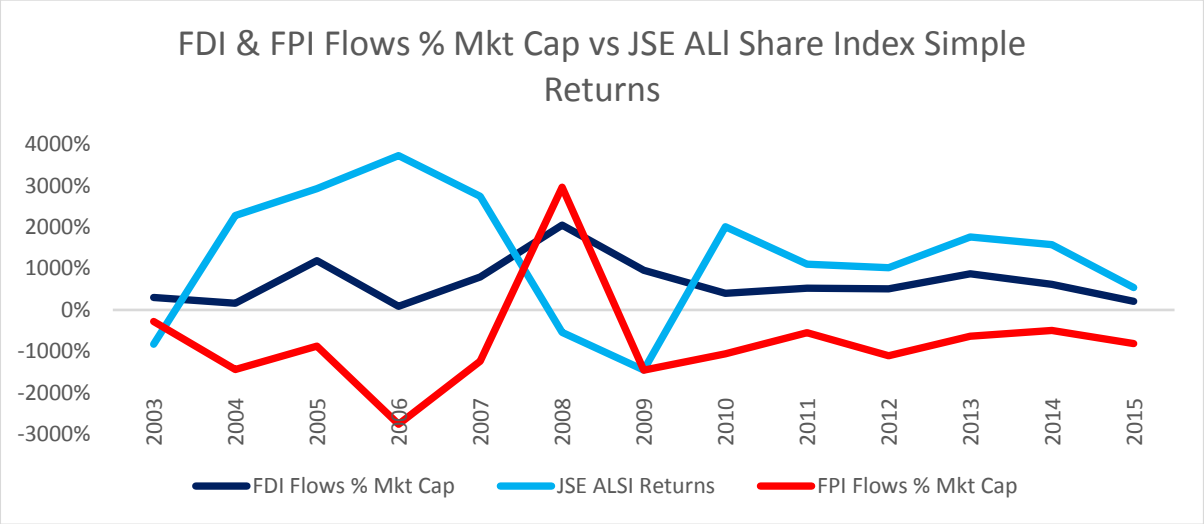


Figure 1.2 suggests that there is some sort of positive relationship between JSE ALSI returns and capital flows during periods of high capital flight from 2003 to 2008. This is followed by period of stable capital flows and JSE ALSI returns, clearly resembling a strong positive relationship and this observation warrants further investigation. Several studies have already shown that stock markets are a good leading indicator of GDP growth because stock market investors and traders use real economic data to predict the future revenues of firms.

Studies such as the one by le Cluss-Rossouw and Viviers (2015) found that FDI inflows from BRIC countries into SADC accelerated the recipient region's economic growth and export ability because it increased supply capacity resonated with those obtained by Zhang and Song (2002) who established that increased levels of FDI had a positive effect on provincial manufacturing export performance in China and Xuan and Xing (2008) who said that in Vietnam, FDI inflows resulted in higher exports particularly to the source country.

1.2 Statement of the Problem

There is room to analyse and evaluate the relationships amongst the GDP growth rate, JSE ALSI returns and total capital flows especially as South Africa endures a low growth climate. The study will assess the impact of changes in inward and outward capital flows on South African GDP growth and JSE ALSI returns. In so doing, it gives an insight into whether South Africa economically benefits from global financial integration, given its financial liberalisation policy. Secondly, this study estimates the sensitivity of South Africa GDP growth and JSE ALSI returns to positive and negative capital flow regimes. Lastly, it identifies the type of capital flow which significantly influences SA GDP growth and JSE ALSI returns.

1.3 Research Questions

To address the research problem identified in section 1.2, this study answers a broad research question as following:

1. What is the impact of foreign capital flows on South African GDP growth and JSE ALSI returns?

The sub-questions are as follows:

1. Is there a causal relationship between foreign capital flows and South African GDP growth and do negative and positive regimes of foreign capital flows impact South African GDP growth and JSE ALSI returns?
2. Is there a causal relationship between foreign capital flows and JSE ALSI return; if there is a relationship, do the foreign capital flows positively stimulate South African economic growth and JSE ALSI Returns?

1.4 Research Objectives

In line with the research questions above, this study had to achieve the following objectives:

1. To measure the sensitivity of South African GDP growth and JSE ALSI returns to both negative and positive foreign capital flows.

2. To measure the impact and relationship between foreign capital flows and South African economic growth and JSE ALSI returns.

Achieving the above-mentioned research objectives provides an insight for traders, investors and economic policy makers on how to effectively augment foreign capital flows data within their analysis. This study provides an in depth understanding of the differential impact of foreign capital flows based on type and regimes to GDP growth and JSE ALSI returns. Based on magnitude and significance of influence, investors and policy makers will correctly assess and prioritise foreign capital flow variables on economic and JSE ALSI returns performance drivers.

1.5 Significance of the Study

This study is relevant given the neoliberal foreign capital flows policy stance that South Africa took in 1995 and the monetary policies that most developed markets such as the U.S., Japan and the United

Kingdom (U.K.) have employed since the mid-2000s. Foreign investor participation has increased in the domestic capital market because of improved liberalisation. Quantitative easing in developed markets in the aftermath of the global financial crisis coupled with the liberal policy in South Africa may have benefited domestic firms and this study includes this post crisis period which is important to observe.

Capital market integration has been correlated with high financial market valuations, stronger currencies, increased commodity prices and faster growing emerging market economies as well as contagion risk during financial crises. This study is significant because understanding the extent to which capital flows into South Africa help the economy allows policy makers to evaluate their policies. Enabling them to amend policies so that South Africa is adequately compensated for the increased risks that come with capital markets integration.

1.6 Definition of Key Terms

Per the International Monetary Fund (IMF), International Capital Flows can be grouped into three broad categories: foreign direct investment (FDI), foreign portfolio investment (FPI), and bank and other investment. The definitions of these three are as follows:

- FDI or Foreign Direct Investment occurs when an investor, in many cases a firm rather than an individual, gains some control over the functioning of an enterprise in another country. This typically takes place through a direct purchase of a business enterprise or when the purchaser acquires more than 10 percent of the shares of the target asset.

- FPI or Foreign Portfolio Investment occurs when investors purchase non-controlling interests in foreign companies or buy foreign corporate or government bonds, short-term securities, or notes.

- Bank Investments is the third major type of capital flow. Bank-related international investment includes deposit holdings by foreigners and loans to foreign individuals, businesses, and governments.

- Total Capital Flows is the total amount of money that enters an economy or leaves it within a given period. It is determined as the sum of FDI, FPI and Bank Investments

1.7 Limitations of Study

The dependant variables that the proposed study hopes to explain are variables that depend on a lot of factors and it is often not easy to isolate the effects of a change in one single variable on these dependant variables. The risk of contamination and thus spurious regressions is high thus; careful consideration needs to be put into ensuring the regressions are robust. Furthermore, once regression results have been obtained, care must be exercised in interpreting the direction of causality. Capital flows may drive economic growth and stock market returns however, high economic growth and strong stock market returns tend to attract capital inflows (Wesso, 2001).

1.8 Summary

Since 1994, the South African government has gradually liberalised capital markets and encouraged the free flow of capital into and out of the country with the aim of increasing FDI and economic growth. During this period, several crises such as the mortgage crisis in the U.S.A in 2008 and the Asian financial crisis at the end of the millennium resulted in significant capital flight from S.A. which was correlated with low growth to negative in the S.A. economy. The study measures the impact of changes in capital flows on share prices and on the GDP growth in S.A. By observing the effect of three different measures of capital flows on the GDP growth and JSE ALSI returns the results of this study add to the body of literature and assists policy makers and market participants make to informed decisions.

2 Literature Review

Capital flows to emerging market economies have traditionally been dominated by FDI, but portfolio equity and bank related flows have increasingly become important. Changes in capital flow composition to emerging market economies has created interest in researching on the causes and implications of these relatively new forms of FDI into emerging economies (Rothenberg and Warnock, 2011). Dynamics of net capital flows may be caused by capital inflows or outflows which are in turn, related with other factors and as a result, capital inflows and outflows needed to be studied separately (Rothenberg and Warnock, 2011).

Ahmed and Zlate (2014) examined the determinants of private capital flows into emerging market economies and found that growth and interest rate differentials had a statistically significant influence. Another finding was that there had been significant changes in the behaviour of net inflows before and after the global financial crisis particularly for portfolio inflows explained partly by the greater sensitivity of such flows to interest rate differentials since the crisis. Lastly, Ahmed and Zlate (2014) made the finding that introduced capital controls seemed to have discouraged both total and portfolio net inflows.

Whilst several empirical studies have investigated the relationship between capital flows and economic growth, there is still no consensus on whether capital market liberalisation is good for emerging market economies or not. In line with this study's broad objective of analysing the impact that capital flows have on South African GDP and stock market returns, the literature review begins by looking at the theoretical framework of capital flows before undertaking an empirical review.

2.1 Theoretical Framework

Neoclassical and neoliberal economic theories advocate for the free movement of capital across the world with the expectation of spurring economic growth. This growth should also help financial markets in the sense that lower cost of capital can be achieved as capital mobility increases efficiency. The neoclassical model predicts that capital should, on net, flow from developed markets to emerging markets where the capital will be used to finance the economic development of emerging market economies (Sandrey, 2013). Emerging Market economies are those that generally grow the fastest as they close the development gap between their economies and those of developed market economies hence, they have more profitable investment opportunities and should thus attract capital that fuels their growth (Prasad, Rajan and Subramanian, 2007). Such neoliberal ideas are behind the liberalisation of capital markets in South Africa and an audit of their effects on the economy and financial markets is due.

Rothenberg and Warnock (2011) conceded that while there was consensus amongst economists that trade integration yields positive economic growth, the jury was still out on how financial integration affected economic growth. Thus, the theoretical arguments that underpin our understanding of the effect of capital flows on economic growth are at best inconclusive. For example, foreign capital inflows have an ambiguous effect on domestic investment and subsequently growth. This is because, inbound capital may raise domestic investment, but it may also increase imports and is subject changes in investor sentiment, hence, can dampen domestic production (Funke *et al.*, 2005). Access to foreign capital may allow one firm to increase investment and that firm's expansion may induce another to reduce investment. Finally, an increase in inflows may have no impact on the level of domestic investment, since funds would move only to finance investment demand without increasing that demand.

The first set of theories argue that financial integration increases the pool of savings that developing countries can tap into to finance their investment expenditure (Aizenman, Jinjarak and Park, 2013). When capital flows freely, it will go to economies where it is relatively scarce to earn higher returns (Bonizzi, 2013). Emerging markets are poorer than developed markets so, capital should theoretically flow *downhill* from developed market economies to emerging market economies. This has an effect of accelerating growth rates of emerging market economies whilst offering participants with excess savings an opportunity to earn higher returns and diversification benefits.

These theories are based on both the standard neoclassical theory, framed using an equilibrium analysis of the international funds loanable market and the capital asset pricing model (CAPM). The following identity is derived from the above neoclassical theories:

$$CA = X - M = S - I \quad (1)$$

Where, CA is current account, X represents exports, M are imports, S stands for savings and I are investments. What equation (1) can be interpreted to mean is that emerging markets should have current account deficits as domestic saving (S) will be less than investment expenditure (I), i.e. S < I. However, based on empirical evidence, most emerging market economies tend to have current account surpluses and currency outflows.

The Harrod-Domar Model postulates that the rate of economic growth g_y in the steady state equals the productivity of capital α multiplied by the rate of savings or investment s.

$$g_y = \alpha s \quad (2)$$

The extended Harrod-Domar model, which directly considers the effect of foreign capital inflows, k^f and expands equation (2) into equation (3) below:

$$g_y = \alpha(k^f + s) \quad (3)$$

The Two-Gap Approach model which argues that foreign capital inflows not only raise the resources available for investment but also increase the availability of foreign exchange to import capital goods (Mpofu, 2014).

The second set of theories also frame their arguments using the international loanable funds market; but come to very different conclusions. Primarily, these theories argue that the international loanable funds market has too many imperfections to serve emerging markets. Factors such as variable investor risk appetite, information asymmetry and transaction costs amongst many others, ensure capital flows are at best unpredictable (Bonizzi, 2013).

These theories postulate that financial integration only serves to destabilise growing economies. It introduces the risk of financial contagion, heightens the risk of capital flight and amplifies the peaks and recessions of an economy's business cycle, increasing volatility in the affected markets. Stylised facts such as the fact that faster growth in emerging markets is often associated with improvements in the current account balance (or financial outflows), as was evidenced amongst the Asian tigers, are cited in support of these theories (Aizenman *et al*., 2013).[1]

The Auerbach-Kotlikoff (AK) Dynamic Life-Cycle Simulation Model (hereinafter AK Model) is an example (Mpofu, 2014). In the AK Model the steady-state growth rate of the AK framework with financial intermediation and international capital flows is depicted by the equation below

$$g^* = A^* \frac{I^*}{Y} - \delta = A^* \emptyset^* \frac{(S + NCF)}{Y} - \delta = A^* \emptyset^* s^* - \delta \quad (14)$$

[1] The Four Asian Tigers or Asian Dragons are the highly developed economies of Hong Kong, Singapore, South Korea and Taiwan. These regions were the first newly industrialized countries.

In the above equation, economic growth g* is directly proportional (A is the constant of proportion) to the invested capital as a fraction of GDP $\frac{I^*}{Y}$ after considering depreciation (δ) of capital stock. Since intermediaries only channel a portion (∅) of all domestic savings (S) and capital inflows (NCF), $I^* = \emptyset(S + NCF)$. In this simple endogenous growth model, capital flows can only yield in economic growth if they are used to fund new investment expenditure and not other uses such as financing current investment expenditure or consumption. Furthermore, NCF needs to be always greater than 0. Negative capital flows will per the model yield in lower economic growth.

South Africa is a unique emerging market economy but unlike China or the Asian Tigers, it has a persistent current account deficit which relies on being funded by foreign capital inflows. It also has very low economic growth rates that seem to be highly susceptible to the ebbs and flows of foreign capital flows. Consequently, understanding just how foreign capital flows affect both its economy and its stock market will add a unique point to the debate between proponents for and against free capital markets. The section below reviews studies that have analysed capital flows and economic growth.

2.2 Empirical Review

The area of foreign capital flows and growth in emerging markets has interested researchers as globalisation proliferated, thus, the literature in this area is extant. Consequently, there are varied findings of studies spread amongst establishing short-run and long-rung relationships between FDI, FPI and economic growth. Funke *et al.* (2005) noted that in the decade prior to their analysis, South Africa had attracted more FDI compared to FPI and consequently analysed the determinants of the level as well as components of capital flows to emerging market economies. After analysing 81 emerging market economies using the general method of moments, they found liberalisation of capital

flows increased FDI shares. This led to Funke *et al.* (2005) arriving at the conclusion that liberalisation of capital markets and a reduction of exchange rate volatility would positively affect FDI inflows.

In a similar study, Fedderke and Romm (2006) who were concerned with the determinants of South African economic growth analysed economic growth and FDI determinants between 1956 and 2003. Their study found that FDI, which tended to be capital intensive, complemented economic growth in South Africa and that FDI flows were greatly influenced by the rate of return and the risk profile of the investment liabilities. This led their study to conclude that policy ought to be focused on reducing political risk, taxes for corporates and economic integration into the world economy.

The study by Aizenman *et al*. (2013) investigated the relationship between economic growth and lagged international capital flows (which broadly fell into FDI and FPI categories) in 100 countries between 1990 and 2010. This was the period where the integration of emerging markets with the international financial system improved significantly. Aizenman *et al*. (2013) analysed the relationship before and after the global financial crisis and found that the relationship between growth and lagged capital flows depended on the type of flows, economic structure, and global growth patterns. In addition, they established that there was a strong and statistically significant relationship between FDI (both inflows and outflows) and growth. On the other hand, the relationship between growth and equity flows was smaller and less stable and the relationship between growth and short-term debt was statistically significant before the global financial crisis but negative after the crisis.

In a related study, Mpofu (2014) analysed the long-term equilibrium relationship between economic growth proxied by GDP and private capital inflows in South Africa. The study examined the co-integrating relationship between private capital inflows and economic growth by employing Johansen's cointegration tests and vector error correction modelling (VECM) on quarterly net flows data for the period beginning from the last quarter of 1989 until the end of 2009. Results from the

VECM analysis suggested that private capital inflows positively impacted South African economic growth.

Sunde (2017) employed the autoregressive distributed lag (ARDL) model to analyse the impact of FDI and exports on South African economic growth between 1990 and 2014. After establishing cointegration amongst economic growth, FDI and exports, Sunde (2017) found that both FDI and exports spurred South African economic growth. After conducting Granger causality tests, the study found that there was unidirectional causality from FDI to economic growth which led to the conclusion that there was FDI-led growth for South Africa. Sunde (2017) concluded that there was need for government to put in place polices that stimulate and incentivise FDI to assist with long-run economic growth.

South African studies suggested that international capital inflows had a favourable impact on economic growth. These results imply that policies that increase the ease of FDI and FPI inflows are essential for South Africa especially in the current economic climate where economic growth is depressed, and sustainable capital sources need to be spurred. Although the capital inflows have a positive impact, it remains important to ascertain how the variability of the inflows pose a risk on economic growth, especially in the long-term. The importance of capital flows on economic growth is evidenced by other international studies which investigated this relationship in other emerging market economies.

Borensztein, De Gregorio, and Lee (1998) evaluated the effect of FDI on economic growth on 69 developing countries and found FDI to be a significant contributor of technology transfer. In addition, they found that this contribution was greater for economic growth compared to domestic investment although the benefits of FDI would be greatly realised if a minimum level of human capital was present. Other relatable studies include Zhang and Song (2002) who established that increased levels of FDI

had a positive effect on provincial manufacturing export performance in China and Xuan and Xing (2008) who said that in Vietnam, FDI inflows resulted in higher exports particularly to the source country. Xuan and Xing (2008) specifically observed that a 1% increase of FDI to Vietnam resulted in 0.13% increase in exports to the source country.

Anwar and Nguyen (2011) suggested that the presence of international firms increased domestic firms' propensity to export through intrafirm linkages. Their study found that this remained so even after accounting for other factors such as technology level of domestic firms, ownership structure, geographic proximity to foreign firms and orientation of foreign firms. Anyanwu (2012) made an argument highlighting that an African country with a larger export base tend to attract more FDI which was supported by earlier African studies by Bezuidenhout (2007) and Hailu (2010) which confirmed a bi-directional causal relationship between exports and FDI.

Olayiwola and Okodua (2013) studied the contribution of FDI to the performance of non-oil exports in Nigeria and found unidirectional causality running from FDI to non-oil exports. The studies suggested that the presence of international investment increased domestic firms' propensity to export through interfirm linkages. Le Cluss-Rossouw and Viviers (2015) found that nearly 53% of the variance in SADC exports to the BRIC countries could be explained by BRIC FDI only and recommended that SADC be more cooperative to FDI inflows. They found that nearly 53% of the variance in Southern African Development Community (SADC) exports to BRIC countries could be explained by BRIC FDI.

Enisan (2017) investigated FDI flows in Nigeria using a Markov switching model. They found that the FDI process in Nigeria was governed by two different regimes. In addition, the shifts from one regime to the next was contingent upon transition probabilities. Enisan (2017) proceeded to show that the main determinants of FDI were GDP growth, macroeconomic instability, financial development,

exchange rate, inflation and discount rate; implying that liberalization emanating from inflation and enhanced the value of domestic currency attracted FDI into the country.

2.3 Summary

The studies reviewed showed that capital inflows tended to have a net positive impact on South African economic growth. Those focusing on the real economic impact using GDP and those choosing to look at exports had a reconcilable conclusion. Although there remain other international studies that analysed the capital flows and economic growth such as Isiks, Isiksal and Jalali (2017) in Turkey there is a need to review the behaviour and evolution of these relationships in South Africa if economic growth is to be spurred. It has been noted that the literature reviewed suggests FDI can stimulate the economy positively because it enhances growth through technology diffusion, human capital development, export promotion, employment generation and productivity growth. Thus, having noted that there is a case for more liberalisation of international capital flows, the exact type of relationship has not been fully interrogated with respect to the type of capital flows and their impact on economic growth and returns on the stock market. It is plausible that this scenario is also true for the South African economy, but it is important to ascertain this thorough empirical analysis. It is worth noting that South Africa is a unique emerging market economy; unlike China, the Asian Tigers or emerging Latin American countries, it has a persistent current account deficit which relies on being funded by foreign capital inflows. South Africa also has very low economic growth rates that seem to be highly susceptible to foreign capital flows. Consequently, understanding just how foreign capital flows affect both its economy and its stock market will add unique point to the debate between proponents for and against free capital markets. The following section outlines the methodology used by this study to achieve its objectives.

3. Methodology

The method employed by this study was designed to achieve its broad objective of ascertaining the impact of foreign capital flows on South African GDP growth and JSE ALSI returns. In addition, it is this study's objective to estimate the level of sensitivity that the South African GDP growth rate and the JSE ALSI had to positive and negative capital flow regimes. The following section outlines the data requirements for the study as well as the sources of the data.

3.1 Data Description

The study analysed a dataset spanning from September 1995 until December 2016 using quarterly data and as suggested by the topic, the dependent variables are GDP growth and JSE ALSI returns. Quarterly data was the highest frequency that GDP figures are released, in addition, related studies used this same frequency. The variables selected for analysis are consistent with the achievement of research objectives and are supported by the literature reviewed.

3.1.1 Dependent Variables

- Real gross domestic product (GDP)

This study tests whether GDP growth has a relationship with capital flows and as such, it is a dependent variable. Several similar studies such as the one by Le Cluss-Rossouw and Viviers (2015) have used GDP growth as an indicator of the increase in the size of the economy. The *a priori* expectation is that GDP would have a positive all with capital flows, however, this relationship is what the study sought to test.

- Johannesburg Stock Exchange All Share Index (JSE ALSI)

The other dependent variable is the JSE ALSI because capital flows can take the form of FPI which can be invested on the stock market. As such, it is expected that JSE ALSI would respond to changes in

capital flows and there is a potential for contemporaneous or lagged relationship. The all share index is a proxy for market performance and the data were available from the Johannesburg Stock Exchange (JSE).

3.1.2 Explanatory Variables

- Foreign direct investment (FDI) net inflows as % of GDP.

FDI measured the amount of investment that came into South Africa from the rest of the world in the form of acquisitions of existing companies or setting up of new ones. This factor's inclusion was necessary because it has been argued to be necessary for growth in emerging markets. For example, Pham and Nguyen (2013) stated that there was an indirect link between trade flows and FDI and Olayiwola and Okodua (2013) who studied the contribution of FDI to the performance of non-oil exports in Nigeria and found a unidirectional causality running from FDI to non-oil exports.

FDI is said to generate impulse responses in the economy because it enhances growth through technology diffusion, human capital development, export promotion, employment generation and productivity growth (Ramirez, 2006). This study expected FDI to have a significant impact on the dependent variables.

- Foreign portfolio investment (FPI) as a % of GDP.

The FPI is the investment into South Africa in the form of financial asset purchases such as bonds, shares and Treasury bills. This factor was expected to have a very significant impact on the behaviour of the stock market as represented by the JSE ALSI. It was necessary to disaggregate FDI to isolate FPI because it helps attribute the causal factors of economic growth and stock market returns for both policy makers and investors. A study by Aizenman *et al*. (2013) investigated the relationship between economic growth and lagged international capital flows, disaggregated into FDI, portfolio investment,

equity investment, and short-term debt in 100 countries between 1990 and 2010 which enabled a more comprehensive analysis.

- Total Capital Flow (TCF) as a % of GDP

Total capital flows represent the total flows of money that is intended for investment purposes in South Africa. This variable was essential for the purposes of this study whose intention was to establish the significance of capital flows in affecting JSE returns as well as economic growth. The data on total capital flows was obtained from the South African Reserve Bank (SARB) database.

- Effective Corporate Tax (TAX) as a % of GDP

Data on the effective corporate tax rate was sourced from the South African Revenue Services (SARS). The argument for the relevance of this variable lies in the fact that investors are liable for tax and as such, higher taxes tend to discourage investment as opposed to lower taxes. As such, is was plausible to conceive the argument that effective corporate taxes were a likely factor when analysing the effect of capital flows on South African GDP and JSE ALSI returns.

- South Africa Interest Rate (REPO)

The repo forms the basis for setting interest rates in the South African economy and is an essential variable for establishing the interest rates. Interest rates affect the cost of borrowing as well as the required return on investments and as such were identified as a likely factor to affect GDP as well as return on the JSE ALSI. Timeseries data for the repo rate was obtained from the SARB database.

- Consumer Price Index (CPI). South African statistics department

Inflation tends to shift the wealth among investors because higher rates of inflation will diminish the value of cash flows to be received later (Chen, Roll and Ross, 1986). In the U.S. a study revealed that share returns were negatively related with expected inflation but in the United Kingdom (UK) they were found to be positive (Bulent Gultekin, 1983). Fama (1981) argued that the expected inflation,

rate was negatively correlated with the level of anticipated real activity and as a result, were supposed to be negatively correlated with the expected rate of inflation. This study is going to use the consumer price index (CPI) to estimate the level of inflation since it reflects the general price level.

3.2 Econometric Models

The broad objective of this study is to ascertain the relationship that foreign capital flows have with South Africa GDP growth and JSE ALSI Returns. The basic models that were employed by this study for testing capital flow effects on GDP and JSE ALSI returns are presented in equations (5) and (6) below respectively, consistent with related literature.

$$Ln(GDP) = \beta_0 + \beta_1 lnGDP_{t-1} + \beta_2 FDI_{st,t} + \beta_3 FPI_t + \beta_4 TCF_t + \beta_5 TAX_t + \beta_6 REPO_t + \beta_7 CPI_t + \mu_t \quad (5)$$

The effect of flows on ALSI returns:

$$Ln(JSE\ ALSI) = \beta_0 + \beta_1 JSE_ALSI_{t-1} + \beta_2 FDI_{st,t} + \beta_3 FPI_t + \beta_4 TCF_t + \beta_5 TAX_t + \beta_6 REPO_t + \beta_7 CPI_t + \mu_t \quad (6)$$

Where:

GDP	=	real gross domestic product (GDP).
JSE ALSI	=	Johannesburg Stock Exchange All Share Index returns.
FDI	=	Foreign direct investment net inflows as % of GDP.
FPI	=	Foreign portfolio investment as a % of GDP.
TCF	=	Total Capital Flows as a % of GDP
TAX	=	Corporate Tax as a % of GDP
REPO	=	South Africa Interest Rate as a %
CPI	=	Consumer Price Index (CPI) Inflation rate

β_0 is the intercept term whilst $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6$ and β_7 represent the slope coefficients estimated and μ_t represents the stochastic error term.

3.2.1 Tests for Stationarity

Before any analysis was undertaken on the data outlined above, this study was cognisant of the fact that the time series data had to be tested for stationarity; running non-stationary data would lead to spurious regressions. A spurious regression may arise if the series are trending together. The consequences of a spurious regression are that the hypotheses cannot be validly tested because, for example, the test statistics will no longer be following the t-distribution and the F-statistic would no longer be following the F-distribution. As such, tests for stationarity were crucial. The first step was to transform the data into natural logarithms as this reduced the size of the values but still captures the variability within the data. The data was tested for stationarity using the Augmented Dickey-Fuller (ADF) test for stationarity and it was conducted under the following hypothesis:

H_0: $y_t \sim I[1]$ [series is non-stationary and has at least one unit root]

H_1: $y_t \sim I[0]$ [series is stationary]

Where y_t is the series and I [0] and I [1] represents the order of the series. If the null hypothesis could not be rejected, the test proceeded to examine if the series had two unit roots using the following hypothesis:

H_0: $y_t \sim I[2]$ [series has two unit roots]

H_1: $y_t \sim I[1]$ [series has one unit root]

If the null hypothesis was rejected, it was concluded that the series had one-unit root, meaning that series was non-stationary, and the first difference of the data-series was used. The analysis went on to address the objectives of the study which started by testing for co-integration.

3.2.2 Co-integration Tests

This study used co-integration to establish whether capital flows, GDP growth and JSE ALSI returns had a long-term relationship. Co-integration techniques founded by the works of Granger (1981) which were extended by Engle and Granger (1987) and then enhanced by Johansen (1988) due to shortcomings characterizing the former methodology are useful at studying economic and financial relationships. Studies have used co-integration techniques which are applicable in numerous areas such as: purchasing power parity (PPP), money demand studies, the cost of carry relationship and the relationship between stock prices and dividends (Campbell and Shiller, 1987). Non-stationary variables are said to be co-integrated if their linear combination is stationary (Brooks, 2008: 336). The implication of co-integration is that deviation from equilibrium is stationary, with finite variance, though the series themselves are non-stationary and have infinite variance. This means that it is plausible to have variables diverging from a co-integrating relationship in the short-run, but they will still revert in the long-run (Darrat, Elkhal and Hakim, 2000: 127). Consequently, a co-integrating relationship can be viewed as a long run relationship.

One of the methods used for testing co-integration is the Engle-Granger method which estimate a bivariate model after testing for stationarity are complete. In this case, would for example, estimate GDP growth with portfolio flows using the following model:

$$Log\ GDP\ =\ c + \beta LogFPI\ + u_t$$

where log GDP denotes the log of GDP, log FPI denotes the log of FDI, c and u_t denote regression parameters and β denotes the slope coefficient. The residuals from each of individual test equations would then be tested for stationarity using the augmented Dickey-Fuller test with the following hypotheses:

$$H_0 = \textit{there is no cointegration between log GDP and log FPI}$$

$$H_1 = \textit{there is cointegration between log GDP and log FPI}$$

The critical values were provided from Engle and Granger (1987) and the null hypothesis was rejected if the test statistic was more negative than the critical value. If a co-integrating relationship between prices and dividend yields is found then an error correction model ECM was estimated (Engle and Granger, 1987). A deviation from the long-run value is defined by the ECM as an error and measures it as the difference between the actual value of the dependent variable and its estimated value based on the selected co-integrating vector equilibrium (Yaffee and McGee, 2000). The coefficient of the lagged residual is the error correction coefficient and specifies the speed of adjustment of the dependent variable to its long run value.

Although the Engle-Granger method explained above is easy to use, the method developed by Johansen (1988) and Johansen and Juselius (1990) is more extensively employed. This is because the Engle-Granger method is only useful for finding one co-integrating relationship because it only works in a bivariate scenario. The Johansen method in a VAR is relatively more appropriate in a multivariate system compared to the Engle-Granger method. In using the Johansen method, this study ensured that the variables were non-stationary at their levels and were differenced once to ensure stationarity as described in section 4.2.1. The co-integrating relationship tests were estimated and the max and trace statistics suggested the existence of co-integrating relationships. From it the appropriate lag length for the VAR were suggested and used. Selecting the appropriate lag length for incorporation in

the VAR is important and was done using information criteria; Aikaike's information criterion (AIC), Schwarz information criterion (SIC) and Hannan-Quinn criterion (HQC).

3.2.3 The VECM

After establishing the existence of co-integration, a VECM was estimated to analyse the joint behaviour of the series in the dynamic system. A vector error correction model (VECM) is a restricted VAR designed for use with non-stationary series that are known to be co-integrated. According to Enders (2004) the VAR model can be described as a systems regression which has more than one dependent variable and allows for bidirectional causality amongst the variables. The VAR model allows a variable to be dependent upon not only its own lags, but the lags of other variables and the captures different features of data which OLS cannot. The general notation for the VAR for example, given a bivariate VAR with one lag can be written as:

$$y_{1t} = \beta_{10} + \beta_{11}y_{1t-1} + \alpha_{11}y_{2t-1} + u_{1t} \quad (4)$$

$$y_{2t} = \beta_{20} + \beta_{21}y_{2t-1} + \alpha_{21}y_{1t-1} + u_{2t} \quad (5)$$

Where u_{it} is a white noise disturbance term and y_{it} are the endogenous variables and can be simplified and written in the standard format of the VAR as:

$$y_t = A_0 + A_1y_{t-1} + e_t \quad (6)$$

Where y_t is the dependent variable, A_0 is the intercept matrix, A_1 is the matrix of coefficients, y_{t-1} are lags of y_t and e_t is the error term.

The general form of the VECM used in the study was as follows:

$$\Delta \log GDP_t = \alpha_0 + \lambda_1 EC^1{}_{t-1} + \sum_{i=1}^{n} \alpha_i \Delta \log GDP_{i-1} + \sum_{j=1}^{n} \alpha_j \Delta logFPIt_{i-j} + \varepsilon_{t-1}$$

Where, Δ is the difference operator, $EC^1{}_{t-1}$ is the error correction term lagged one period; λ is the short- run coefficient of the error correction term (-1< $\lambda < 0$); and ε is the white noise. The error correction coefficient(λ) is very essential in this error correction estimation as the greater the coefficient is indicative of higher speed of adjustment of the model from the short-run to the long-run (Granger and Weiss, 1983).

Optimal lag length is required to use the VAR and this study used information criteria to arrive at optimal lag length. The relations between the variables may happen in earlier lags or months and it must be realistic (the length of time through which one factor affects another). Lags that are too long may become unrealistic. The information criteria used by this study for lag length were the Akaike's information criterion (AIC), Schwarz's Bayesian information criterion (SBIC) and the Hannan-Quinn information criterion (HQIC) (Brooks, 2008). In cases where information criteria do not give conclusive results using economic theory may be better or using information criteria suitable for the sample size. For instance, the AIC is better suited for smaller sample sizes (Brooks, 2008: 294). It was also important to consider what prior studies had chosen the optimal lag length to be so that interpretation would have economic relevance.

3.2.4 Granger Causality

Granger causality tests were conducted to have a more conclusive analysis and interpretation of the VAR. The reason behind conducting the tests was to establish whether the macroeconomic variables Granger cause changes in the index returns and this was used by Van Rensburg (1999) when selecting macroeconomic variables. This study tested the direction of causality between GDP growth & JSE ALSI Returns against all three different forms of capital flows. The hypothesis tests for the granger causality tests would for example, take the following form for the VAR for equation (8):

H_0: lags of X_t do not explain current JSE_ALSI_t [$\beta = 0$]

H_1: lags of X_t explain current JSE_ALSI_t [$\beta \neq 0$]

Where JSE_ALSI_t is the index return and X_t is the macroeconomic variable and β is the coefficient of the macroeconomic variable. If the null hypothesis could not be rejected, it would imply that the lags of the variable were significant in explaining changes in the index return and the opposite would be true if the null hypothesis was rejected.

3.2.5 The Markov Switching model

One of this study's objectives was to ascertain the sensitivity of SA GDP growth and JSE ALSI returns to both negative and positive foreign capital flows and as such, employed the Markov switching model. The Markov switching model of Hamilton (1989), also known as the regime switching model, uses multiple structures (equations) that can characterize the time series behaviours in different regimes. Permitting the switching between structures enables it to capture more complex dynamic patterns, and this is of importance to the objectives of this study. Popular linear models such as the AR, MA and ARMA models are unable to represent non-linear dynamic patterns which includes asymmetry, amplitude dependence and volatility clustering which the Markov model can do (Brooks, 2008).

Macroeconomic variables tend to be subjected to shocks that create breaks in the time-series and these breaks correspond to some significant even such as a financial crisis, an economic boom or political tensions. Ignoring these breaks can lead to misspecification (spurious behaviour) of a model and these breaks can be detected in stationary, non-stationary and co-integrating relationships. It is possible that when conducting unit root tests rejection of the unit root process can happen because of structural breaks. The Markov model model was later generalised to allow for time-varying duration dependent and seasonally dependent transition probabilities.

The Markov model allows states/regimes to occur over time t = period, s_t = state, m possible states. In this study, there were two regimes, positive and negatives hence the following:

$$y_t = \mu_1 + e_t \qquad when\ s_t = 1$$

$$y_t = \mu_2 + e_t \qquad when\ s_t = 2$$

Where, y_t represents the dependent variable, μ_1 and μ_2 are the means for the positive and negative regimes respectively, s_t is the state and e_t is the mean and is the error term. The notation above can be represented using dummy variables:

$$y_t = \mu_1 D_{1t} + \mu_2(1 - D_{1t}) + e_t$$

Where $D_{1t} = 1$ when $s_t = 1$ and $D_{1t} = 0$ when $s_t = 2$

s_t evolves over time in the following way

$$P(s_t|s_1, s_2, \dots s_{t-1}) = P(s_t|s_{t-1})$$

Probability of moving from state *i* to state *j*

$$P_{ij} = P(s_t = j|s_{t-1} - i)$$

An autoregressive process can take one or two values μ_1 or μ_2

$y_t - \mu_t = \Phi(y_{t-t} - \mu_{t-1}) + \varepsilon_t$; where, $\varepsilon_t \sim iid\ N\ (0, \sigma^2)$

A change in the value of μ above is a change in the state/regime. All the parameters are allowed to change state if thought appropriate. The state variable is associated with indices for constant terms. For example, St =1 is associated with μt $\mu^{(1)}$ the variable is unobservable so probabilities are necessary.

The assumption is that a variable is governed by a Markov chain. There were two possible states; positive or negative, switching conditional probabilities:

$$Prob\ (s_t = 1|s_{t-1} = 1) = p_{11}$$

$$Prob\ (s_t = 2|s_{t-1} = 1) = 1 - p_{11}$$

$$Prob\ (s_t = 2|s_{t-1} = 2) = p_{22}$$

$$Prob\ (s_t = 1|s_{t-1} = 2) = 1 - p_{22}$$

The unconditional probabilities:

$$Prob(s_t = 1) = \frac{(1 - p_{22})}{(1 - p_{11} - p_{22})}$$

$$Prob(s_t = 2) = 1 - Prob(s_t = 1)$$

The transition probabilities indicate the length of time a given regime is expected to last which is important for the study to draw conclusions on. The following section gives the results obtained by the study.

4. Results

4.1 Introduction

The study's analysis began by understanding the distribution of the data and this started by computing the data series' descriptive statistics and correlation coefficients. This was then followed by testes for stationarity before the regression analyses were undertaken.

4.2 Descriptive Statistics

Panel A in Table 4.1 shows the descriptive statistics. The average quarterly growth over the sample period was approximately 2.4% whilst the JSE ALSI return averaged 3.1% quarterly. GDP standard deviation suggested lower volatility than the stock market which was expected. This was evidenced by a standard deviation of approximately 1% for GDP whilst it was nearly 7.8% for the JSE ALSI. Panel B in Table 1 shows the explanatory variables and of importance for this study, were the capital flows time series; FDI, FPI and TCF. It was encouraging to note that the average FDI and FPI were positive, suggesting that investors were on average, putting their capital into the South African economy. These however, had large deviations suggesting that there were period of significant capital inflows and outflows which would make further analysis important. The effective corporate tax rate (TAX) had a very low deviation of approximately 1.4% with an average of 4.9% per quarter meaning that the South African effective tax rate was relatively consistent for the duration of the study. The repo rate averaged 8.4% with a standard deviation of 4.3% suggesting that interest rates did not fluctuate by much during the study period.

Table 4.1 Descriptive Statistics

Variable	Mean	Standard Deviation	Sample Variance	Kurtosis	Skewness	Minimum	Maximum
A) Dependent Variables							
GDP	0,024268	0,010743	0,000115	1,21979	0,742209	0,00387	0,063122
JSE ALSI	0,030633	0,077741	0,006044	1,369129	-0,91872	-0,23171	0,17574
B) Explanatory Variables							
FDI	3291,767	15883,74	2,52E+08	12,55707	2,019812	-39805	93351
FPI	13310,01	27238,59	7,42E+08	5,574947	-0,70298	-111675	96750
TCF	18708,24	24087,55	5,8E+08	0,099951	0,995247	-13366	82063
TAX	0,04864	0,014262	0,000203	-1,01726	-0,21454	0,026125	0,072879
REPO	0,083987	0,042846	0,001836	-0,28109	0,812149	0,035	0,20513
CPI	0,060775	0,025229	0,000637	0,747497	0,39199	0,004333	0,134

After understanding the distribution of the data, the next step was to undertake a correlation analysis. A correlation matrix was prepared on the data variables and the results are displayed in Table 4.2 below. As expected, GDP and the JSE ALSI were highly correlated at 0.8 meaning that there was significant resemblance of behaviour. Based on the correlation analysis, one would expect positive GDP growth to be associated with JSE ALSI positive returns and that both series would behave in a similar manner. Higher levels of capital flows are related with higher GDP in the same quarter but, it is interesting to note that GDP is almost uncorrelated with FDI suggesting that it is likely that they have no relationship at all. The correlation matrix suggest that a higher repo rate has a negative relationship with economic growth as highlighted by its negative coefficient with the JSE ALSI and the GDP. FDI and TCF have a higher correlation with the JSE ALSI as compared to GDP suggesting that over time, capital flow movements were very similar to that of the JSE when compared to GDP. This could be because there are many other factors which are not financial that affected South African GDP.

Table 4.2 Correlation of Economic Variables

	GDP	ALSI ALSI	FDI	FPI	TCF	TAX	REPO	CPI
GDP	1							
ALSI	0.8097	1						
FDI	0.0005	-0.1317	1					
FPI	0.3907	0.5048	-0.5042	1				
TCF	0.6452	0.7733	-0.1217	0.5195	1			
TAX	0.7308	0.6005	0.1073	0.2310	0.4587	1		
REPO	-0.7982	-0.7399	0.0129	-0.3911	-0.5544	-0.6722	1	
CPI	-0.1912	-0.0716	0.1622	-0.2406	-0.0502	-0.0311	0.4814	1

Another important observation worth noting is that the correlations amongst FDI, FPI and TCF are negative; only TCF and FPI are positively correlated. This suggest that there could be a complex relationship amongst these variables because one would suppose that TCF and FDI would have a positive relationship. It is important to note that the correlation matrix is not conclusive as variables may have more sophisticated relationships such as a co-integrated or lagged relationship with each other. Further analysis is required, and co-integration tests were carried, and the following section begins by providing tests for stationarity.

The correlation analysis was necessary to ensure that the data series were not highly correlated because if this were the case, it would have led to a multi-collinearity problem (Farrar and Glauber, 1967). Multi-collinearity is when independent variables explain the same features of the dependent variable. To ensure that autocorrelation did not affect the regression analysis, the data was run with Newey-West (1987) heteroscedasticity and autocorrelation consistent (HAC) standard errors (Brooks, 2008).

4.3 Tests for stationarity

The objective of the tests for stationarity was to understand the integration order of the data series because this would have significant implications for the analysis. For instance, running a non-stationary regression can lead to spurious results which would compromise the quality of the analysis. The other

reason was that Johansen's co-integration which this study used, required the variables to be integrated in the same order. Tests for stationarity were undertaken using the Augmented Dickey-Fuller test for stationarity at the 5% significance level and the results of these tests are displayed in Table 4.3 below. If the test statistic in table 4.3 was significant, then the series was stationary, however, if the test statistic was non-stationary, then the first difference was tested for stationarity; hence a second hypothesis was tested. In all tests undertaken only REPO, TAX and TCF series required the first difference to become stationary.

Table 4.3 Tests for Stationarity[2]

Series	Test Statistic	5% Critical value	P-Value	Conclusion
Panel A) Dependent Variables				
JSE ALSI	-7.596252*	-2.895924	0.0000	Reject H_0; Stationary: I (0)
GDP	-7.394937*	-2.895924	0.0000	Reject H_0; Stationary: I (0)
Panel B) Explanatory Variables				
CPI	-3.373843*	-2.898145	0.0148	Reject H_0; Stationary: I (0)
FDI	-8.662890*	-2.895924	0.0000	Reject H_0; Stationary: I (0)
FPI	-6.299770*	-2.895924	0.0000	Reject H_0; Stationary: I (0)
REPO	-1.951078	-2.896346	0.3078	Fail to reject H_0; Non-Stationary
	-5.994735*	-2.896346	0.0000	Reject H_1; Stationary: I (1)
TAX	-1.595633	-2.895924	0.4804	Fail to reject H_0; Non-Stationary
	-9.331697*	-2.896346	0.0000	Reject H_1; Stationary: I (1)
TCF	-1.503004	-2.897223	0.5272	Fail to reject H_0; Non-Stationary
	-7.237433*	-2.898145	0.0000	Reject H_1; Stationary: I (1)

*(*Significant at 5% level, **significant at 10% level) Chi squared test statistics*

[2] Full output is available in appendix A1.

Dependent Variables

This study used JSE ALSI returns and GDP growth as the dependent variables and tests for stationarity suggested that both series were stationary at their levels. As panel A of Table 4.3 shows, both null hypotheses of non-stationarity of the JSE ALSI and GDP were rejected because the test statistics were more negative than the critical values. This was expected as returns and growth rates tend to have a constant mean over time so, the next step was to determine the integration order of the explanatory variables.

Explanatory Variables

The tests for stationarity were undertaken on the explanatory variables and the results in the table show that there was a mixture of integration orders. The Augmented Dickey-Fuller tests for stationarity on consumer price index (CPI), foreign direct investment (FDI) and foreign portfolio investment (FPI) suggested that they were I(0) stationary at they levels. The repo rate (REPO), effective tax rate (TAX) and total capital flows (TCF) needed to be differenced once before they were stationary meaning that they I(1) stationary, hence the two test statistics.

4.4 Co-integration Tests

Johansen's co-integration was employed to test for the existence of short-run and long-run relationships amongst the variables. Table 4.3 suggested that the variables had different integration orders, consequently, Johansen's co-integration could not be employed for all the variables in the manner that the study intended. As a result, the study analysed co-integration on the group of variables whose integration order was the same. The first test was conducted on the relationship between the JSE ALSI, CPI, FDI and FPI and the second one tested for cointegration of GDP, CPI, FDI and FPI which was in line with the study's objective to establish the effect of capital flows on The JSE

ALSI and GDP. Trace and maximum eigenvalue tests were conducted to ascertain the existence of co-integrating relationships on the JSE ALSI and GDP test equations.

In the first test equation (JSE ALSI, CPI, FDI and FPI), the trace test found that there were at least 3 co-integrating relationships but the maximum eigenvalue found there was one co-integrating relationship. Notwithstanding the different conclusions, these findings suggested the existence of co-integration meaning an ECM could be estimated. The trace statistic suggested that the second test equation (GDP, CPI, FDI and FPI), had three co-integrating equations whilst the maximum eigenvalue test found two co-integrating equations. For both test equations; the trace and eigenvalue tests suggested that there was at least one co-integrating relationship amongst the variables and as such, an ECM was estimated, and Table 4.4 below shows the results.

The results from the first co-integrating equation (JSE ALSI, CPI, FDI and FPI) in the first row, which is the beta matrix, shows that the JSE ALSI had a long-run relationship with the CPI and a 1% increase in the JSE ALSI was associated with 1.29% increase in the CPI. This could be because stock market can be seen as a hedge for inflation and as such, as inflation increased, investors would be attracted by stocks as opposed to interest bearing assets. The JSE ALSI was negatively co-integrated with FDI and FPI although these were not statistically significant meaning that portfolio flows did not have a long-run relationship with the realised ALSI returns.

The alpha matrix in Panel A shows the error correction, which are the short-run adjustments to equilibrium in the JSE ALSI test equation. Even though the JSE ALSI had a long-run relationship with CPI, there was no evidence of any statistically significant short-run dynamics. The JSE ALSI had however, short-run relationships with FDI and FPI as suggested by their statistically significant coefficients in the error correction equation. The error correction equation suggested that a positive deviation from equilibrium of 1% by the JSE ALSI would result in an increase of 74 billion rand but FPI

would decrease by 182 billion rand. The study expected both FDI and FPI to be positive, but it may be conceivable that other exogenous factors may influence investor decisions to move they portfolio holdings in the short-run. The correlation matrix had given a hint that there was likely going to be a negative relationship. Adjusted R^2 showed that 52% of the variability in the ALSI returns could be explained by the explanatory variables in the equation and F-statistic suggested that the regression was statistically significant.

Table 4.4 Co-integrating Relationships

Variable	JSE ALSI	GDP	CPI	FDI	FPI
PANEL A					
JSE ALSI Equation Coefficient Test statistic (beta matrix)	1.0000	-	1.2919 **[4.0670]**	-1.07E-06 [-1.2995]	-6.27E-08 [-0.1355]
JSE ALSI Error Correction Coefficient Test statistic (alpha matrix)	-1.1750 **[-5.7320]**	-	0.0225 [0.6671]	74964.07 **[1.5060]**	-182556.2 **[-2.4825]**
Adj. R-squared	0.5215	-	0.2983	0.4180	0.3973
F-statistic	10.9303	-	4.8726	7.5428	7.0067
PANEL B					
GDP Equation Coefficient Test statistic (beta matrix)	-	1.0000	-0.1072 **[-1.7347]**	2.44E-07 **[1.5449]**	2.49E-07 **[2.8118]**
GDP Error Correction Coefficient Test statistic (alpha matrix)	-	-0.2604 **[-1.5135]**	0.6886 **[4.2085]**	270418.3 [0.9919]	-887189.7 **[-2.1785]**
Adj. R-squared	-	0.3690	0.4374	0.4057	0.3708
F-statistic	-	6.3276	8.0844	7.2209	6.3692

(Test statistics on the coefficients are given in square brackets and those which are bold are significant at the 5% level).

The second test equation in Panel B established that GDP had long-run relationships with CPI, FDI and FPI as evidenced by statistically significant coefficients in the beta matrix. The co-integrating equation

suggested that in the long-run, a 1% increase in GDP growth was associated with a decline of 0.1% in the CPI. This may be because higher inflation may have negative connotations for economic growth in South Africa. The long-run relationship was positive and statistically significant with FDI and FPI suggesting that in the long run, an increase in GDP received a positive long-run response from FDI and FPI. In the short-run however, FPI had a negative response to positive changes in GDP growth. If GDP growth was above equilibrium by 1% CPI would increase by 0.69% but the FDI short-run dynamics were not statistically significant. The F-statistic suggested that the regression was statistically significant with explanatory power of approximately 37% as suggested by the adjusted R^2.

4.5 Granger Causality

The study analysed the presence of causality amongst all the variables but since there was a mixture of integration orders amongst the variables, the VAR was used on the differenced variables. In this framework, optimal lag length was important, and this study was cognisant of the fact that too few lags could result in residuals which were non-stationary and could result in omitted variable bias (Bernanke, Gertler and Watson, 2004). Gutierrez, Souza and Guillén (2009) made the point that too few lags could result in auto correlated errors not representative of a white noise process. If there were to many lags on the other hand, sample uncertainty would be the problem because too many parameters would have to be estimated (Bernanke *et al.*, 2004). It is important to note that information criteria were used for lag length especially when there was no underlying economic theory suggesting what it was supposed to be (Brooks, 2008). The Granger causality tests on ALSI returns and GDP growth were conducted with one lag as suggested by the information criteria.

Table 4.5 Granger Causality Tests

	Test Statistics on the LAGS OF							
Dependent Variable	JSE ALSI	GDP	FDI	FPI	TCF	REPO	TAX	ALL Lags
JSE ALSI	-	-	0.340890	0.264967	0.512730	**16.43044***	0.728209	**18.24941***
GDP	-	-	0.597507	0.118619	0.613820	1.510675	2.436514	4.634324
FDI	0.282972	0.151249	-	0.152020	1.004933	0.124216	**3.022454****	4.786107
FPI	0.072921	2.256708	0.044046	-	0.042183	0.408923	0.032190	0.836640
TCF	0.331365	0.228523	0.504831	0.827152	-	0.311074	1.641211	5.721556
REPO	**17.49408***	**11.61162***	0.484891	0.291104	0.502417	-	0.775954	**19.94507***
TAX	0.046991	0.099125	2.143230	**5.123759***	**2.890738****	0.352080	-	7.087544

*(*Significant at 5% level, **significant at 10% level) Chi squared test statistics*

Table 4.5 above shows that on the JSE ALSI, only the lags of the repo rate (REPO) Granger caused changes in the JSE ALSI; suggesting the returns on the JSE ALSI were influenced by past interest rates values. It was also important to note that the lags of TAX influenced FDI suggesting that foreign investors considered the influence of effective tax rates. The TAX factor itself was affected lags of FPI and TCF suggesting the importance of effective corporate tax considerations for investment into South Africa. The study expected the variables to have more significant causality on the dependent variables as they were co-integrated with the dependent variables. The next section analysed the existence of regime switches in the variables and their impact on ALSI returns and GDP growth.

4.6 Markov Switching Regression

The Markov switching model was estimated on two test equations; the first one was on the JSE ALSI as the dependant variable with REPO, TAX, TCF, FDI and FPI being the explanatory variables, in the second equation, GDP was the dependant variable whilst REPO, TAX, TCF, FDI and FPI as the explanatory variables. The Markov switching model requires series analysed to be stationary and as

such, the non-stationary series had their first difference used in the test equation. It was one of the study's objectives to establish the existence of positive and negative effects of capital flow regimes on the JSE ALSI and South African GDP. A Markov switching regression was estimated with two regimes and the results are displayed in Table 4.6, with panels A and B in the table displaying the coefficient estimates in the two regimes.

In panel A (where the JSE ALSI was the dependent variable), the intercept terms in the two regimes suggested that there were two means; a positive and a negative. In the first regime (positive regime), only the FDI variable was significant, and its coefficient suggested that there was a positive relationship with the JSE ALSI. The TAX variable was weakly significant in the positive regime and all the other explanatory variables were not statistically significant. This observation is complemented by the conclusions reached by Fedderke and Romm (2006) who concluded that taxes where one aspect that policy makers need to review if economic growth was to be spurred.

In the second regime, REPO, FPI and FDI had statistically significant relationships with the JSE ALSI. The coefficient on the REPO suggested a negative relationship, meaning that an increase in the REPO resulted in a decline in the JSE ALSI. This suggested that interest rate increases were regarded as unfavourable news by stock market investors. On the other hand, the stock market responded positively to increases in FPI and FDI into the country. This was complemented by studies who include Mpofu (2014) and Sunde (2017) who found capital inflows as having a positive impact on the South African economy.

Table 4.6 Regime Switching Output on JSE ALSI and GDP

Variable	Coefficient	Std. Error	z-Statistic	Prob.
	Panel A, Dependent Variable: JSE ALSI			
	Regime 1			
C	0.083661	0.008678	9.640651	0.0000
REPO	-0.419804	0.606761	-0.691876	0.4890
TAX	2.592084	1.636614	1.583809	0.1132
TCF	4.47E-07	3.60E-07	1.242816	0.2139
FPI	-3.45E-07	4.48E-07	-0.769909	0.4414
FDI	**1.03E-06***	4.84E-07	2.133080	**0.0329**
	Regime 2			
C	-0.061603	0.009102	-6.768121	0.0000
REPO	**-2.369355***	0.565818	-4.187484	**0.0000**
TAX	-0.954427	2.282378	-0.418172	0.6758
TCF	-2.02E-07	2.23E-07	-0.905978	0.3649
FPI	**1.93E-06***	3.11E-07	6.216277	**0.0000**
FDI	**1.60E-06***	4.58E-07	3.489754	**0.0005**
	Panel B, Dependent Variable: GDP			
	Regime 1			
C	0.034384	0.004404	7.807604	0.0000
REPO	**-0.467438***	0.106308	-4.397020	0.0000
TAX	**1.269211***	0.443857	2.859505	0.0042
TCF	9.19E-09	1.74E-07	0.052834	0.9579
FPI	**-2.18E-07****	1.29E-07	-1.691393	0.0908
FDI	**3.57E-07****	1.99E-07	1.793418	0.0729
	Regime 2			
C	0.021983	0.003721	5.908054	0.0000
REPO	**0.313284***	0.119771	2.615688	**0.0089**
TAX	**-1.733477***	0.391516	-4.427600	**0.0000**
TCF	**-1.13E-07***	3.79E-08	-2.982451	**0.0029**
FPI	-1.03E-08	4.46E-08	-0.231000	0.8173
FDI	**-1.97E-07***	6.43E-08	-3.063758	**0.0022**

*(*Significant at 5% level, **significant at 10% level) Z-test statistics*

In Panel B, GDP was the dependent variable and both regimes suggested a positive mean. All the variables except for TCF were statistically significant in the first regime but in the second regime, the significant variables except for REPO were negative, suggesting both positive and negative effects on capital flows on GDP. REPO and TAX exhibited both positive and negative regimes because they both

had negative coefficients in the first regimes and then had negative coefficients in the second regime. In the first regime, a 1% increase in the REPO and TAX would reduce the GDP by 0.26% and 1.78% respectively. On the capital flows front, FPI and FDI were significant in the first regime but, in the second regime, TCF and FDI were statistically significant.

The results suggest that there are both negative and positive regimes influencing JSE ALSI returns and GDP growth. The probability matrices show the duration of a given regime and Table 4.7 below shows the probability matrices. In Panel A (JSE ALSI equation), there was an approximately 60% probability of staying in the first state and an approximately 47% chance of remaining in the second regime. In this test equation, the first regime is expected to last for 2.47 quarters while it is 1.87 quarters for the second regime. This suggested that the FDI effects were positive and had a prolonged effect on the JSE ALSI since they were positive and significant in both regimes.

Table 4.7 Probability Matrices

Panel A) Dependent Variable: JSE ALSI		
	Constant transition probabilities:	
Regime	**1**	**2**
1	0.596115	0.403885
2	0.532958	0.467042
	Constant expected durations:	
Regime	**1**	**2**
	2.475952	1.876321
Panel B) Dependent Variable: GDP		
	Constant transition probabilities:	
Regime	**1**	**2**
1	0.372390	0.627610
2	0.203823	0.796177
	Constant expected durations:	
Regime	**1**	**2**
	1.593346	4.906222

The second equations, where GDP is the dependent variable, the constant transition probabilities suggested that there was a 37% chance that the regime would stay in the first state whilst that of staying in in the second state was approximately 80%. The constant expected durations were 1.59 quarters in the first state whilst it was 4.9 quarters in the second state. This also suggested the effect of capital flows would be long lasting; negative for the TCF but positive for the FPI.

4.7 Summary

The results have shown some mixed evidence on the impact that the macroeconomic variables had on ALSI returns and GDP growth in South Africa. The tests for stationarity showed that the variables had different integration orders which limited the use of Johansen's co-integration analysis. Co-integration analysis showed that both the ALSI returns and GDP growth had long-run and short-run relationships with the variables. The ECM for both the ALSI returns and GDP growth showed the existence of short-run dynamics; if the ALSI increased, FDI would increase in the FDI whilst FPI would fall, but an increase in GDP in the short-run would also decrease FPI but CPI would increase. In the long-run the ALSI was only positively related with CPI while GDP growth had a positive relationship with FDI and FPI while it was negative with CPI. The regimes were more significant for economic growth and this suggested that economic growth was more responsive to economic cycles as compared to ALSI returns. It could be worthwhile to investigate the same relationships with higher frequency such as monthly data as it can increase the degrees of freedom as well as identifying other short-run dynamics.

5. Conclusion

This study had a primary objective of establishing and analysing the sensitivity of South Africa's GDP growth and JSE ALSI returns to capital flows. This was motivated by the need to establish the impact of positive and negative capital flows which was essential considering that South Africa finds itself in a low growth scenario.

5.1 Summary of Findings

Firstly, the correlation matrix showed that capital flows in the form of FPI and TCF were the most correlated with South African GDP and that FDI was not correlated at all; this correlation remained consistent when tested against the JSE ALSI. These factors were also significant when the cointegrating relationships and regime switching analyses with the JSE ALSI and GDP were undertaken. Cointegration tests suggested that there were no short-run adjustments by the JSE ALSI to capital flows, but there were long-run adjustment relationships.

The study established the existence of both long-run and short-run dynamics for both ALSI returns and GDP growth as expected, and this was consistent with the literature reviewed in section 2.2 (Enisan, 2017). The cointegration analysis showed that long-run relationships between CPI, FDI, FPI and GDP growth which mean that these were important for South African economic growth. The long-run relationship between GDP growth, FDI and FPI suggested that positive GDP growth was given a boost by increases in FDI and FPI as expected.

The Markov switching model suggested that, there existed regime shifts within the test equations analysed, and this was evidenced by the two means that were statistically significant in both the JSE ALSI equation and the GDP equation. The regime switching models suggested that there were two regimes in both the JSE ALSI and GDP and that the capital flows seemed to be more significant in

influencing the GDP more than the JSE ALSI. Taxes were highly correlated with both the JSE ALSI and GDP, the Markov switching regression suggested that this variable was significant, and the Granger causality showed that tax Granger caused changes in FDI. Taxes and interest rates seemed to be more consistent factors suggesting that investors and economic growth may be more sensitive to these factors as opposed to flow of funds.

These results showed that there was mixed evidence on the impact that the macroeconomic variables on GDP growth and ALSI returns. However, the existence of long-run relationships and the evidence suggesting that there were regime shifts in the relationships pointed towards more sophisticated interactions amongst these variables.

5.2 Recommendations and Implications for Policy

These results have implications for both financial practitioners and policy makers. Firstly, they suggested that that policies attracting FDI are necessary however, investors on the JSE would only experience the effects in the long-run. Another important observation for policy is that capital flows tended to be more significant to GDP as opposed to the JSE ALSI. This was observation which could have been greatly influenced by the composition of FDI, meant that the FDI flows tended to benefit the economy at to a larger extent compared to the financial market. What this means is that putting in place policies that attract capital is important, but their effects will be felt more on the GDP as opposed to the stock market.

Taxes were highly correlated with both the JSE ALSI and GDP, the Markov switching regression suggested that this variable was significant, and the Granger causality showed that tax Granger caused changes in FDI. On the policy front, the results suggested that policy that reduces effective taxes while stabilising interest rates may be more effective in both the long and short-term. So, when effective

taxes increase it will likely depress FDI and ultimately GDP. Investors who are for example, holding portfolios indexed to the JSE will likely experience a drop in the value of their portfolios once effective taxes rise. This observation is complemented by the conclusions reached by Fedderke and Romm (2006) who stated that taxes where one aspect that policy makers need to review if economic growth was to be spurred.

5.3 Limitations and Areas for Further Study

Although the findings made by the study were consequential, there were areas where improvements can be made by future studies. Firstly, the study's sample size could be increased to increase degrees of freedom by getting longer time horizon. In addition, further exploration can be made by increasing the frequency of the data; monthly data captures more variability in the data. Secondly, as highlighted earlier in this chapter, the mixed evidence on the impact that the macroeconomic variables on GDP growth and ALSI returns suggested the existence of a more sophisticated relationship. Consequently, non-linear estimations can be introduced to help unravel the relationships. Another important consideration for future studies was to employ models such as the autoregressive distributed lag model (ARDL) that can test for short-run and long-run cointegrating relationships amongst mixed integration orders of time series data.

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Appendix A1 – Cointegration

A) ALSI RT, CPI, FDI, FPI,

Vector Error Correction Estimates
Date: 06/21/18 Time: 15:51
Sample (adjusted): 6/01/1996 12/01/2016
Included observations: 83 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
ALSI_RT(-1)	1.000000
CPI(-1)	1.291918 (0.31766) [4.06695]
FDI(-1)	-1.07E-06 (8.3E-07) [-1.29949]
FPI(-1)	-6.27E-08 (4.6E-07) [-0.13547]
C	-0.104417

Error Correction:	D(ALSI_RT)	D(CPI)	D(FDI)	D(FPI)
CointEq1	-1.174966 (0.20498) [-5.73198]	0.022492 (0.03372) [0.66713]	74964.07 (49777.3) [1.50599]	-182556.2 (73536.7) [-2.48252]
D(ALSI_RT(-1))	0.191345 (0.15677) [1.22054]	-0.016718 (0.02579) [-0.64836]	-40860.53 (38069.5) [-1.07331]	168491.1 (56240.6) [2.99590]
D(ALSI_RT(-2))	-0.039026 (0.11555) [-0.33773]	-0.009400 (0.01901) [-0.49457]	-10823.32 (28060.2) [-0.38572]	99928.73 (41453.8) [2.41061]
D(CPI(-1))	-1.401702 (0.72981) [-1.92065]	0.677514 (0.12004) [5.64423]	-78616.90 (177223.) [-0.44361]	-215171.8 (261813.) [-0.82185]
D(CPI(-2))	1.089576 (0.69577) [1.56599]	-0.331001 (0.11444) [-2.89239]	145447.5 (168958.) [0.86085]	199048.4 (249604.) [0.79746]

D(FDI(-1))	-8.38E-07	-4.81E-08	-0.699511	0.009918
	(4.8E-07)	(7.9E-08)	(0.11660)	(0.17226)
	[-1.74532]	[-0.60928]	[-5.99921]	[0.05758]
D(FDI(-2))	-8.75E-07	5.63E-08	-0.503482	0.045319
	(4.6E-07)	(7.6E-08)	(0.11247)	(0.16616)
	[-1.88925]	[0.73946]	[-4.47648]	[0.27274]
D(FPI(-1))	3.81E-07	-5.24E-08	0.021060	-0.704659
	(3.3E-07)	(5.4E-08)	(0.07996)	(0.11812)
	[1.15679]	[-0.96729]	[0.26339]	[-5.96557]
D(FPI(-2))	-2.98E-08	-3.52E-08	-0.156939	-0.432806
	(3.3E-07)	(5.4E-08)	(0.07958)	(0.11757)
	[-0.09102]	[-0.65252]	[-1.97207]	[-3.68140]
C	-0.001691	2.07E-05	-7.913621	1775.803
	(0.00769)	(0.00126)	(1867.42)	(2758.76)
	[-0.21985]	[0.01636]	[-0.00424]	[0.64369]
R-squared	0.574028	0.375287	0.481847	0.463472
Adj. R-squared	0.521511	0.298268	0.417965	0.397325
Sum sq. resids	0.357514	0.009672	2.11E+10	4.60E+10
S.E. equation	0.069982	0.011510	16994.03	25105.50
F-statistic	10.93032	4.872637	7.542772	7.006671
Log likelihood	108.2960	258.1097	-920.9153	-953.3040
Akaike AIC	-2.368580	-5.978548	22.43169	23.21214
Schwarz SC	-2.077153	-5.687121	22.72312	23.50357
Mean dependent	-0.001950	4.02E-06	-154.7711	1091.012
S.D. dependent	0.101169	0.013741	22275.20	32339.05

Determinant resid covariance (dof adj.)	8.29E+10
Determinant resid covariance	4.96E+10
Log likelihood	-1493.102
Akaike information criterion	37.03859
Schwarz criterion	38.32087

B) GDP GROWTH, CPI, FDI, FPI,

Vector Error Correction Estimates
Date: 06/21/18 Time: 16:00
Sample (adjusted): 6/01/1996 12/01/2016
Included observations: 83 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1

GDP_GROWTH(-1)	1.000000
CPI(-1)	-0.107162 (0.06178) [-1.73467]
FDI(-1)	2.44E-07 (1.6E-07) [1.54488]
FPI(-1)	2.49E-07 (8.9E-08) [2.81178]
C	-0.021658

Error Correction:	D(GDP_GROWTH)	D(CPI)	D(FDI)	D(FPI)
CointEq1	-0.260417 (0.17206) [-1.51351]	0.688592 (0.16362) [4.20848]	270418.3 (272616.) [0.99194]	-887189.7 (407256.) [-2.17846]
D(GDP_GROWTH(-1))	-0.517475 (0.16360) [-3.16309]	-0.415011 (0.15557) [-2.66765]	-137741.6 (259207.) [-0.53140]	742796.9 (387223.) [1.91826]
D(GDP_GROWTH(-2))	-0.297478 (0.12576) [-2.36551]	-0.254401 (0.11959) [-2.12733]	-137576.2 (199250.) [-0.69047]	223469.9 (297656.) [0.75077]
D(CPI(-1))	0.004912 (0.11348) [0.04328]	0.537863 (0.10791) [4.98423]	-56714.81 (179799.) [-0.31543]	-268435.7 (268599.) [-0.99939]
D(CPI(-2))	-0.248939 (0.10918) [-2.28001]	-0.256070 (0.10383) [-2.46632]	166403.1 (172991.) [0.96192]	31157.19 (258428.) [0.12056]
D(FDI(-1))	-4.98E-08 (7.7E-08) [-0.64556]	-1.62E-07 (7.3E-08) [-2.21484]	-0.775057 (0.12223) [-6.34074]	0.331958 (0.18260) [1.81792]
D(FDI(-2))	-8.61E-08 (7.4E-08) [-1.15567]	-2.37E-08 (7.1E-08) [-0.33464]	-0.537245 (0.11803) [-4.55167]	0.206707 (0.17633) [1.17230]
D(FPI(-1))	7.45E-08	-1.39E-07	-0.000580	-0.512451

	(5.2E-08)	(4.9E-08)	(0.08245)	(0.12317)
	[1.43077]	[-2.81340]	[-0.00704]	[-4.16036]
D(FPI(-2))	6.05E-08	-8.84E-08	-0.152056	-0.338950
	(4.9E-08)	(4.7E-08)	(0.07783)	(0.11627)
	[1.23071]	[-1.89304]	[-1.95373]	[-2.91529]
C	-0.000348	-1.88E-05	-6.888057	1666.830
	(0.00119)	(0.00113)	(1887.39)	(2819.53)
	[-0.29255]	[-0.01657]	[-0.00365]	[0.59117]
R-squared	0.438238	0.499175	0.470967	0.439852
Adj. R-squared	0.368979	0.437429	0.405744	0.370793
Sum sq. resids	0.008574	0.007754	2.15E+10	4.80E+10
S.E. equation	0.010838	0.010306	17171.51	25652.16
F-statistic	6.327580	8.084382	7.220857	6.369198
Log likelihood	263.1075	267.2827	-921.7776	-955.0919
Akaike AIC	-6.098977	-6.199582	22.45247	23.25523
Schwarz SC	-5.807550	-5.908156	22.74390	23.54665
Mean dependent	-8.15E-05	4.02E-06	-154.7711	1091.012
S.D. dependent	0.013643	0.013741	22275.20	32339.05

Determinant resid covariance (dof adj.)	1.58E+09
Determinant resid covariance	9.47E+08
Log likelihood	-1328.851
Akaike information criterion	33.08074
Schwarz criterion	34.36302

Appendix A2 – Markov Switching Model

MARKOV MODEL

Dependent Variable: GDP_GROWTH
Method: Markov Switching Regression (BFGS / Marquardt steps)
Date: 10/25/18 Time: 22:01
Sample (adjusted): 12/01/1996 12/01/2016
Included observations: 81 after adjustments
Number of states: 2
Initial probabilities obtained from ergodic solution
Standard errors & covariance computed using observed Hessian
Random search: 25 starting values with 10 iterations using 1 standard
deviation (rng=kn, seed=1713475399)
Convergence achieved after 19 iterations

Variable	Coefficient	Std. Error	z-Statistic	Prob.
		Regime 1		
C	0.034384	0.004404	7.807604	0.0000
DREPO	-0.467438	0.106308	-4.397020	0.0000
DTAX	1.269211	0.443857	2.859505	0.0042
DTCF	9.19E-09	1.74E-07	0.052834	0.9579
FPI	-2.18E-07	1.29E-07	-1.691393	0.0908
FDI	3.57E-07	1.99E-07	1.793418	0.0729
		Regime 2		
C	0.021983	0.003721	5.908054	0.0000
DREPO	0.313284	0.119771	2.615688	0.0089
DTAX	-1.733477	0.391516	-4.427600	0.0000
DTCF	-1.13E-07	3.79E-08	-2.982451	0.0029
FPI	-1.03E-08	4.46E-08	-0.231000	0.8173
FDI	-1.97E-07	6.43E-08	-3.063758	0.0022
		Common		
AR(1)	0.214860	0.205558	1.045252	0.2959
AR(2)	-0.121314	0.186694	-0.649801	0.5158
AR(3)	0.385045	0.151600	2.539883	0.0111
AR(4)	0.289589	0.184695	1.567930	0.1169
LOG(SIGMA)	-5.166518	0.114610	-45.07912	0.0000
		Transition Matrix Parameters		
P11-C	-0.521977	0.737250	-0.708005	0.4789
P21-C	-1.362571	0.506675	-2.689241	0.0072

Mean dependent var	0.023882	S.D. dependent var	0.010822
S.E. of regression	0.011896	Sum squared resid	0.009056
Durbin-Watson stat	2.170124	Log likelihood	274.5629
Akaike info criterion	-6.310194	Schwarz criterion	-5.748533
Hannan-Quinn criter.	-6.084848		

Inverted AR Roots	.92	-.11-.80i	-.11+.80i	-.48

Equation: EQ02

Date: 10/25/18 Time: 22:04
Transition summary: Constant Markov transition
probabilities and expected durations
Sample (adjusted): 12/01/1996 12/01/2016
Included observations: 81 after adjustments

Constant transition probabilities:
P(i, k) = P(s(t) = k | s(t-1) = i)
(row = i / column = j)

	1	2
1	0.372390	0.627610
2	0.203823	0.796177

Constant expected durations:

	1	2
	1.593346	4.906222

Dependent Variable: ALSI_RT
Method: Markov Switching Regression (BFGS / Marquardt steps)
Date: 10/25/18 Time: 22:07
Sample (adjusted): 12/01/1996 12/01/2016
Included observations: 81 after adjustments
Number of states: 2
Initial probabilities obtained from ergodic solution
Standard errors & covariance computed using observed Hessian
Random search: 25 starting values with 10 iterations using 1 standard
deviation (rng=kn, seed=1713475399)
Convergence achieved after 20 iterations

Variable	Coefficient	Std. Error	z-Statistic	Prob.
Regime 1				
C	0.083661	0.008678	9.640651	0.0000
DREPO	-0.419804	0.606761	-0.691876	0.4890
DTAX	2.592084	1.636614	1.583809	0.1132
DTCF	4.47E-07	3.60E-07	1.242816	0.2139
FPI	-3.45E-07	4.48E-07	-0.769909	0.4414
FDI	1.03E-06	4.84E-07	2.133080	0.0329

Regime 2				
C	-0.061603	0.009102	-6.768121	0.0000
DREPO	-2.369355	0.565818	-4.187484	0.0000
DTAX	-0.954427	2.282378	-0.418172	0.6758
DTCF	-2.02E-07	2.23E-07	-0.905978	0.3649
FPI	1.93E-06	3.11E-07	6.216277	0.0000
FDI	1.60E-06	4.58E-07	3.489754	0.0005
Common				
AR(1)	0.024103	0.179041	0.134621	0.8929
AR(2)	-0.238883	0.194800	-1.226298	0.2201
AR(3)	0.452187	0.149171	3.031333	0.0024
AR(4)	-0.157098	0.186302	-0.843244	0.3991
LOG(SIGMA)	-3.508295	0.113614	-30.87906	0.0000
Transition Matrix Parameters				
P11-C	0.389303	0.465132	0.836973	0.4026
P21-C	0.132022	0.452588	0.291706	0.7705

Mean dependent var	0.029607	S.D. dependent var	0.079133
S.E. of regression	0.078827	Sum squared resid	0.397675
Durbin-Watson stat	1.742491	Log likelihood	123.6774
Akaike info criterion	-2.584628	Schwarz criterion	-2.022967
Hannan-Quinn criter.	-2.359282		
Inverted AR Roots	.43-.17i	.43+.17i	-.42+.75i	-.42-.75i

Equation: EQ02
Date: 10/25/18 Time: 22:08
Transition summary: Constant Markov transition
probabilities and expected durations
Sample (adjusted): 12/01/1996 12/01/2016
Included observations: 81 after adjustments

Constant transition probabilities:
P(i, k) = P(s(t) = k | s(t-1) = i)
(row = i / column = j)

	1	2
1	0.596115	0.403885
2	0.532958	0.467042

Constant expected durations:

	1	2
	2.475952	1.876321

Appendix A3 – Granger Causality

E) ALSI RT, FDI, FPI, dREPO, dTAX, dTCF

VAR Lag Order Selection
Criteria
Endogenous variables: ALSI_RT DREPO DTAX DTCF
FDI FPI
Exogenous variables: C
Date: 06/21/18 Time: 17:50
Sample: 9/01/1995 12/01/2016
Included observations: 78

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1968.357	NA	3.90e+14	50.62453	50.80581*	50.69710*
1	-1919.919	88.18088	2.84e+14*	50.30562*	51.57462	50.81362
2	-1905.077	24.73721	4.97e+14	50.84812	53.20483	51.79156
3	-1862.875	63.84362	4.42e+14	50.68911	54.13353	52.06797
4	-1836.566	35.75294	6.14e+14	50.93760	55.46973	52.75189
5	-1805.905	36.95065	8.08e+14	51.07449	56.69434	53.32422
6	-1790.383	16.31819	1.70e+15	51.59956	58.30712	54.28472
7	-1732.347	52.08369*	1.34e+15	51.03454	58.82980	54.15512

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Vector Autoregression Estimates
Date: 06/21/18 Time: 18:03
Sample (adjusted): 3/01/1996 12/01/2016
Included observations: 84 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	ALSI_RT	DREPO	DTAX	DTCF	FDI	FPI
ALSI_RT(-1)	-0.004460	0.058937	0.001057	17214.15	-14065.08	12056.28
	(0.11804)	(0.01409)	(0.00488)	(29904.2)	(26440.6)	(44646.4)
	[-0.03778]	[4.18259]	[0.21677]	[0.57564]	[-0.53195]	[0.27004]
DREPO(-1)	-3.376825	0.536615	0.020417	-117711.8	-65768.02	-201494.7
	(0.83307)	(0.09945)	(0.03441)	(211051.)	(186606.)	(315096.)
	[-4.05345]	[5.39590]	[0.59336]	[-0.55774]	[-0.35244]	[-0.63947]
DTAX(-1)	2.329641	-0.287074	-0.075662	886028.4	1063123.	185260.2
	(2.72999)	(0.32589)	(0.11276)	(691617.)	(611510.)	(1032571)
	[0.85335]	[-0.88088]	[-0.67101]	[1.28110]	[1.73852]	[0.17942]
DTCF(-1)	2.97E-07	3.52E-08	2.92E-08	-0.521068	-0.093291	-0.032274
	(4.2E-07)	(5.0E-08)	(1.7E-08)	(0.10525)	(0.09306)	(0.15714)
	[0.71605]	[0.70881]	[1.70022]	[-4.95064]	[-1.00246]	[-0.20539]
FDI(-1)	-3.53E-07	-5.03E-08	-3.66E-08	0.108822	0.027854	0.047990
	(6.0E-07)	(7.2E-08)	(2.5E-08)	(0.15316)	(0.13542)	(0.22866)
	[-0.58386]	[-0.69634]	[-1.46398]	[0.71051]	[0.20568]	[0.20987]
FPI(-1)	2.09E-07	-2.61E-08	-3.79E-08	-0.093397	-0.035402	0.302408
	(4.1E-07)	(4.8E-08)	(1.7E-08)	(0.10269)	(0.09080)	(0.15332)
	[0.51475]	[-0.53954]	[-2.26357]	[-0.90948]	[-0.38990]	[1.97242]
C	0.024787	-0.001814	0.000914	211.9086	3841.217	9027.527
	(0.01003)	(0.00120)	(0.00041)	(2540.39)	(2246.14)	(3792.75)
	[2.47193]	[-1.51507]	[2.20774]	[0.08342]	[1.71014]	[2.38021]
R-squared	0.216418	0.330563	0.085115	0.306455	0.060303	0.087259
Adj. R-squared	0.155360	0.278399	0.013825	0.252412	-0.012920	0.016136
Sum sq. resids	0.400746	0.005711	0.000684	2.57E+10	2.01E+10	5.73E+10
S.E. equation	0.072142	0.008612	0.002980	18276.52	16159.64	27286.52
F-statistic	3.544451	6.336993	1.193923	5.670621	0.823554	1.226877
Log likelihood	105.3094	283.8499	373.0013	-939.8597	-929.5192	-973.5248
Akaike AIC	-2.340700	-6.591665	-8.714316	22.54428	22.29808	23.34583
Schwarz SC	-2.138132	-6.389097	-8.511748	22.74685	22.50064	23.54840
Mean dependent	0.030127	-0.001042	0.000319	67.55952	3403.845	13574.90
S.D. dependent	0.078497	0.010138	0.003001	21137.93	16056.25	27509.37

Determinant resid covariance (dof adj.)	1.21E+14

Determinant resid covariance	7.15E+13
Log likelihood	-2054.983
Akaike information criterion	49.92818
Schwarz criterion	51.14358

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 06/21/18 Time: 18:03
Sample: 9/01/1995 12/01/2016
Included observations: 84

Dependent variable: ALSI_RT

Excluded	Chi-sq	df	Prob.
DREPO	16.43044	1	0.0001
DTAX	0.728209	1	0.3935
DTCF	0.512730	1	0.4740
FDI	0.340890	1	0.5593
FPI	0.264967	1	0.6067
All	18.24941	5	0.0026

Dependent variable: DREPO

Excluded	Chi-sq	df	Prob.
ALSI_RT	17.49408	1	0.0000
DTAX	0.775954	1	0.3784
DTCF	0.502417	1	0.4784
FDI	0.484891	1	0.4862
FPI	0.291104	1	0.5895
All	19.94507	5	0.0013

Dependent variable: DTAX

Excluded	Chi-sq	df	Prob.
ALSI_RT	0.046991	1	0.8284
DREPO	0.352080	1	0.5529
DTCF	2.890738	1	0.0891
FDI	2.143230	1	0.1432
FPI	5.123759	1	0.0236
All	7.087544	5	0.2142

Dependent variable: DTCF

Excluded	Chi-sq	df	Prob.
ALSI_RT	0.331365	1	0.5649
DREPO	0.311074	1	0.5770
DTAX	1.641211	1	0.2002
FDI	0.504831	1	0.4774
FPI	0.827152	1	0.3631
All	5.721556	5	0.3343

Dependent variable: FDI

Excluded	Chi-sq	df	Prob.
ALSI_RT	0.282972	1	0.5948
DREPO	0.124216	1	0.7245
DTAX	3.022454	1	0.0821
DTCF	1.004933	1	0.3161
FPI	0.152020	1	0.6966
All	4.786107	5	0.4425

Dependent variable: FPI

Excluded	Chi-sq	df	Prob.
ALSI_RT	0.072921	1	0.7871
DREPO	0.408923	1	0.5225
DTAX	0.032190	1	0.8576
DTCF	0.042183	1	0.8373
FDI	0.044046	1	0.8338
All	0.836640	5	0.9746

F) GDP GROWTH, FDI, FPI, dREPO, dTAX, dTCF

VAR Lag Order Selection
Criteria
Endogenous variables: GDP_GROWTH DREPO DTAX
DTCF FDI FPI
Exogenous variables: C
Date: 06/21/18 Time: 18:05
Sample: 9/01/1995 12/01/2016
Included observations: 78

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1821.013	NA	8.92e+12	46.84650	47.02778*	46.91907*
1	-1775.501	82.85552	7.01e+12*	46.60259*	47.87159	47.11060
2	-1755.228	33.78790	1.07e+13	47.00586	49.36257	47.94929
3	-1709.006	69.92568*	8.55e+12	46.74375	50.18817	48.12262
4	-1680.578	38.63359	1.12e+13	46.93790	51.47003	48.75219
5	-1654.917	30.92446	1.68e+13	47.20300	52.82285	49.45273
6	-1634.401	21.56786	3.11e+13	47.60004	54.30759	50.28519
7	-1591.080	38.87789	3.59e+13	47.41232	55.20758	50.53291

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Vector Autoregression Estimates
Date: 06/21/18 Time: 18:05
Sample (adjusted): 3/01/1996 12/01/2016
Included observations: 84 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	GDP_GROWTH	DREPO	DTAX	DTCF	FDI	FPI
GDP_GROWTH(-1)	0.240221	0.320690	-0.009924	92517.90	66561.98	-427756.4
	(0.11246)	(0.09411)	(0.03152)	(193535.)	(171151.)	(284747.)
	[2.13601]	[3.40758]	[-0.31484]	[0.47804]	[0.38891]	[-1.50223]
DREPO(-1)	-0.142354	0.369049	0.018706	-166559.3	-37594.25	-195035.9
	(0.11582)	(0.09692)	(0.03246)	(199314.)	(176261.)	(293248.)
	[-1.22910]	[3.80775]	[0.57625]	[-0.83566]	[-0.21329]	[-0.66509]
DTAX(-1)	-0.621168	-0.175132	-0.065297	919336.2	960111.0	471217.3
	(0.39795)	(0.33301)	(0.11154)	(684823.)	(605617.)	(1007574)
	[-1.56093]	[-0.52591]	[-0.58542]	[1.34244]	[1.58534]	[0.46768]
DTCF(-1)	4.77E-08	2.22E-08	2.81E-08	-0.524903	-0.082659	-0.060944
	(6.1E-08)	(5.1E-08)	(1.7E-08)	(0.10473)	(0.09261)	(0.15408)
	[0.78347]	[0.43657]	[1.64842]	[-5.01214]	[-0.89251]	[-0.39553]
FDI(-1)	-6.88E-08	2.95E-08	-3.69E-08	0.131994	0.025110	0.008126
	(8.9E-08)	(7.5E-08)	(2.5E-08)	(0.15327)	(0.13555)	(0.22551)
	[-0.77299]	[0.39617]	[-1.47857]	[0.86117]	[0.18525]	[0.03604]

FPI(-1)	-1.90E-08	6.70E-08	-3.69E-08	-0.066245	-0.051719	0.301094
	(5.5E-08)	(4.6E-08)	(1.5E-08)	(0.09475)	(0.08380)	(0.13941)
	[-0.34441]	[1.45442]	[-2.38938]	[-0.69912]	[-0.61721]	[2.15975]
C	0.018746	-0.009352	0.001172	-1961.131	2052.737	19854.48
	(0.00318)	(0.00266)	(0.00089)	(5471.81)	(4838.95)	(8050.63)
	[5.89548]	[-3.51480]	[1.31529]	[-0.35841]	[0.42421]	[2.46620]
R-squared	0.096172	0.286122	0.085733	0.305531	0.058699	0.112408
Adj. R-squared	0.025743	0.230495	0.014492	0.251417	-0.014649	0.043245
Sum sq. resids	0.008697	0.006090	0.000683	2.58E+10	2.01E+10	5.58E+10
S.E. equation	0.010627	0.008893	0.002979	18288.69	16173.43	26907.97
F-statistic	1.365527	5.143599	1.203415	5.646013	0.800277	1.625260
Log likelihood	266.1861	281.1504	373.0297	-939.9156	-929.5909	-972.3513
Akaike AIC	-6.171098	-6.527391	-8.714993	22.54561	22.29978	23.31789
Schwarz SC	-5.968530	-6.324823	-8.512425	22.74818	22.50235	23.52046
Mean dependent	0.024046	-0.001042	0.000319	67.55952	3403.845	13574.90
S.D. dependent	0.010767	0.010138	0.003001	21137.93	16056.25	27509.37

Determinant resid covariance (dof adj.)	3.01E+12
Determinant resid covariance	1.79E+12
Log likelihood	-1900.005
Akaike information criterion	46.23822
Schwarz criterion	47.45363

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 06/21/18 Time: 18:05
Sample: 9/01/1995 12/01/2016
Included observations: 84

Dependent variable: GDP_GROWTH

Excluded	Chi-sq	df	Prob.
DREPO	1.510675	1	0.2190
DTAX	2.436514	1	0.1185
DTCF	0.613820	1	0.4334
FDI	0.597507	1	0.4395
FPI	0.118619	1	0.7305
All	4.634324	5	0.4621

Dependent variable: DREPO

Excluded	Chi-sq	df	Prob.
GDP_GRO			
WTH	11.61162	1	0.0007
DTAX	0.276579	1	0.5990
DTCF	0.190593	1	0.6624
FDI	0.156950	1	0.6920
FPI	2.115324	1	0.1458
All	13.91004	5	0.0162

Dependent variable: DTAX

Excluded	Chi-sq	df	Prob.
GDP_GRO			
WTH	0.099125	1	0.7529
DREPO	0.332059	1	0.5644
DTCF	2.717276	1	0.0993
FDI	2.186161	1	0.1393
FPI	5.709136	1	0.0169
All	7.144442	5	0.2101

Dependent variable: DTCF

Excluded	Chi-sq	df	Prob.
GDP_GRO			
WTH	0.228523	1	0.6326
DREPO	0.698334	1	0.4033
DTAX	1.802152	1	0.1795
FDI	0.741617	1	0.3891
FPI	0.488774	1	0.4845
All	5.611547	5	0.3459

Dependent variable: FDI

Excluded	Chi-sq	df	Prob.
GDP_GRO			
WTH	0.151249	1	0.6973
DREPO	0.045491	1	0.8311
DTAX	2.513314	1	0.1129
DTCF	0.796576	1	0.3721
FPI	0.380945	1	0.5371
All	4.646709	5	0.4605

Dependent variable: FPI

Excluded	Chi-sq	df	Prob.
GDP_GRO			
WTH	2.256708	1	0.1330
DREPO	0.442342	1	0.5060
DTAX	0.218720	1	0.6400
DTCF	0.156442	1	0.6925
FDI	0.001299	1	0.9713
All	3.042066	5	0.6935