Analysis of South Africa's financial market relationship with business cycle indicators for financial stability

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DECLARATION

I declare that

ANALYSIS OF SOUTH AFRICA'S FINANCIAL MARKET RELATIONSHIP WITH BUSINESS CYCLE INDICATORS FOR FINANCIAL STABILITY

is s my own independent work and that all resources that have been quoted or used have been fully acknowledged and indicated by means of complete references, and that this dissertation has in no manner either in its entirety or in part, been submitted for degree purposes at another university.

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Chama Chipeta

DEDICATION

"For the foolishness of God is wiser than man's wisdom, and the weakness of God is stronger than man's strength (1 Cor. 1:25). For of Him, and in Him, are all things: **to Him be the glory, to the ages**. Amen! (Rom. 11:36)"

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LETTER FROM THE LANGUAGE EDITORS

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TO WHOM IT MAY CONCERN

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ABSTRACT

Keywords:

Bond market, business cycles, capital market, commodity market, exchange rate market, Johannesburg Stock Market, South Africa.

Various developments spearheaded by social, political and economic behaviour have shaped both the soundness and the vulnerability of the market economy through direct and indirect mechanisms. Retrospective observation of past and present economic and financial patterns indicate that the economy undergoes alternating phases, characterised by periods of recessions and expansions caused by different factors. Knowledge and understanding of such patterns, their basic and scientific nature as well as their causes and potential indicators, has proved to be socially, politically and economically profitable for policy setting, including the uplifting of the social and economic agendas. To prevent or, at least, curb or mitigate the potential effects of likely financial crises, which may resultantly affect both the financial and real economy, it is important that a large contingent of economic agents, specifically investors, scholars and practitioners, predict behavioural dynamics of market fluctuations and their potential ramifications.

For an emerging economy such as South Africa's, ensuring the stability of the financial sector is critical for avoiding further economic stagnation amid pre-existing heightened unemployment, poverty and inequality as well as relatively low growth trajectories. This study examined the co-movement or the explanatory capacity of South Africa's subcomponent variables of the composite business cycle indicators (BCIs) in explaining the behaviour and patterns of the financial market. Specifically, the financial market's capital markets included the stock, bond and commodity and exchange rate markets. The aim of the research was to identify whether the component series of the composite BCIs can serve as leading, lagging or coinciding indicators of each of the capital market segments.

A diverse set of econometric models and methods were employed. These included the cross-correlations test, the Granger causality model, variance decomposition, the Generalised Autoregressive Conditional Heteroscedasticity (GARCH) process, and an autoregressive distributed lag (ARDL) model. Results revealed that South Africa's official component series of the composite BCIs have explanatory power over the capital market segments. Based on the observation of turning points showcased by the chart analysis, varying time-series of the BCIs were identified to exhibit leading, lagging and coinciding properties with the stock, bond,

commodity and exchange rate market. Accordingly, these indicators provided causal signals of the various capital markets with cyclical attributes of pro-cyclicality and counter-cyclicality with the capital markets. Nevertheless, a small sample of BCIs were acyclical to the market segments. Findings of concordance between identified leading series of each capital market were at least reiterated by the analysed short and long-run cointegration analysis based on the ARDL model.

The study conclusively established that South Africa's official subcomponents of the composite BCIs are not only valuable resource indicators on a macroeconomic context, they are also key signals for the interpretation of financial market or capital market analysis. These indicators can thus be useful in formulating macroprudential or monetary policy for maintaining financial market stability and are not limited to mere macroeconomic policy. The combined use of both financial and real economic time-series for financial market analysis can amplify the understanding of turning points of the stock, bond, commodity and exchange rate. Likewise, component series of the composite BCIs can also be used by investors in gauging the market sentiments for sound and value judgement to increase profitability. Thus, business cycle aggregates cannot only serve as a reflection of the real economy, but also, as a metric and gauge for financial sector dynamics and attitudes.

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LIST OF ABBREVIATIONS

ADF	-	Augmented Dickey Fuller
AIC	-	Akaike Information Criterion
ALBI	-	All Bond Index
ALCI	-	All-Commodity Index
ALSI	-	All-Share Index
AMEX	-	American Stock Exchange
AMH	-	Adaptive Market Hypothesis
AR	-	Autoregressive
ARCH	-	Autoregressive Conditional Heteroscedasticity Model
ARDL	-	Autoregressive Distributed Lag Model
ARIMA	-	Autoregressive Integrated Moving Average
ARMA	-	Autoregressive Moving Averages
AUD	-	Australian Dollar
BB	-	Bank-based financial system
BCBS	-	Basel Committee on Banking Supervision
BCIs	-	Business Cycle Indicators
BESA	-	Bond Exchange of South African
BIS	-	Bank of International Settlements
CAD	-	Canadian Dollar
CCF	-	Cross-Correlation Function
CISCA	-	Collective Investment Schemes Control Act
CPI	-	Consumer Price Index
CUSUM	-	Cumulative Sum of Recursive Residuals
DF	-	Dickey-Fuller Test
DFM	-	Dynamic Factor Model

DSGE	-	Dynamic Stochastic General Equilibrium
ECM	-	Error Correction Model
ECT	-	Error Correction Term
EIC	-	Economy-Industry-Company
EMA	-	Exponential Moving Average
EMES	-	Emerging Market Economies
EMH	-	Efficient Market Hypothesis
EMU	-	European Monetary Union's
EU	-	European Union
EUT	-	Expected Utility Theory
EWN	-	Eyewitness News
EY	-	Ernst & Young
FAIS Act	-	Financial Advisory and Intermediary Services Act
FAVAR	-	Factor-Augmented Vector Auto-Regression Model
FDI	-	Foreign Direct Investment
FMA	-	Financial Markets Act
FSB	-	Financial Stability Board
FSCA	-	Financial Sector Conduct Authority
FSR	-	Financial Sector Regulation Act
G20	-	Group of Twenty
GARCH	-	Generalised Autoregressive Conditional Heteroscedasticity
GBP	-	British Pound
GDP	-	Gross Domestic Product
GLS	-	Generalized Least Squares
GSCI	-	Goldman Sachs Commodity Index

HP	-	Hodrick-Prescott Filter
HQC	-	Hannan–Quinn Information Criterion
IMF	-	International Monetary Fund
IOSCO	-	International Organization of Securities Commissions
JPY	-	Japanese Yen
JSE	-	Johannesburg Stock Market
LCOI1	-	Gross Value Added at Constant Prices, Excluding Agriculture, Forestry & Fishing
LCOI2	-	Total Formal Non-Agricultural Employment
LCOI3	-	Value of Retail & New Vehicle Sales at Constant Prices
LCOI4	-	Industrial Production Index
LCOI5	-	The utilisation of production capacity in manufacturing
LLAI1	-	Cement Sales (In Tons)
LLAI2	-	Value of non-residential buildings completed at constant prices
LLAI3	-	The ratio of gross fixed capital formation in machinery & equipment to final consumption expenditure on goods by households
LLAI4	-	The ratio of inventories to sales in manufacturing & trade
LLAI5	-	Nominal labour cost per unit of production in the manufacturing sector: Percentage change over twelve months
LLAI6	-	Predominant prime overdraft rate of banks
LLAI7	-	The ratio of consumer instalment sale credit to the disposable income of households
LLEI1	-	Job advertisement space in the *Sunday Times* newspaper: percentage change over twelve months
LLEI2	-	Number of residential building plans passed for flats, townhouses & houses larger than 80m’

LLEI3	-	Interest Rate Spread: 1-Year Government Bonds Less 91-Dat Treasury Bills
LLEI4	-	Real M1 money supply (Deflated with CPI) * Six-Month smoothed Growth Rate
LLEI5	-	Index of commodity prices (In US Dollar) for a basket of South African-product export commodities
LLEI6	-	A composite leading indicator of South Africa's major trading partner countries: percentage changes over twelve months
LLEI7	-	Gross operating surplus as a percentage of gross domestic product
LLEI8	-	RMB/BER Business Confidence Index
LLEI9	-	The new balance of manufacturers observing an increase in the average number of hrs. worked per factory worker (half weight)
LLEI10	-	The net balance of manufacturers observing an increase in the volume of domestic order received (half weight)
LLEI11	-	Number of new passengers
LM	-	Lagranges Multiplier Test
M2	-	Money Supply
MA	-	Moving Average
MACD	-	Moving Average Convergence/Divergence
MB	-	Market-based financial system
MEC	-	Minerals and Energy Complex
MPT	-	Modern Portfolio Theory
MTFS	-	Multiple Trading Platforms
NASDAQ	-	National Association of Securities Dealers Automated Quotation
NBER	-	National Bureau of Economic Research
NFCS	-	Non-Financial Companies

NYSE	-	New York Stock Exchange
OAS	-	Option-Adjusted Spread
OECD	-	Organisation for Economic Co-Operation and Development
PIC	-	Public Investment Commissioners
PT	-	Prospect Theory
PWC	-	PricewaterhouseCoopers
RBC	-	Real Business Cycle Theory
REER	-	Real Effective Exchange Rate
REH	-	Rational Expectations Hypothesis
REITs	-	Real Estate Investment Trusts
RMB	-	Rand Merchant Bank
RSI	-	Relative Strength Index
RWH	-	Random Walk Hypothesis
SAFEX	-	South African Futures Exchange
SARB	-	South African Reserve Bank
SIC	-	Schwarz Information Criterion
SSA	-	Securities Services Act
Stats SA	-	Statistics South Africa
SVAR	-	Structural Vector Autoregressive Method
TARCH	-	Threshold Autoregressive Conditional Heteroscedasticity Model
UNCTAD	-	United Nations Conference on Trade and Development
UNDP	-	United Nations Development Programme
USA	-	United States of America
USD	-	United States Dollar
VAR	-	Vector Autoregression

VAR	-	Vector Autoregressive Model
VECM	-	Vector Error Correction Models
VIX	-	Volatility Index
ZAR	-	South African Rand

CHAPTER 1: INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

The financial market is an integral part of any vigorous and well-functioning economy (OECD, 2009:7; Evans & Moten, 2011:5). Sub-Saharan countries, such as South Africa, have witnessed the deepening of financial systems and increased prominence of the financial market over the past years, partially driven by improvements in the institutional finance framework and increased demand (Beck, Fuchs & Uy, 2009:37; Andrianaivo & Yartey, 2010:395). Nevertheless, South Africa's financial market and global investment landscape continue to be pressured by uncertainty arising from social and economic impediments as well as geopolitical factors (EY, 2017:9). Moreover, South Africa's post-crisis recovery and growth performance following the 2008-09 financial recession has been relatively weak (OECD, 2013:4; Mminele, 2017:5). Concerns about (another) potential recession, which may undermine economic performance, accentuates the need to understand the financial market behaviour in guiding decisions of investors and policy agents. Amongst the general financial market segments are the capital market and money market, which respectively account for long-term and short-term financing or traded financial assets (Capital Market Authority, 2012:20). In particular, this thesis examines South Africa's heterogeneous capital markets such as the bond market, commodity market, the exchange rate market and the stock market, in relation to the country's leading, lagging, and coincident business cycle indicators (BCIs). The study seeks to ascertain the interactive relationships and usefulness of South Africa's BCIs in correspondence with their probable or unlikely capacity to lead, lag or coincide with the aforementioned capital markets.

Nwankwo (1998:146) and Al-Faki (2006:6-9) opined that capital markets are defined by the composition of complex and specialised financial institutions and mechanisms which facilitate and pool long-term and intermediate funds to be made available for investment purposes to government, businesses and individuals for economic development. Enquiries pertaining to factors which move financial cycles, regarding the demand and supply of assets and credit, relate to the very basic principles of supply and demand governing business cycle or real sector fluctuations (Nason & Tallman, 2016: 840-443). Ideally, such an understanding, at least, links the behaviour of financial market cycles to business cycles. There is an extensive body of theoretical and empirical traditional literature (Avouyi-Dovi & Matheron, 2005; Braun & Larrain, 2005; Claessens, Kose & Terrones, 2012) dedicated to examining and modelling the linkages between the various economic factors and the financial market. However, the scope of most studies on BCI's and the various financial markets has amply covered research

pertaining to developed economies, thereby highlighting the state of infancy and underdevelopment of Africa's financial market structures (Allen, Otchere & Senbet, 2011:80; Tita & Meshach, 2016:4).

In terms of the meagre amount of literature dedicated to the African economic landscape, studies have remotely perused the stock market relative to leading BCIs, with fairly limited attention paid to other BCIs (coincident and lagging indicators) and financial markets. For instance, Moolman and Jordaan (2005) investigated whether the direction of South Africa's commercial share price index can be explained by the leading BCIs. Jefferis and Okeahalam (2000), and Van Rensburg (1995, 1998, 1999), amongst others, sought to analyse the determinants of the commercial Johannesburg Stock Market (JSE) Index.

In broad terms, the financial market's research orientation has largely been accompanied by efforts to forecast movements of heterogeneous capital and money markets with the help of micro-finance or market indicators, and/or broad economic indicators based on either technical or fundamental analysis, or both (Larsen, 2010:1; Rusu & Rusu, 2003:104). Asteriou and Hall (2007:230) opine that time series analysis consists of two principal forms of analysis characterised by forecasting and dynamic modelling. Simply put, time series forecasting deals with the development of efficient forecasting models, whereas dynamic modelling attributes to itself the understanding of economic structures and hypothesis testing. The field of financial econometric studies has traditionally encompassed a series of forecast modelling methods, including dynamic and regression modelling as well as other scientific methods. Such methods include, *inter alia*, forms of Dynamic Stochastic General Equilibrium (DSGE) models, Autoregressive Integrated Moving Average (ARIMA) methods, Dynamic Factor Models (DFMs) and the Vector Autoregression (VAR) models of the classical and Bayesian variants (Muradoglu, Metin & Argac, 2001:641-649; TSAY, 2005:48-63; Asteriou & Hall, 2007:230-247; Liu, 2008:7-27; Casassus & Higuera, 2011).

A traditional view generally applied to the index of corporate stock prices is that movements in stock prices precede real economic activity variations, making them suitable for providing signals of future changes in the economy (Bosworth, Hymans & Modigliani, 1975:257-258; Carlstrom, Fuerst & Ioannidou, 2002:1-3). The stock market also presents direct effects on real economic activity (Pearce, 1983:7-8). Moolman (2003:289-303) argues that South Africa's commercial share price index tends to lead the business cycle by six months, making it a leading economic indicator. However, Moolman and Jordaan (2005:68-78) contend that although stock prices are considered to be leading indicators, other BCIs tend to lead the

business cycle over longer periods and can, therefore, be used to signal the direction of the movement in the commercial share price. This narrative is considered in conceptualising the stock market and other capital markets (the bond market, exchange rate market and the commodity market) in regard to BCIs.

During the formative years of 1946 to 1970, the South African Reserve Bank (SARB) began to gauge business cycles based on the "growth cycle" definition. The latter accentuates fluctuations in aggregate economic activities' long-term growth trends, also known as the trend adjusted business cycles (Venter, 2005:1b). This approach is contrary to the classical definition of business cycles, which highlights periods of complete expansions in aggregate economic activity, accompanied by complete contractions in aggregate real economic activity (Venter, 2016:102). The analysis of financial variables based on the latter definition may nevertheless present problems in forecasting as periods of short-lived cycles as well as periods in which certain economic sectors may undergo downturns relative to others and may not be reflected by the classical definition's implied overall business cycle recession and expansion dates. For that reason, the present study focuses on South Africa's individual time series economic indicators as well as the composite indices, to examine the asymmetries between the financial market and BCIs.

The use of BCIs to track changes in economic business cycles began in efforts to identify reference turning points (peaks and troughs) of the business cycle. These indicators are conjured through the integration of numerous BCIs to form single indices of each of the three composite indices (leading, coincident and lagging) of the business cycle (Venter, 2005:1-5b). Composite BCIs are monitored on a continual basis to identify early indications of likely reference turning points. The grouping of indicators into a single composite is said to offset the variations against each other, in the different series (Provincial treasury, 2012). A country's leading, lagging and coincident BCIs, which are used to track changes in business cycles, underlie the central business cycle theory for economic analysis and forecasting. Assessing BCIs in line with financial market cycles arise depending on whether these indicators lead, lag or coincide with the various capital markets. In particular, this examines whether real sector activities determine financial market cycles.

Basic economic literature propagates the linkages between financial markets and business cycles based on credit prices (as explained via the credit channel) and asset prices, *i.e.* housing and equity prices (Claessens *et al*., 2012:178). Oliveira (2014:20) emphasises that the interactions between financial and business cycles are amassed by a series of processes derived

from financial market segments, such as equity indexes and the real estate, *inter alia*, which influence business cycle dynamics. Other linkages are amplified through channels involving the financial accelerator and other related mechanisms (Avouyi-Dovi & Matheron, 2005; Braun & Larrain, 2005:1097; Claessens *et al*., 2012). For instance, Kvietkauskienė and Plakys (2017:59-84) assert that conditions of economic contractions and recoveries present changes in the market's volatility and returns. Holmes and Maghrebi (2016:1) furthermore note that expected future economic conditions affect the capital market's stock market, whereas market returns reliably affect the business cycle. As such, market prices tend to conclusively fluctuate relative to BCIs, which are able to affect market returns. Meanwhile, financial market performance can be considered a pro-cyclical barometer of real economic activities as previously elaborated with regard to the stock market. Considering the business cycle's commanding capacity to gauge overall economic performance, it is presumably ideal for some BCIs, if not all, to reveal certain facets of the movements in individual capital markets. Henceforth, synchronisation or co-movement in both cyclical movements of the heterogeneous capital markets and the BCIs is anticipated.

1.2 PROBLEM STATEMENT

Sustained economic development can be ensured through building it on the key foundations of a well-functioning financial system (Demirguc-Kunt, 2006:1). From the outset, the financial market has been marked by growing public and investor interest, led by incentives of profit-making investment opportunities. Nevertheless, episodes of market uncertainty and increased volatility, as depicted by the 2007/08 global economic crisis, which is often regarded as the worst crisis following the economic downturn of the 1930s, tends to lead towards attitudes of heightened risk-aversion, driven by uncertainty on certain assets' fundamental value (SARB, 2017:2a). In particular, effects of the 2007/08 financial market meltdown were characterised by the global recession in the form of the deterioration of standards of living, the collapse of large financial institutions, global stock market downturns, plummeting aggregate consumer spending as well as a great decline in general activity and aggregate demand (Helleiner, 2011:67-87; Shahrokhi, 2011:193-210). Such occurrences at least confirm the excessive linkages between real economic performance and financial stability (SARB, 2017:2a). To avoid loss encountered by financial market distress, economic agents are faced with the never-ending need to understand the direction and behaviour of market prices in order to exercise structured and prudent decision making.

The 2007/08 financial crisis has proven that the functionality of the financial sector and its markets are a crucial economic component. The wellbeing of its functionality is unquestionably a prime factor in assessing the performance of the rest of the economy (Baily & Elliot, 2013:5). Instability within the country's financial market is, however, inevitably detrimental to economic growth (Van der Merwe, 1999:229). South Africa's capital market institutions play a vital role in this country's processes of economic development. Being one of the biggest developing economies, Khetsi and Mongale (2015:154) note that South Africa's stock market alone largely accounts for the country's gross domestic product (GDP) and is comparable to other developing economies such as Indonesia and Brazil. Alile (1997) and Ekundayo (2002) also highlight that large investment volumes acquired internationally and locally are essential for a nation to establish sustainable development and enhanced economic growth.

According to the International Monetary Fund (2014:7), South Africa's financial markets operate in a challenging economic environment where financial institutions are increasingly exposed to credit risk. Meanwhile, the rise in interest rates leaves households and firms vulnerable, while large current account and fiscal deficits, a sluggish economic outlook as well as other deteriorating economic factors, makes South Africa susceptible to sudden capital flow shocks and contagion (The International Monetary Fund, 2014:7). In a pragmatic world of imperfect information, market uncertainty and volatility are overwhelming matters for both market participants and policy authorities. Caprio and Honohan (1999) illustrated that high-income countries tend to be characterised by greater forms of volatilities due to greater economic concentration. The understanding that uncertainty and volatility are crucial matters for developed economies, presents an even greater concern for a developing nation such as South Africa.

A common trait immersed in a wealth of literature dedicated to understanding financial market behaviour is inherently characterised by the gauging of financial market performance based on market-specific indicators as well as on selected economic factors. Focus on lagged values of market-specific indicators, such as default risk or term premium measures, earning-price ratios, interest rates and dividend yields, has underlined prime efforts to capture inferences and forecasts of capital market trends (Chauvet & Potter, 2000:88). However, Plachý and Rasovec (2015:101) note that the value and volume of capital market transactions executed are not solely influenced by market-related factors, but by the state of economic development and conditions on a macro level as well. Ideally, economic theory assumes that no market operates

in isolation; thus, analysing financial markets based on business cycles or economic performance is not farfetched.

Considering the financial market's pertinent and crucial role in the economy, it is essential to understand the functionality and interrelations of capital markets and BCIs. Despite the financial market and/or capital market's crucial role in steering and stimulating economic growth and development, as mentioned earlier, minimal study has been undertaken on the subject of the capital market and business cycles, especially within developing economies. This, despite the apparent and serious need to tap into the financial market's potential to steer growth and development and the need to enforce sustained financial market stability. These highlighted issues underscore a critical challenge to policymakers and research scholars and necessitate further analysis of the BCIs and capital market nexus. This matter is a challenge in the mitigation of financial market uncertainty amid financial development processes and the conduct of monetary economic policy. Further examination of the subject matter may serve as a prerequisite towards policymakers' ability to maximise the positive externalities affiliated with financial market development and information sharing while executing measures to mitigate likely financial market and economic contingencies for enhanced and sustainable growth. Understanding the relationships between the financial sector and the real sector across the different phases of the financial cycle and business cycle remains limited. Turning points of both financial and business cycles in South Africa are yet to be scrutinised relative to other empirical studies of emerging and developed economies.

1.3 OBJECTIVES OF THE STUDY

1.3.1 Primary research objectives

The central objective of the study is to explore the capacity of South Africa’s threshold BCIs in leading, coinciding or lagging behind the heterogeneous capital markets.

1.3.2 Theoretical research objectives

Various theoretical objectives were pursued in fulfilment of the study’s primary objective:

- To provide a conceptual distinction between the financial market's capital and money markets, as well as the underlying definitions and concepts of the various capital market segments (the stock or equity market, the bond market, exchange rate market and the commodity market);
- To review the potential criteria for identifying economic factors as suitable indicators;

- To provide theoretical underpinnings of business cycle definitions and concepts;
- To establish a conceptual analysis of economic theory relevant to business cycles and financial cycles;
- To review the policy insinuations of the financial market environment and the historical or trend performance of financial market cycles relative to BCIs; and
- To review literature and empirical findings on the relationships between BCIs and the equity market, the bond market, exchange rate market and the commodity market.

1.3.3 Empirical research objectives

The study subsequently yielded the following empirical objectives:

- To examine the capacity of BCIs in explaining capital market segments or, more simply put, whether BCIs lead, lag or coincide with the capital market's stock or equity market, the bond market, exchange rate market and the commodity market. This objective sought to determine whether BCIs are suitable gauging indicators and predictors of South Africa's capital markets. To achieve this objective, the study made concurrent use of Granger causality and cross-correlation tests, with prior usage of the ARIMA model for the prewhitening and filtering of data series. The variance decomposition analysis was subsequently presented to confirm established findings;
- To establish the relative nature of cyclicality of BCIs to capital market segments. Cross-correlation signals were utilised in identifying series as pro-cyclical, counter-cyclical or acyclical;
- To model the volatility of the equity, bond, commodity and exchange rate markets on South Africa's BCIs. The underlying objective assisted in analysing the relative price volatility of South Africa's capital markets in accordance with the various BCIs. The Generalised Autoregressive Conditional Heteroscedasticity (GARCH) process provided the foundation for establishing the results of the objective;
- To analyse the interrelationships or interactions of BCIs and the equity market, the bond market, the exchange rate market and the commodity market. This objective assisted in highlighting the associated short-run and long-run dynamics of South Africa's BCIs and the equity market, the bond market, exchange rate market as well as the commodity market. The study sought to achieve this objective using the Autoregressive Distributed Lag (ARDL) model;

- To provide indices of identified leading indicators for the respective capital market segments by selecting the most significant indicators. This objective was relevant in identifying suitable and relevant indicators to be utilised for the development of a composite series of each capital market indicator index respective to leading groupings. The study undertook the formally recognised mythological approach utilised by the South African Reserve Bank (SARB) to create composite indicators of the business cycle in South Africa (Van der Walt & Pretorius, 1994). The approach is also comparable to the method used by The Conference Board (2001:47) but with minor improvements and adjustments; and
- To establish whether South Africa's leading indicators are able to explain future movements or behaviour of the respective capital market segments. If achieved, this objective could assist with relaxing South Africa's financial market uncertainty for enhanced investor decision making in reference to the real sector or business cycle performance. The underlying objective was achieved through the charting of turning points of the constructed composite indices versus those of capital market movements. Charting, as a means of graphical illustration, is used in technical analysis to depict market prices and historical patterns in analysing chart patterns for future price predictions according to the extent to which they match (Leigh, Modani, Purvis & Roberts, 2002:155).

1.4 RESEARCH DESIGN AND METHODOLOGY

The thesis incorporates a qualitative analysis delineating relevant literature pertaining to the subject matter. The study also presents a quantitative analysis undertaken according to the utilisation and scrutinisation of secondary time series data of empirical assessments in order to achieve the set empirical objectives.

1.4.1 Literature review

The literature and theoretical background for the qualitative analysis of the study was supported by and sourced from miscellaneous archives, such as books, articles, thesis and other pertinent sources. These sources provided a founding theoretical and conceptual background useful in delineating the interrelationships as well as existing explanations on the capacity of BCI's to lead, lag or coincide with the stock market, bond market, exchange rate market and commodity market.

1.4.2 Data and Sample Period

The empirical background was supported by South Africa's time series data sets pertaining to the various BCIs and the stock market, bond market, exchange rate market and the commodity market. The incorporated time series covers a monthly collection of data sets over the period spanning from June 2003 until November 2017, inclusive of approximately 174 monthly observations. The selected time span was chosen based on data availability and the discounting of economic embargos characteristic of the Apartheid regime's economic system. The quantitative analysis was conducted using a series of data sets with the various capital market segments as the dependent variables, while the miscellaneous components of BCIs are the explanatory or independent variables. The collective data series of the stock market were retrieved from the Johannesburg Stock Exchange (JSE), while the real effective exchange rate was obtained from the South African Reserve Bank (SARB) and the commodity market was captured from South Africa Data Porta, whereas the time-series data of the bond market was obtained from IRESS SA (INET BFA). Collectively, time-series data sets of South Africa's component BCIs were retrieved from the SARB according to the following indicators encapsulated in Table 1.1.

Table 1.1: Composite Business Cycle Indicators of the SARB (Component time series)

Component time series of the composite business cycle indicators		
Leading indicator	**Coincident indicator**	**Lagging indicator**
Job advertisement space in the *Sunday Times* newspaper: Percentage change over twelve months	Gross value added at constant prices, excluding agriculture, forestry and fishing	Cement sales (in tons)
Number of residential building plans passed for flats, townhouses and houses larger than 80m'	Total formal non-agricultural employment	Value of non-residential buildings completed at constant prices
Interest rate spread: 1-year government bonds less 91-dat Treasury bills	Value of retail and new vehicle sales at constant prices	Ratio of gross fixed capital formation in machinery and equipment to final consumption expenditure on goods by households
Real M1 money supply (deflated by CPI)* six-month smoothed growth rate	Industrial production index	Ratio of inventories to sales in manufacturing and trade

Component time series of the composite business cycle indicators		
Leading indicator	**Coincident indicator**	**Lagging indicator**
Index of commodity prices (in US dollar) for a basket of South African-product export commodities	Utilisation of production capacity in manufacturing	Nominal labour cost per unit of production in the manufacturing sector: percentage change over twelve months
Composite leading indicator of South Africa's major trading partner countries: percentage changes over twelve months	n/a	Predominant prime overdraft rate of banks
Gross operating surplus as a percentage of gross domestic product	n/a	Ratio of consumer instalment sale credit to disposable income of households
RMB/BER Business Confidence Index	n/a	n/a
New balance of manufacturers observing an increase in the average number of hours worked per factory worker (half weight)	n/a	n/a
Net balance of manufacturers observing an increase in the volume of domestic order received (half weight)	n/a	n/a
Number of new passenger vehicle sold: percentage change over twelve months	n/a	n/a

Source: SARB Quarterly Bulletin (2015b) (description of variables as obtained from the SARB (2018)).

1.4.3 Statistical analysis

The development of financial market inferences is normally conducted based on several approaches involving fundamental and technical analysis. Mishra (2013:283) explains that these are common forms of research approaches utilised by scholars, investors, analysts and the scientific community. Investors are normally directed to depend on fundamental factors during their decision-making process based on the prominent nature of capital market instruments. Fundamental analysis often relates to factors of the specific company or industry or the overall economic environment (Roy, 2013:272). Technical analysis, on the other hand, exploits hidden implications in trading activities; this relates to the analysis of trends and

patterns exhibited in price and volume charts. On this type of basis, the former assumes that historic patterns are repetitive and the correlation between volume and prices exhibit the behaviour of the market (Kwaśnicka & Ciosmak, 2001:195-208).

The complementary use of fundamental and technical analysis to utilise their advantages and strengths could provide a well-informed scientific and research background. In the current thesis, various econometric tests and modelling methods were pursued. These include a descriptive analysis of the considered time series and further econometric tests involving the ARIMA model, the Cross-Correlation test, the Granger causality test, variance Decomposition, the GARCH model, and the ARDL model. The ARIMA model was employed as a pre-test measure of prewhitening and/or filtering the data series to remove possible autocorrelations and equip the data for further cross-correlations testing. The cross-correlations and Granger causality tests were adopted as measures of identifying potential forecasting capabilities of BCIs in predicting or forecasting capital market segments with further explanatory testing by means of variance decomposition.

In addition, GARCH processes were adopted to model the volatility of the stock, bond, commodity and exchange rate markets on South Africa's BCIs. The ARDL model was subsequently employed as a test to cointegration to capture the interrelationships of the set variables within the short and long-run. Lastly, the chart analysis, a means to technical analysis, was employed to contrast and scrutinise the behaviour and concordance of the turning points of capital markets relative to the constructed composite indicators. The latter, as leading, lagging and coinciding composites, were developed for each market based on the identified leading, lagging or coinciding properties of each BCI respective to explaining each capital market.

1.5 CONTRIBUTION OF THE STUDY

Studies dedicated to financial market analysis in developing countries such as South Africa remains an untapped and underdeveloped field. This study presents a useful contribution to the growing scientific research on the various approaches by which financial market analysis may be interpreted. The interpretation of the financial market's capital market segments is based on the performance of BCIs. In so doing, this thesis identifies the most significant BCIs which have the greatest influence and affect South Africa's capital market. Such a contribution will assist towards the general improvement of the understanding of financial market dynamics and thus empower economic agents, such as issuers and investors in designing useful trading rules

based on the study's findings, and thus help absorb long-run investment profits. Ideally, the new knowledge will also assist policymakers in setting up structured policy frameworks upon the use of the identified BCIs with the capacity to explain financial market performance in securing market stability and soundness. The maintenance of financial market stability based on the understanding of capital market's cyclical performance with the help of BCIs may assist in securing a sustainable growth and development enabling environment.

1.6 CHAPTER CLASSIFICATION

The following chapters comprise the subsequent structure and planning of the thesis.

Chapter 1: Introduction and background

This chapter yielded the introductory issues and contextual background which led to the study's subsequent analysis. The problem statement, the miscellaneous research objectives, the intended research contribution as well as the scope of the thesis were the focus of the chapter.

Chapter 2: The theory of financial markets and business cycles

This chapter delineates the relevant and applicable theory and literature that address the concerns of the thesis. Theoretical prepositions specific to financial and/or capital market cycles and business cycles are further detailed and examined by highlighting the nexus mechanisms of the business cycle and South Africa's heterogeneous capital markets.

Chapter 3: Trends and policy analysis of the financial market and the macro-economic environment

The chapter provides a concise trend and historical analysis of South Africa's capital market cycles concerning the various capital market segments and the country's business cycles regarding the set objectives. This is carried out by means of descriptive tools such as graphs, figures and tables. The chapter also delineates South Africa's financial market and business cycle policies.

Chapter 4: Empirical analysis of economic indicators and financial market relationships

This chapter presents an analysis of various bodies of literature surrounding the existing findings on the interactions between capital market segments (the stock market, exchange rate market, and the bond market) and segments of the business cycle or economic indicators (leading, lagging and coincident indicators).

Chapter 5: Research design and methodology

This chapter expounds on the time series and sample period as well as the applied statistical and econometric models relevant to the current thesis in fulfilment of the set objectives. The dynamic nature of South Africa's economic environment, particularly capital market cycles and business cycles, guided the layout and selection of suitable modelling methods to account for distortions and dynamics within the series.

Chapter 6: Results and discussion of the financial market and business cycle indicators

This chapter establishes the empirical findings and results of the thesis. The chapter subsequently provides discussions on the established empirical findings of the thesis and links these findings with theory and the recent literature.

Chapter 7: Summary, Recommendations and Conclusion

Finally, this chapter constitutes the study summary, it provides a concise conclusion of the major highlights of the study and subsequently provides recommendations, proposals and new ideas for future research.

CHAPTER 2: THE THEORY OF FINANCIAL MARKETS AND BUSINESS CYCLES

2.1 INTRODUCTION

The current ongoing economic and financial distress, following Japan's asset crash during the early 1990s, and the 2007-08 World financial crisis, has increasingly directed attention to financial market dynamics and its cycles. The growth in investment and trading levels have, over time, led to investors seeking for efficient methods and tools to increase investment gains whilst mitigating risk. The cyclical behaviour of financial aggregates is often interpreted as a means to reflect real economic sector activities as well as an outcome of the changes in overall attitudes and perceptions of both macroeconomic and financial risk (Caballero, 2010:85-105). The closely intertwined operations of the financial market and real economic activities instil interest in the study of synchronization between the financial market and macroeconomic developments.

The ruinous Great Depression, which lasted from 1929 to 1939, gave rise to early interests by Fisher (1933) and Keynes (1936) regarding the effects of macroeconomic and financial issues. They sought to make sense of and provide solutions to the foregoing economic and social instability. Since then, numerous research studies on financial and economic behaviour have emerged, with proponents of neoclassical and behavioural finance being the premier contributors. The theoretical provenance of the neoclassical school of thought is backed by influences of the classical economic theory.

Behavioural finance challenges the assertions of classical and neoclassical finance on matters of economic behaviour and decision-making of organisations and individuals. It posits that financial market cycles, such as those of the stock market, are a product of closely interrelated emotional, psychological, social, economic and even political factors, which integrate in a highly intricate manner. Neoclassical finance theories, such as the efficient market hypothesis, also concede that financial cycles are a product of stochastic and highly dynamic processes. This chapter considers and expounds on the theoretical dichotomies of financial market and economic business cycle aspects. It focusses on the manner in which theoretical foundations of finance and macroeconomic theory seek to explain market behaviour and the general welfare effects of such behaviour. Particularly, the chapter focusses on achieving objectives relating to the provision of a conceptual distinction between the financial market's capital and money markets including definitions and concepts of the various capital market segments. Also, the chapter reviews the potential and applicable criteria for the identification of economic

indicators as suitable market signals. Moreover, theoretical underpinnings of business cycle definitions and concepts were assessed, including the analysis of pertinent theory relating to business cycles and financial cycles.

2.2 THE FINANCIAL MARKET CONCEPTUALISED

Wurgler (2000:188) posits that changes in financial market movements are integral to macroeconomic fluctuations of contemporary economies, habitually resulting in either substantial economic crises or economic booms. Financial markets are assumed to be a conduit for efficient capital resource allocation and enhanced economic growth. This is initiated in a manner where capital is withdrawn from sectors with poor profit-making prospects, and invested in those with potential for high/er returns, serving as one of the driving forces behind capital resource allocation (Wurgler, 2000:188). Capital markets consequently tend to execute a twofold function: first, the provision of capital and second, good governance facilitation based on the production and monitoring of information (Tadesse, 2004:701).

Traditional definitions, according to Mishkin (1992:115-130) as cited in Van Zyl, Botha, Skerritt and Goodspeed (2009:5), conceive financial markets as a focus on markets centred on the channelling of funds across surplus and deficit economic units. Typically, these would be the markets for the borrowing and saving of money (Mishkin, 1992:115-130). Van Zyl *et al*. (2009:5) continue, stating that financial market funding can be allocated between the two economic units, through direct financing and indirect financing. Direct financing speaks to the trading of financial instruments, called securities, within the primary market (such as the stock market) for capital. This is done directly between lenders and borrowers in the absence of either banks, brokers or other forms of financial intermediaries (Simion, Stanciu & Armăşelu, 2015:1333).

Indirect financing oversees the allocation or facilitation of funds through intermediaries, such as financial institutions and/or commercial banks, through linking the demand and supply for capital by meeting the different requirements of lenders and borrowers (Öner, 2007:137). In this way, banks act as financial intermediaries (middlemen) and depository institutions that store savings deposits and further create income by channelling these deposits where funds are supplied by depositors and demanded by borrowers (Tursoy, 2018:8). Indirect financing is seen as a suitable means of financing due to the associated transactions costs and asymmetric information such as adverse selection and moral hazard, which makes direct financing more costly; whereas, both transaction and information costs are reduced in indirect funding

(Scholtens & Van Wensveen, 2003:16; Öner, 2007:137). Figure 2.1 illustrates the flow of funds within the financial market with respect to direct borrowing and lending of funds as a means of direct financing within financial markets such as the stock market. Figure 2.1 additionally schematically depicts the flow of funding in indirect financing, which is facilitated by financial intermediaries, such as commercial banks, in channelling the supply and demand for savings deposits or funds.

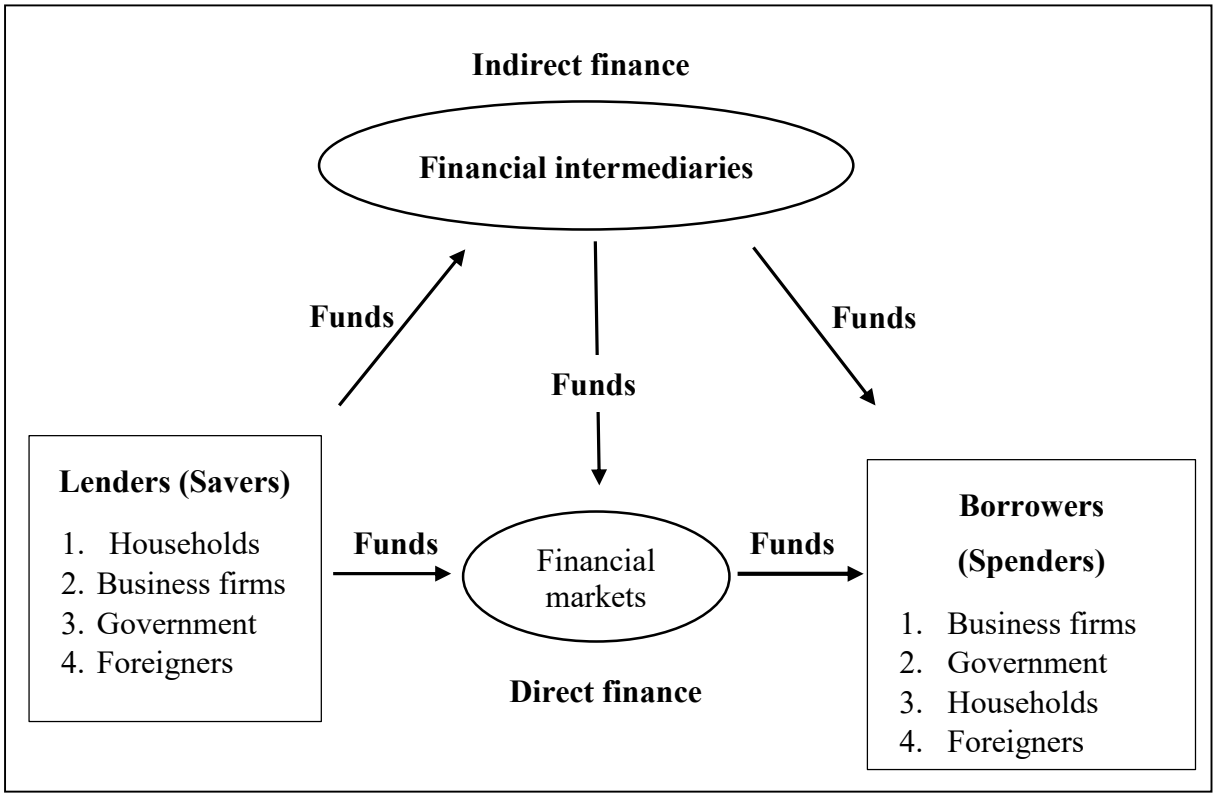


Figure 2.1: The financial system's flow of funds

Source: Van Zyl *et al*. (2009)

On the basis of the structural approach, the financial system is characterised by three main components, this includes: (a) financial markets, (b) financial intermediaries and (c) financial regulators (Darškuvienė, 2010:6). The role of the financial markets in the financial system is to oversee the facilitation of the flow of funds of investments by individuals, corporations and governments (Darškuvienė, 2010:6). The financial market acts as a transmission mechanism for the lending of funds to the various entities (governments, firms, individuals) in need of funding. This can take place in the form of credit - a deposit mechanism in the banking sector based on the issuance of securities as provided by the issuers of required resources- to those who need them (Stošić-Mihajlović, 2016:31). Figure 2.2 depicts the main participants of the financial system in terms of their transmission mechanisms as formerly discussed.

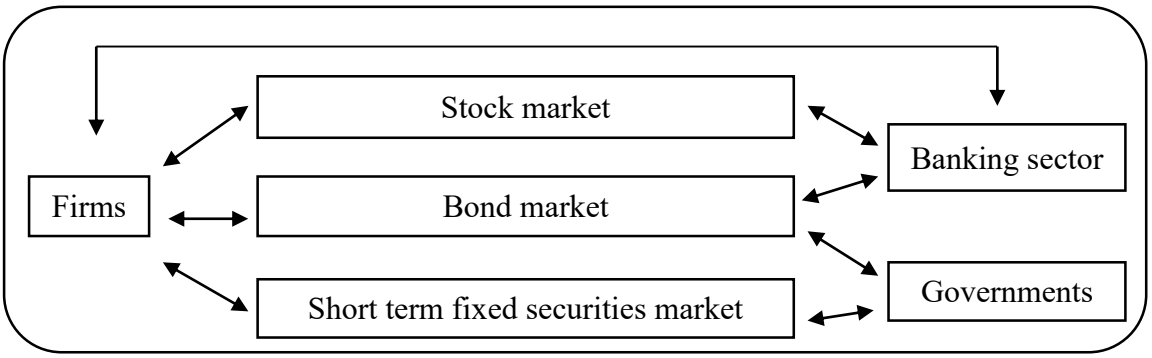


Figure 2.2: The financial system structure

Source: Darškuvienė (2010:6)

2.2.1 The financial market's capital markets

According to Jasienė and Paškevičius (2009:66), the financial market is characterised by two closely interrelated markets, the capital market and the money market. A common distinction between the two markets is the maturity of their financial claims and obligations (Jasienė & Paškevičius, 2009:66). Stapelberg (1981:23) asserted that the capital market is a concept of an abstract market, not a physical market, which constitutes the long-term trade of securities, whereas the money market includes short-term trade of securities sought to finance liquidity needs. The money market typically constitutes short-term financing from one day to one year, but mostly three years (Ambrosi, 2014). The claims for direct and indirect capital are characterised by the activities of the investment market within the capital market (Vihar, 2007:1). The capital market makes up the long-term and intermediate forms of funding to individuals, governments, and businesses. It is considered a complex and sophisticated structure of mechanisms and institutions involved in the trade of securities with maturity of over one year (Fourie, Falkena & Kok, 1999:183). However, the former markets are said to be volatile and largely unpredictable, with substantial influence on the outcomes and effectiveness of economic policy, i.e., mostly influencing fiscal and monetary decisions (Hassan, 2013:2).

The market for long-term funding typically comprises three main components: the long-term bank deposits and loans, the equity market and the bond market, which serve distinctive purposes but are complementary to each other (Mboweni, 2006:2). The financial system's capital market presents with them different forms of capital market instruments, according to Herbert (2004:421); these include preference shares, ordinary shares and debt instruments. Ordinary shares speak to the long-term financing with a face value or nominal value issued to owners of an entity. Shareholders of ordinary shares claim their returns on a residual basis.

That is, claims to assets and income by shareholders are subsequently made once claims by creditors and preference shareholders have been made or paid; therefore, returns on ordinary shares may be less than that of preference shares (Mary, Adedinran & Elizabeth, 2012:8). Preference shares constitute long-term financing made to a company, with dividends of a fixed percentage made before payments to ordinary shareholders. Debt instruments, or bonds, characterise the borrowing of funds by state agencies or by private entities on a long-term basis. These can be acquired by pension funds, insurance companies, commercial banks, or even individuals. The bond carries with it the amount, interest and maturity period, as well as prior claims on assets and income in the event of liquidation (Mary *et al*., 2012:8).

The capital market is made up of two components; specifically, the primary market and the secondary market. The capital market's newly issued securities are issued in the primary market, whereas the secondary market facilitates the trading of previously issued securities (Debessay & Harege-Work, 1994:227). Accordingly, banks, pension funds, stockbrokers, insurance companies, and Public Investment Commissioners (PICs) oversee the issuing of securities to match the demand of the primary market (Fourie, Falkena & Kok, 1992:121). The primary market provides a platform on which quoted entities may raise new funds for expansion or where money can be raised as an investment (Soyede, 2005:8). The secondary market is characterised by the market for existing securities where market securities are bought and sold upon being issued in the primary market (Mary *et al*., 2012:9). , Figure 2.3 graphically represents the interactions of the capital market's primary and secondary markets as well as the regulatory function and the flow and facilitation of funds and markets. It also illustrates mechanisms of the demand and supply of funds and assets between market participants.

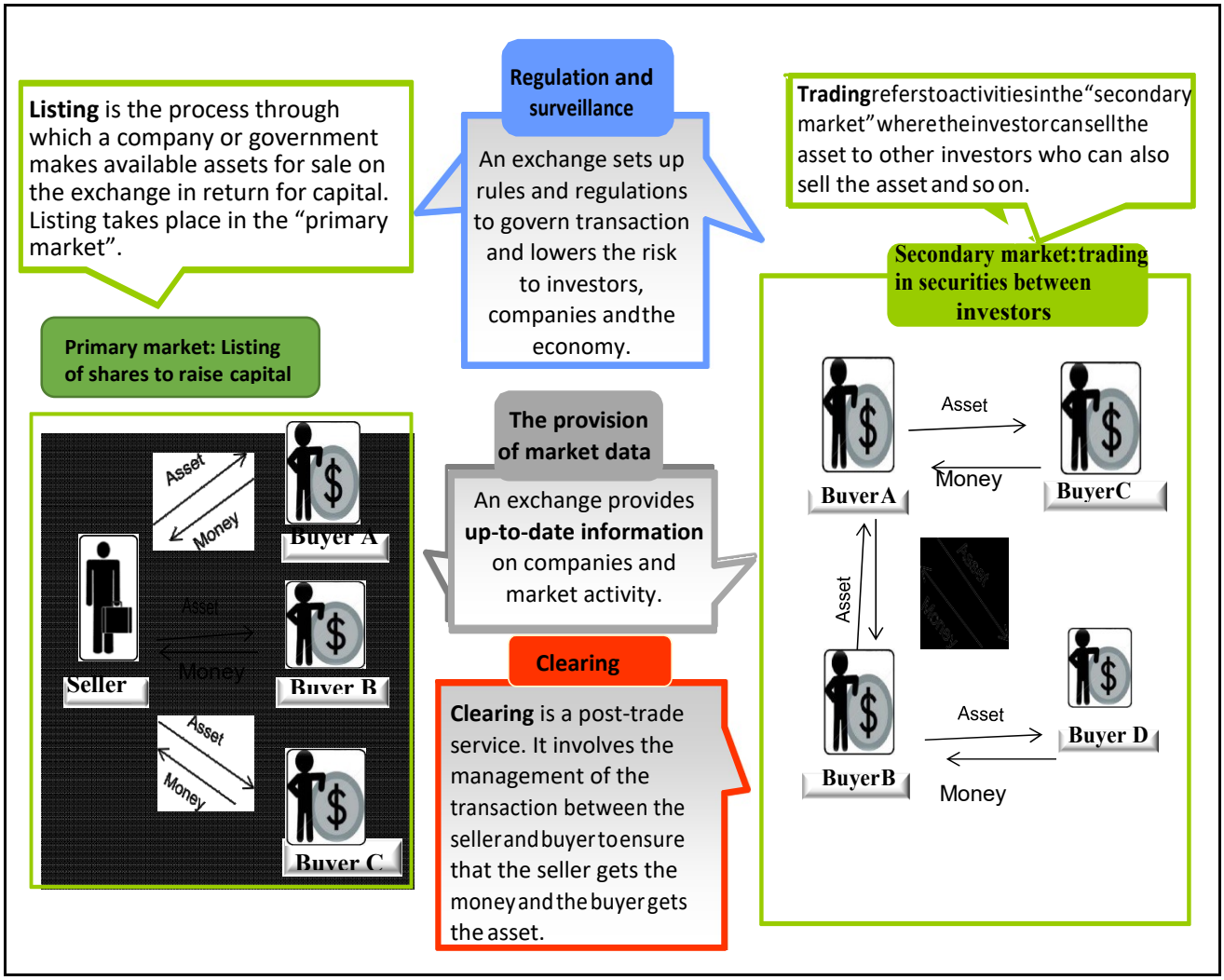


Figure 2.3: The primary and secondary markets

Source: Ambrosi (2014)

Capital markets are perceived to perform a number of functions identified by traditional discussions in form of the (a) allocation of scarce capital among competing users and uses, and the (b) provision of signals which act as guiding tools to managers during investment decision making (Stiglitz, 1985:133). Bank loans would be used for smaller funding activities or bridging finance in an environment with adequately efficient capital markets, but as credit ratings improve, it is most suitable to issue bonds in financing larger projects due to lower and fixed costs of funding. Nevertheless, a satisfactory debt/equity ratio needs to be maintained upon establishing a good credit rating, this, in turn, necessitates financing in the form of equity (Mboweni, 2006:2). The capital market serves as a financial asset used to raise funds to create investment from investors with surplus funds to those operating on a deficit through the use of capital market instruments like bonds, commodities, and equity, as represented in Figure 2.4 (Goodspeed, 2017).

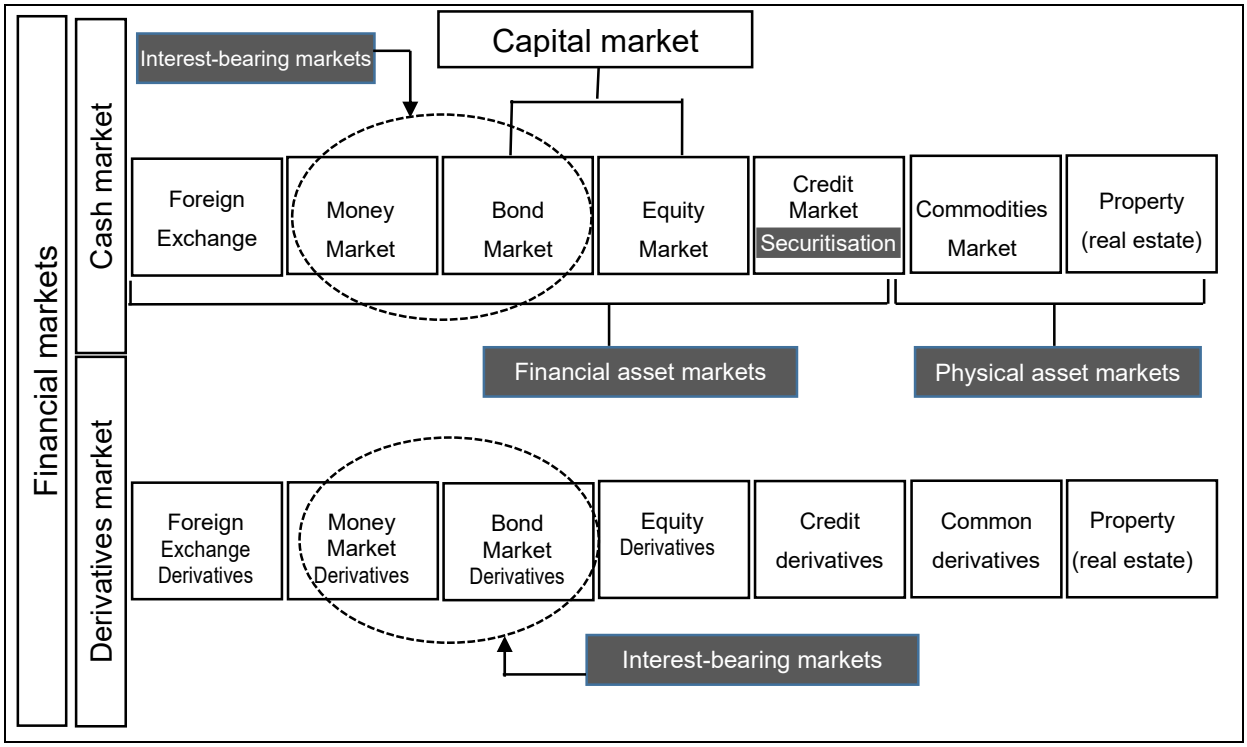


Figure 2.4: South Africa's capital market

Source: Goodspeed (2017)

Based on Figure 2.4, South Africa's capital markets, in terms of the various financial asset markets, includes the foreign exchange market, money market, bond market, equity market, credit market, commodities market and the property market. According to Hassan (2013:2), the currency market is the most common speculative target, which can affect the dynamics of the exchange rate. The speculation of commodities may heighten industrial and food input price movements, whereas the weight of the equity market increases the economy's macroeconomic sensitivity to bubbles and crashes of asset prices (Hassan, 2013:2). This study focusses on the stock market, bond market, commodity market and the foreign exchange market with respect to the country's business cycle indicators (BCIs).

According to Hassan (2013:2), derivatives ensure the replication of payoffs, which are otherwise distorted by capital controls in the case of their being imposed, and also enables the management of exposure to volatility, such as those in the exchange rate and interest rate. Meanwhile, the yield curve, which is the difference (spread) between long-term and short-term interest rates (yields) (Bauer & Mertens, 2018; Zaloom, 2009:252), is influenced by arbitrage in the fixed income market effects, which affects long-term investment and the monetary transmission mechanism (Hassan, 2013:2).

El-Din and Saif (2007:54) explain that a capital market which is efficiently liquid, is one which prudently resolves crucial problems associated with: (a) the parting of funds and (b) economic risk exposure, on the supply side of funds. The latter can be achieved through the structuring of fitting instruments of the capital market and the establishment of favourable regulatory and financial institutions. Financial institutions are therefore regarded as key players of the financial market due to their intermediation role or the determination of the flow of funds; while the role of regulating and monitoring participants of the financial system is carried out by financial regulators (Darškuvienė, 2010:6). Falkena, Bamber, Llewellyn and Store (2015:1) posit that the regulatory function reflects the views of a country's type of economic system where industrial economies and most developing countries typically consider the market-orientated approach. This approach, according to Falkena *et al*. (2015:1) assumes that the operation of the market mechanism generally produces optimal results in regards to optimal decisions, efficiency and financial resource allocation. Here, efficient resource allocation may also mean an efficient allocation of physical resources. Nevertheless, it is also acknowledged that the market mechanism may not be perfectly operational in all circumstances, while the regulatory function ought to provide redress against established market imperceptions and shortcomings. Thus, based on the general philosophy, a cautious approach should be taken to secure overall economic efficiency, promote consumer protection and ensure institutional soundness and safety.

2.2.1.1 The equity market

The equity market, synonymously known as the stocks or shares market, describes listed and marketable financial market instruments of corporations, which are quoted and traded on the JSE Ltd (Van Zyl *et al*., 2009:322). The equity market is a key financial or capital market sector which constitutes investment activities concerned with the trading of long-term financial instruments. Equity instruments are provided or issued by corporations with the intention of galvanising funds for corporate operations. A residual claim is given to the provider of funds on the firm's income and becomes a shareholder of the entity (Darškuvienė, 2010:73). Van Zyl *et al*. (2009:322) postulate that financial instruments provide investors' ownership to listed companies' productive assets.

2.2.1.2 The exchange rate market

The exchange rate is a key indicator of economic performance based on its ability to portray the competitiveness of a country within foreign markets and its capacity to affect economic

activity via mechanisms of the external sector (Khomo & Aziakpono, 2016:1). According to Al Samara (2009:3), most developing countries are faced with heightened exchange rate volatility, which is related to erratic movements in relative prices which translates to an increased degree of economic uncertainty. Understanding the sources of volatility in the exchange rate is crucial towards constructive, credible and efficient implementation of economic policies, i.e. monetary policy. Khomo and Aziakpono (2016:1) assert that for countries that seek to avoid currency overvaluation in relation to the diversification of exports and export-led growth, maintaining the exchange rate within its equilibrium is a required condition for economic growth.

2.2.1.3 The commodity market

The commodities market constitutes the market where the trading of precious commodities, such as agricultural products, metals and so forth, takes place (Van Zyl *et al*., 2009:471). The trade for commodities is formally held within commodities exchanges. These are efficient meeting platforms for sellers and buyers, established for better management of price risks and improved marketing of physical products (Mezui, Rutten, Sekioua, Zhang, N'Diaye, Kabanyane & Nekati, 2013). These exchanges exhibit significant benefits ranging from boosting agricultural and finance links, enhancing economic inclusiveness, reducing price risk and improving price discovery to enhancing the efficiency and competitiveness of the commodity sector (Mezui *et al*., 2013; Rashid, 2015:2). Rangasamy (2009:117) projects commodity prices as being useful economic indicators because they are characteristic of properties of a leading indicator. They are a good signal of economic shocks since their market prices are configured by the international market and are therefore regarded as exogenous in nature.

2.2.1.4 The bond market

Liquidity is a major gauge of the bond market's health and soundness due to its role in the provision of an efficient and robust financial system (Kapingura & Ikhide, 2011:2). The bond market represents a form of debt market in which the government or businesses seek to galvanise funding for long-term ventures as a means of the issuer's long-term borrowing instrument (Darškuvienė, 2010:57). Practically speaking, money is loaned by the investor to an entity, either a government or a corporation, where payments are made to the investor while the principal capital is repaid on the maturity date. The bond may subsequently be traded in the secondary market by the bond owner or investor (Ytterdal & Knappskog, 2015:9).

Adelegan and Radzewicz-Bak (2009) expands on the importance and need for establishing sufficiently liquid regional and domestic bond markets in the wake of the 2007/08 financial crisis. This is based on the rationale that the promotion of domestic bond markets provides benefits resulting from enhanced efficiency and functioning. In other words, capital allocation is enhanced through the allocation of savings regarding assets attributed with high returns, its provision of other financing sources as well as its facilitation of risk management based on its distribution of risk amongst various investor groups. Bae (2012:2) elaborates that the degree of economic development influences bond market development and, at the same time, efficient capital markets are crucial for economic development. Likewise, the extent of a nation's economic development may serve as a signal of a need for development in parts of the capital markets aligned with financial and economic aspects of a country.

2.2.2 Analytical methods to financial market analysis and interpretation

The study of financial market behaviour encompasses different methods of analysis. Lawrence (1997:3) and Pavlou, Blanas and Golemis (2007:90) assert that such methods may include technical analysis and fundamental analysis as well as the traditional regression or time series forecasting techniques. These methods are subsequently conceptualised. According to Turner (2007), these forms of analysis all aim to analyse and forecast supply and demand shifts. Technical analysis upholds the premise that the future of security price trends can be foretold using past information about price; nonetheless, this assumption contradicts the precepts of the efficient market hypothesis (EMH) which contends that past information cannot lead to investors acquiring abnormal profits (Jordan & Miller, 2000). Conversely, fundamental analysis relies on the potential earnings of securities, in the case that actual prices incline towards their intrinsic value, therefore using the intrinsic value assists in the movements of security prices (Jordan & Miller, 2000).

2.2.2.1 Fundamental analysis

Fundamental analysis, as a method for valuing securities (Darškuvienė, 2010:109), is considered as the traditional method for the analysis of a company's fundamentals in regard to its proceeds and expenses or overheads, annual growth rates, market position and so on (Murphy, 1999). Fundamental analysis seeks to determine the intrinsic value of a specific company's share or its operations in order to examine its economic prospects (Darškuvienė, 2010:109) based on the examination of related financial, economic and other quantitative and qualitative factors (Suresh, 2013:45). The analysis monitors a company's profits and the

dividends which the company offers while taking into account expectations of interest rates and the company's associated risk (Rusu & Rusu, 2003:104). This analysis also considers earnings, profitability, cash flows and the financial leverage of a company's financial statements; it also presents projections of growth prospects of earnings by which the security's fair value is determined, using one or more of the equity valuation methods. Publically available information is therefore used to establish a security's intrinsic value following the estimation of financial ratios (efficiency, liquidity, profitability, gearing, and investment) which is an indication of whether companies are overvalued or undervalued in order to present an all-inclusive picture of the firm's performance (Pavlou *et al*., 2007:90).

Subsequently, mathematical, statistical and financial algorithms are applied to the company's official periodic financial statements in order to examine the price of the shares as accurately as possible (Rusu & Rusu, 2003:104). Aspects of the basic steps to fundamental analysis include, (a) understanding the present overall economic conditions and trends (i.e. inflation, employment, interest rates, productivity and GDP growth) to assist the investor with awareness about the economic environment the industry and country the firm operates, and, (b) analysing the conditions and obtaining an understanding of the respective company's financial value and health (Bonga, 2015:2). This means simply analysing the macroeconomic and industry-specific conditions.

According to Suresh (2013:45), fundamental analysis carries with it the following objectives:

- To forecast the national economy's direction of performance as economic activity affects investor expectations and attitudes, corporate profit and ultimately, security prices;
- To examine the changes in security prices by analysing the operative forces in the general economy and the influences of the distinctive or idiosyncratic to companies and industries; and
- To choose the optimal time and optimal securities for the investment.

Suresh (2013:45) further elaborates that fundamental analysis incorporates the following three phases, known as the Economy-Industry-Company (EIC) framework or, the top-down approach:

- Economic analysis - Conducting an economic analysis to understand the macroeconomic environment and its developments;

- Industry analysis - Analysing the firm relative to the prospects of the industry to which it belongs; and
- Company analysis - Analysing the company's projected performance.

In this approach, fundamental practitioners are the first to present predictions for the economy, followed by industry and finally, the business sector. Predictions of the overall industry are believed to be led by forecasts of the overall or parts of the general economy, whereas, forecasts pertaining to the individual company are founded by both the overall industry and the economy. Additionally, this approach also compares industry groups to other industry groups in the same sector as well as comparing different companies that are in the same sector, against each other (Suresh, 2013:45).

2.2.2.2 Technical analysis

Technical analysis seeks to scrutinise past market patterns and trends from which behavioural forecasts of the future market are derived (Darškuvienė, 2010:110). It focuses on the study of historical fluctuations in price, based on the study of price charts for determining patterns of price and the usage of price data in various calculations to predict future movements in price (Larsen, 2010:1). The rationale for this approach is that the history of capital markets, such as the stock market, tends to repeat itself (Petrusheva & Jordanoski, 2016:26). The general study of the stock market's internal data considers that all financial, economic, psychological and political factors are incorporated or factored into a single component: the share quotation (Bonga, 2015:1; Rusu & Rusu, 2003:104). Technical analysis is founded on the basic assumption that fundamentals of a company, coupled by the market psychology and macro-economic factors, are all priced into the security, therefore precluding the need to consider each of these factors individually (Chsherbakov, 2010:45-56).

When assessing the daily price, analysts may extract varying indicators to establish if the respective security exhibits any sort of trend (Thomsett, 1999:567-581). If ever a particular price and volume pattern has been preceded by certain price movements, it is argued that the price pattern will be repeated by alike price actions (Menkhoff & Taylor, 2006:4; Larsen, 2007:4).

Suresh (2013:48) advanced that the following assumptions provide the foundation for technical analysis:

- The interaction of operating supply and demand market factors are the sole determinants of the market value of a security;

- Numerous rational and irrational factors surround the demand and supply factors of a security, and these can be both subjective and objective factors;
- Security prices tend to move in upward or downward waves or trends, depending upon the emotions, psychology and sentiments of traders or operators;
- Past trends influence present trends, and the forecasting of future trends is made possible through past price trends;
- Apart from minor fluctuations, security prices tend to fluctuate in trends which continue for a substantial duration; and
- Variations in trends in security prices are influenced by changes in supply and demand. Shifts in demand and supply may be detected based on charts which display market action.

Darškuvienė (2010:111) contends that based on the postulates of the Efficient Market Hypothesis (EMH), which asserts that, if information is rapidly echoed in security prices, then trends are not given the opportunity to emerge, therefore, the fifth and sixth assumptions are flawed. Nevertheless, technical analysis creates the impression that new information only enters the market over a period of time and not at a single point in time. For instance, new information may first be presented to insiders, then to professionals and lastly, to the general public. As information becomes more widely accessible, the security price gradually establishes its new equilibrium (Darškuvienė, 2010:111).

Technical analysts, or chartists, often use visual charts similar to Figure 2.5, to study changes in security prices based on the history of quotations, through an interval of at least 6 months, and presume that previous behaviour will follow through the future behaviour and use this to anchor the future evolution of the security price (Bonga, 2015:1; Rusu & Rusu, 2003:104). Typical examples of technical indicators include Moving Average (MA), Moving Average Convergence/Divergence (MACD), Exponential Moving Average (EMA) and the Relative Strength Index (RSI) (Agrawal, Chourasia & Mittra, 2013:1362). When considering the technical approach, the assertion is that an inherent correlation exists between price and the company; this can, therefore, be used to establish when to enter and exit the market (Larsen, 2010:1). Figure 2.5 paints a picture of the typical patterns and component elements of financial securities in regard to technical analysis.

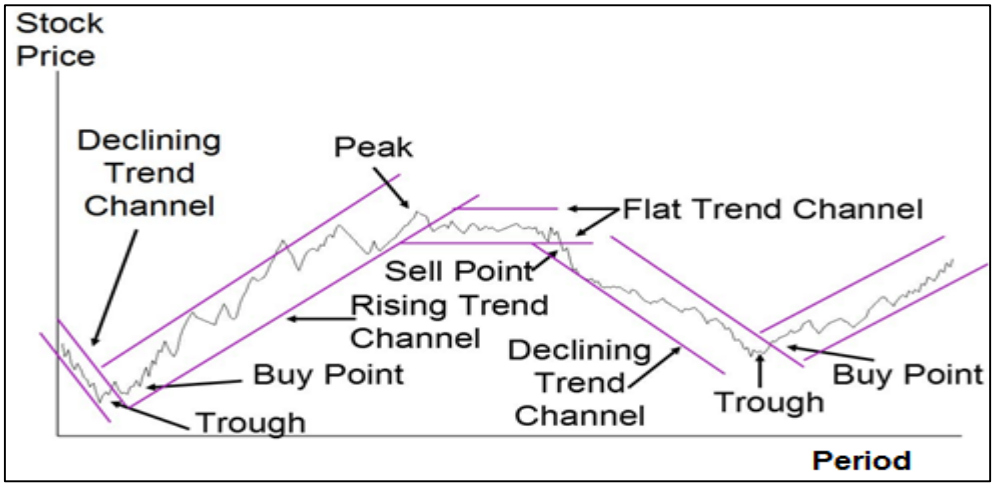


Figure 2.5: Typical cycle of a financial security

Source: Wheale (2015)

According to Suresh (2013:49), technical analysis encompasses a number of tools and techniques used in the analysis of market movements based on the following aspects:

- Prices: Any change in price is considered to be reflected in supply and demand of securities as well as investors' attitude;
- Time: The magnitude of change in price is a function of time. The longer the preceding reversal in the trend, the greater the price changes that follow;
- Volume: The volume of transactions reflects the intensity of price changes. In the instance where a surge in the price level is complemented by a minute variation in transactions, this suggests that the intensity of such a variation is not strong enough; and
- Width: Reflects whether a change in trend is concentrated across the majority of industries or sectors or is spread in just a few securities measures or determines the quality of price change. Analysing the width of the market thus notes the degree to which variations in price have occurred in the market in conjunction with a particular general trend.

2.2.2.3 Traditional regression methods of time series analysis

Rusu and Rusu (2003:106) submit that time series modelling consists of either stochastic or deterministic modelling. According to Renard, Alcolea and Gingsbourger (2013:133-134) parameters of a stochastic model are characteristic of random distributions as opposed to a single or common distribution, whereas parameters of deterministic models function in tandem with state variables, which are exclusively determined by those within the model and combinations of the former states of the variables. Outcomes of deterministic data can be

predicted based on a set of parameters (Gelman, Leenen, Van Mechelen, De Boeck & Poblome, 2010:188) founded on their inherent absence of randomness, whereas stochastic models incorporate uncertainty or randomness (Shmulevich & Aitchison, 2009:2). Thus, stochastic processes are tantamount to a simple random walk process, which is synonymous to the notion of market efficiency as described in the EMH (Alon, Avin, Koucký, Kozma, Lotker & Tuttle, 2011:482; Vinogradov, 2012:5584). Dupernex (2007:167) explains that stochastic processes and thus market efficiency, are based on the understanding that series, such as those of stock prices which are considered to exactly mirror the available information, are characterised by the instantaneous reaction of investors to any information, which thus eliminates profit opportunities.

Time-series as a forecasting tool seeks to determine future values based on the analysis of past data, including project estimates by modelling nonlinear functions based on recurrence relations obtained by using historical data (Lawrence, 1997:5). As such, the recurrence relation is used as a means of predicting new values within the time series for presenting likely approximations. Time series analysis attempts to provide answers to factors which cause a series to behave in a particular manner, interdependencies of variables and the forecasting prediction of future states where market prices of bonds, equity and other securities can serve as typical time-series examples (Serin, 2017:2).

Serin (2017:2) also points out that various issues may be encountered when estimating time series analysis: these may include possible non-stationarity of the series, the autocorrelation of residuals, seasonal dependence and so on. However, Serin (2017:2) further reassures that various tools and methods exist which can solve these issues. Dase, Pawar and Daspute (2011:10) posit that time series or traditional regression methods constitutes a twofold of the forms of time series forecasting, particularly, the univariate and multivariate models. Lawrence (1997:6) goes on to state that univariate models, such as the Box-Jenkins, are characterised by a single variable within the recurrence equations containing historical values of prices and moving averages. The Box-Jenkins model particularly necessitates the usage of a great deal of data and is considered to be a complicated process for establishing the most suitable model parameters and equations.

Moreover, Lawrence (1997:6) asserts that multivariate models are expanded univariate models with equations characterised by more than a single variable. This is the case for a regression analysis, which entails multiple regression, univariate regression and positive linear regression (Timbó, Labidi, do Nascimento, Lima, Neto & Matos, 2016:26). Lawrence (1997:6) however

cautions that time series forecasting mostly provides reasonable accuracy across short time periods, although such accuracy tends to sharply diminish with an increase in the length of prediction. Accordingly, Steel (2014:15) posits that some components may be found in time series analysis and that these may include a trend (the increasing or decreasing general direction of a series over time), seasonality (frequent variations within time series which is due to re-occurring events, such as a spike in Christmas sales during the period), and random components (additional variations in the time series which can be associated with noise or other random occurrences). To begin forming inferences, the analysis of time series needs to constitute variables which are stationary, meaning that such a variable must showcase a constant variance and mean along the period. In addition, the variable's covariance value along separate time frames relies solely on the lag separating such separate time-frames as opposed to the precise time for which the covariance is calculated (Steel, 2014:15).

2.2.3 Selecting macro-economic variables for capital market analysis

The explanatory data set prescribed in this study consists of macroeconomic variables of South Africa's business cycle or real economy as presented in Table 1.1 of Chapter 1 in Section 1.4.2. Brinson, Singer and Beebower (1991) describe macroeconomic variables as important measures of the general economy which can be based on a national or regional level and which tend to impact the general population rather than just a few individuals. The selected explanatory variables were chosen based on their recognised real economic influence, these variables are employed by the South African Reserve Bank as measures of macroeconomic and business cycle activities. The aforementioned time-series, as tabulated in Table 1.1 of Section 1.4.2 in Chapter 1, are respectively recognised by the SARB (2018) as official lagging, coincident and leading indicators of the business cycle. Peiró (1996), Humpe and Macmillan (2009) assert that there is a real sense of relatedness between changes in economic or real cycles and the volatility of financial cycles, such as the stock market cycles.

Chauvet and Potter (2000:88) also attribute the use of economic variables which tend to convey publicly available information to be critical explanatory factors of business conditions. The economic theory behind Fama's (1970) EMH also stresses the nature of macroeconomic factors, being fully reflective of all relevant information, which prevents investors and speculators from earning abnormal profits from financial markets. To its benefit, this supports the study at hand in examining whether potentially attributed information about the financial market and general economic performance can be used to foretell movements in the various capital markets.

The selection of relevant real explanatory variables lies in their overall economic influence and their influence on the discount rate of the cash flows and not just on the anticipated cash flows of firms (Rapach, Wohar & Rangvid, 2005). Olsen (2009:21) outlines Baumohl's (2007) useful attributes behind the selection of indicators for economic market analysis; they must meet the pertinent characteristics of accuracy, up-to-date information and timeline availability, they must incorporate the cyclical component of business cycle expansions and contractions, be consistent in their predictions and must have a degree of relevance.

2.3 THE BUSINESS CYCLE AND THE MACRO-ECONOMIC ENVIRONMENT CONCEPTUALISED

Business cycles, also known as trade cycles or economic cycles, have been a long-standing centrepiece of knowledge and research following their steadfastness through huge social and economic changes whilst confounding a great number of forecasters (Burns, 1947:27). Despite all business cycles being different, their nature provides an interesting common element for analysis (Jagrič & Ovin, 2004:42). Zarnowitz (2007:22) reassures that in spite of all their differences, expansions and contractions of business cycles provide movements of recurrent, serially correlated and cross-correlated patterns in various economic activities.

Business cycles have proven to be a crucial feature of market-orientated economies (Jagrič & Ovin, 2004:42) inherently included in economic systems as expansions and contractions (Škare & Stjepanović, 2015:83). Increasing interest has been generated concerning the dating of business cycles in terms of establishing their underlying turning points, as pertains to the local maxima and minima of across a given time series (Shen, Ren, Huang, Shi & Wang, 2018:2900). Garrison (1989:6) contends that the market process is inherently constituted by business cycles, which likewise serve as market process disturbances. Suggesting that for those who consider business cycles as Econo-rhythms, meaning continuous rhythmic movements in macro-economic magnitudes, both the upper turning point (the downturn) and the lower turning point (the upturn) are endogenous, and for those who perceive business cycles in terms of monetary disequilibrium, business cycles are exogenous.

2.3.1 The business cycle: recoveries and recessions

A business cycle, according to Mohr (2005), is a pattern of contraction and expansion, which aggregate economic activity exhibits in its overall trend. A stylised reference variable used to represent the business cycle is the real gross domestic product GDP, or output according to Claessens *et al*., (2012:179). GDP reveals the aggregate value of the total products and services

made within a country's borders, which are used for export, consumption and investment during a given period (Karlsson & Orselius, 2014:8). A noteworthy conceptualisation of business cycles hinges on the most cited traditional definition by scholars of the National Bureau of Economic Research (NBER), and by Burns and Mitchell (1946). Their definition serves as the foundation of the contemporary economic thinking of business cycles as pertains to the construction of cyclical fluctuation models or the measurement of business cycles (Škare & Stjepanović, 2016:84). Burns and Mitchell (1946:3) asserted that business cycles are fluctuations in a nation's aggregate economic activity, defined by recurrent and not periodic sequential changes of a cycle, characterised by general expansions occurring at the same time in most of the economic undertakings, followed by general recessions, contractions, and revivals which come together in the next cycle of the expansion phase. Accordingly, the NBER (1998) defines a recession as "… a persistent period of decline in total output, income, employment and trade, usually lasting from six months to a year, and marked by widespread contractions in many sectors of the economy". A recession is also defined as negative growth exhibited in a period of at least 2 consecutive quarters (Reklaitė, 2011:102).

The definition of business cycles based on successive periods with respect to a certain duration of relative expansion and contraction of general economic activity is referred to as the classical cycles or reference cycles (Du Plessis, 2006:4; Škare & Stjepanović, 2016:84). A full cycle can thus consist of two phases, the (1) expansion phase, which is formed from a trough to a peak, and the (2) contraction phase, which is formed from a peak to a trough, as represented in Figure 2.6, (further down) (Du Plessis, 2006:4). Turning points refer to the subsequent transitions between troughs and peaks, respectively underlying the highest and lowest points in the business cycle (Karlsson & Orselius, 2014:7). Turning points run from moments of expansions and contractions (Golosnoy & Hogrefe, 2009:2) and are perceived to be fluctuations or dates of the business cycle (Bowers, 1985). It is suggested that the average business or economic cycle tends to last around four to six years (Swart, 2018).

Karlsson and Orselius (2014:7) also posit that business cycles are the variation between actual GDP and the respective trend, which indicates the potential GDP achieved when the economy experiences full employment. The identification of business cycles based upon the absolute declines or changes in aggregate production levels is considered as a classic example of the business cycle, known as classic cycles (Škare & Stjepanović, 2016:84). When actual GDP lies above the underlying trend, the economy thus experiences an expansion and in a recession, the trend lies above actual GDP (Karlsson & Orselius, 2014:7). Table 2.1, below, expounds on the

different phases of a typical business cycle, underlining the period of expansion, peak, contraction and trough phases.

Table 2.1: Business cycle phases

Expansion	Peak	Contraction	Trough
• Increased economic activity levels • The level of inflation increases • More goods and services are realised • A decrease in the interest rate • Increase in household expenditure	• Most economic resources are consumed, e.g. capital & skilled labour • Prices experience upward pressure, and current account balance worsens due to increased imports	• Interest rate starts to increase • Economic activity begins to decrease • Unemployment rate increases • Reduced production of goods & services • Inflation decreases • Decreased spending levels	• The central bank is leveraged to begin lowering their repo rate • The turning point occurs at the point of the contraction phase • Improvement in the current account begins to show, due to low costs of exports & the absence of domestic demand for imports

Source: De Jager (2017)

To identify the aggregate business cycle, authorities first use data which permits them to identify reference cycles. Firstly, this involves the identification of cyclical peaks and troughs in the underlying series of economic variables. Secondly, this determines whether the variation or cycles are common enough in all the observed series (Škare & Stjepanović, 2016:84). The "duration", according to Burns' and Mitchell's (1946) conceptualisation of business cycles, is an important construct for distinguishing the fluctuations of business cycles. The periods of expansion and contraction in general economic activity can be operationalised based on a reliable measure of aggregate economic activity, which should be available across a long enough horizon (Du Plessis, 2006:4). Du Plessis (2006:4) thus argues that the elaborate construction of classical cycles or reference cycles was essentially based on many series (composites) while noting the clustering of their individual turning points, as the prerequisite for "duration" was not the case in the 1940s. Figure 2.7 depicts the characteristics of the business cycle with respect to the peak, contraction, trough, and expansion in terms of the short-term cycles and long-term trend.

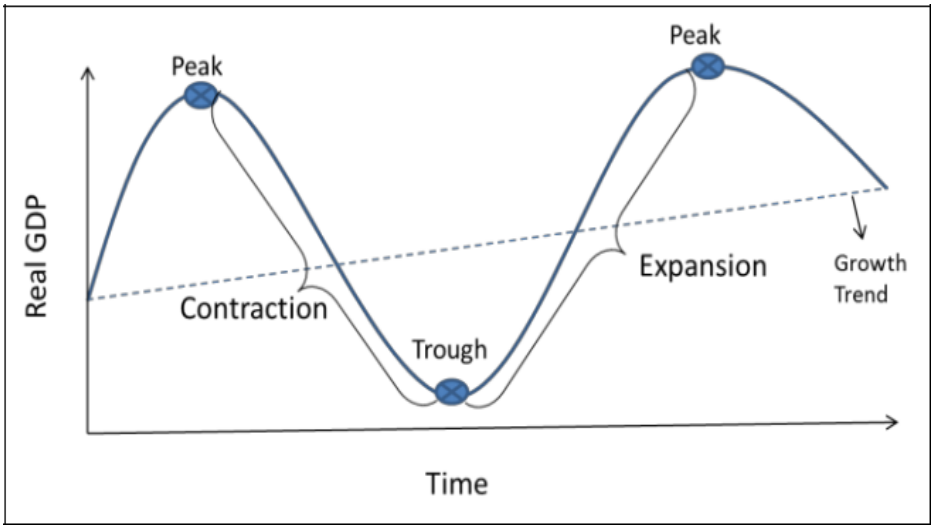


Figure 2.6: The business cycle

Source: Congressional research service (2017)

The conceptualisation of business cycles by Burns and Mitchell (1946) reveals their understanding of business cycles as separate phases or regimes of expansions from contractions. Certain series of business cycles are characterised as leading or lagging indicators, in accordance with the broad state of business conditions (Diebold & Rudebusch, 1996). Related to the classic cycles approach, Zarnowitz (1992) provides an alternative approach to identifying business cycles, considered as growth- or deviation cycles or, trend-adjusted cycles (Venter, 2009:61) which consider the deviation of the series from its long-term trend, as opposed to considering the absolute changes in the general level of production. The growth cycle approach or definition is officially used by South Africa's central bank to track the country's business cycles turning points. Variations in the rate of total economic undertakings are depicted in the growth cycle (Venter, 2009:61). This implies the computation of whether an economic series is developing above or below its trend (Van Ruth, 2010:8).

Economic agents, based on the timing, use changes in macroeconomic variables as relative references of the changes in the general economy based on the use of leading, coincident and lagging indicators. As previously mentioned, these indicators are known to describe the different stages of the business cycle (Van Ruth, 2010:4). They are considered to be capable variables for providing information about the direction of the business cycle (Reklaitė, 2011:92). Composite indicators of the business cycle, the lagging, coincident and leading indicators, are thus analysed continuously and constructed by integrating numerous economic indicators to form a single index based on the weighted averaging of the selected series (Reklaitė, 2011:92; Venter, 2009:61). Leading indicators were formally introduced by Burns

and Mitchelle (1946) based on their nature to lead respective cycles and detect turning points of the business cycle. Figure 2.7 illustrates the leading, lagging and coincident indicators relative to GDP over a given period. The leading indicator is shown to lead both the coincident and lagging indicators, while the coincident indicator provides detail on present movements with past or historical performances depicted in the lagging indicators.

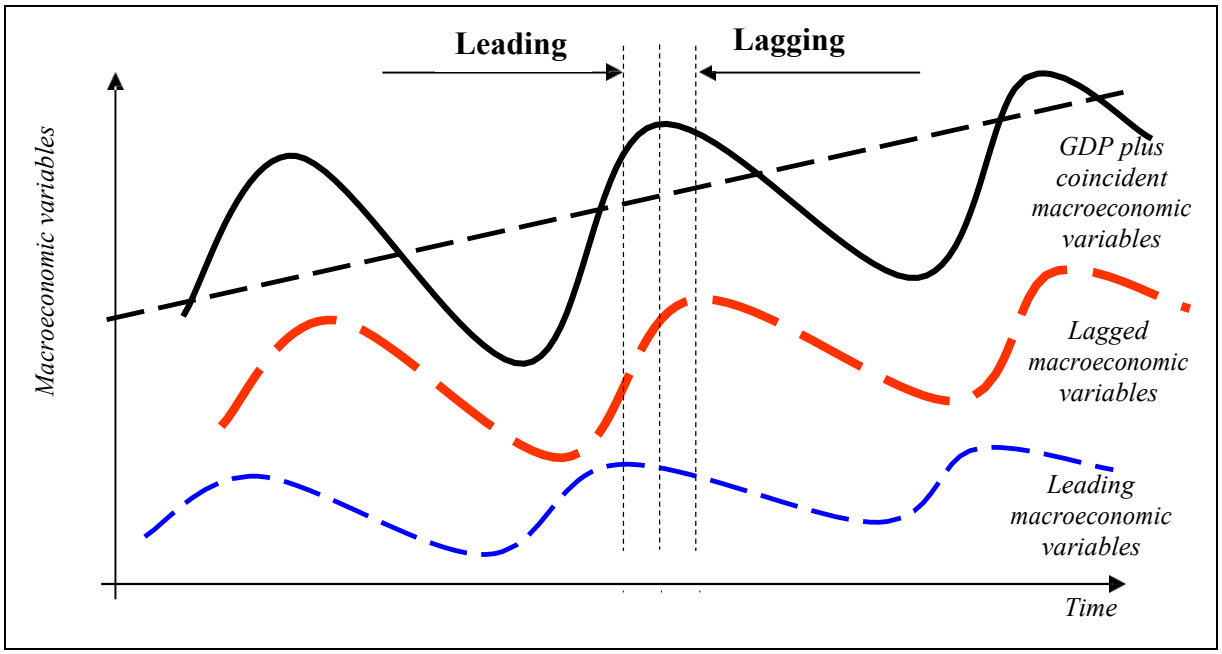


Figure 2.7: The business cycle vs. leading, lagging and coincident indicators

Source: Pilinkus and Boguslauskas (2009)

Early classical economic thinking refuted the existence of business cycles under the assertion that war was the primal reason for business cycles in the market, nevertheless, De Sismondi (1819) initially discovered and motivated the existence of business cycles through the findings on the economic crises which occurred during peacetime (Škare & Stjepanović, 2015:83). Further alternatives to identifying or dating business cycles are provided in Table 2.2.

Table 2.2: The various methods of identifying business cycles

Authors	Methods for defining business cycles
Burns and Mitchell (1946)	Business cycles are identified by the fluctuation in aggregate or general economic activity
Lucas (1977)	Business cycles are recurrent fluctuations of output and employment about a trend
Singleton (1988), King and Rebelo (1999), Cogley and Nason (1995)	Business cycles are defined using the Hodrick-Prescott filter
King, Plosser, Stock and Watson (1991)	The authors suggest that business cycles and growth are mutually determined, using a model of the real business cycle
Zarnowitz (1992)	Business cycles are based on growth cycles in a manner that the deviation from the long-term trend determines the decline in the series
Baxter and King (1993)	Business cycles are defined using a spectral analysis of time series
NBER (2010)	Cyclical peaks and troughs provide the basis of business cycles

Source: Škare and Stjepanović (2016:84)

Together with the leading, lagging and coincident indicators, Table 2.3 distinguishes the various aspects of the macroeconomic variables of the business cycle.

Table 2.3: Description of cycle indicators

Cycle indicators	Description
Economic indicators	Indicators that reflect the total economic condition and provide signals about the health of the economy
Business cycle indicators	Economic indicator time series identified as either leading, coincident or lagging the corresponding movements of business cycles. These indicators measure the sensitivity of the economy's cyclical movements
Composite lagging indicator	A weighted average of selected individual economic indicators which have historically preceded changes in general economic activity
Composite leading indicator	A weighted average of a selected number of individual economic indicators which have historically preceded changes in general economic activity
Composite Coincident indicator	A weighted average of selected economic indicators which have historically coincided with the business cycle

Cycle indicators	Description
Concordance index	Concordance among variables is perfect (perfect similarity of variables' contractions and expansions) when the index equates to 1 and perfect dis-concordance (a clear lag or not aligned) when equal to 0
Current diffusion index	A composite of month-to-month percentage changes in 251 seasonally adjusted time series of production, demand, employment and income in different sectors, weighted by the contribution to aggregate value-added
Historical diffusion index	The number of series which increase during any particular period as a percentage relating to the overall sum of the series under consideration.
Volume index	A measure of volume or quantity in relation to another point in time. It can represent the relative variation from one time to another
Measurements of the business cycle	
Procyclical	Variables or indicators which are positively interrelated relative to the general economic wellbeing, e.g. GDP.
Countercyclical	Variables or indicators which are negatively interrelated with the general economic wellbeing, e.g. Unemployment
Acyclical	These are variables with characterised by a lack of association concerning the state of the markets and largely present little use.

Source: Adapted from Avouyi-Dovi and Matheron (2005:274); Davies and Van Seventerl (2009:7); Pilinkus and Boguslauskas (2009:27); Karlsson and Orselius (2014)

2.3.2 Approaches to business cycle analysis

The modelling of the real market undertakings is considered a function of economic variables which indicates, for every point in time, whether the market is in a phase of expansion or recession (Leiva-Leon, 2014:2). Alexandrov (2018:42-43) underscores that the business or economic cycles exist in various forms, ranging from long waves and economic growth cycles, to short-term cycles, where the primary difference lies in their respective durations. Short-term (or cyclical) cycles can reflect monthly, quarterly or annual economic conditions relative to the time spread being analysed, where the series may potentially change at different rates to negative, positive or zero, thus consisting of a trend which may be formed in varying directions – as ascending, descending or horizontal (Avouyi-Dovi & Matheron, 2005:274; Alexandrov, 2018:42-43). Conversely, the economic growth cycle portrays long-term (structural) cycles inherent of effects which become visible when observing longer periods of time, and contains a unidirectional and ascending trend characterised by a rise, peak, recession and bottom (Barakauskaite-Jakubauskiene, 2011:42). With the use of suitable statistical filtering techniques, the modern business cycle approach enables the separation of a series based on the

permanent or structural component or, the short-term or cyclical component, constituting the two components of a time-series (Avouyi-Dovi & Matheron, 2005:273).

Harding and Pagan (2002), suggested a method of examining the concordance amongst economic series according to the use of the concordance index/indicator, which indicates the average periods at which two series coincide at the same cyclical phase based on the identification of turning points. Consequently, correlations amongst cyclical components of two economic series can be calculated to gauge the scope of their co-movement based on the growth rate of the structural components of the two series (Avouyi-Dovi & Matheron, 2005:273). Most modern means of analysing business cycles and relative theory have included more technical techniques, such as the dynamic stochastic general equilibrium theory (Gomme, Rogerson, Rupert & Wright, 2004). Dynamic factor models have been used by a number of studies, such as Stock and Watson (1989, 1991, 1993), to identify co-movement according to the utilisation of a combination of macroeconomic series and subsequently identifying a single common factor from such series. This may involve the de-trending of economic series according to linear de-trending methods, which presuppose that the respective series is inherent of a deterministic time trend. Other approaches may be based on the hypothesis that a stochastic trend contains a unit root in the series (Škare & Stjepanović, 2015:85).

2.4 FINANCIAL MARKET AND BUSINESS CYCLE INTERACTIONS: A GENERAL PERSPECTIVE

This segment makes the conceptual analysis of the overall or theoretical insinuations concerning the interactions among financial market and business cycle variables available. The study undertook further analysis of such linkages by reviewing existing empirical literature as provided in Chapter 4. Amongst the key competing views on the linkages between the financial sector and the real sector are the monetarist and Keynesian approaches. The monetarist view encompasses the previous view, which was prevalent before the 1930s' Great Depression, and the newly conceptualised form of this view, the modern quantity theory, gained traction during the 1960s and 1970s (Campbell, 1982:500). The formation of the new monetarist economists, spearheaded by Milton Friedman, was encouraged by the advent of John Maynard Keynes' "Keynesianism" during and after the Great Depression (Jahan & Papageorgiou, 2014:38-39). This started as many began to doubt the so-called "old-time religion", following the onset and persistence of the Depression. Under these circumstances, new explanations of macroeconomic behaviour were sought after (Teigen & Rasche, 1972:10-11).

The new monetarists assigned the financial market and monetary policy as the centrepiece of the interpretation of the behaviour of aggregate economic activities. Both views concede the demand for money as a pertinent component of how the economy operates. For the monetarists, money demand, particularly the demand for real money balances, which is the stock of money adjusted for inflation levels, is assigned as the core of its argument. The demand for money, however, is simply held as one of the various equally important economic relationships for Keynesian analysis (Campbell, 1982:500).

Research indicates that financial institutions are crucial for promoting the creation of new industries and igniting spillover effects within economic sectors (UNDP, 2009:60). This resonates with the various functions performed by financial sectors in any economy. Such functions may consist of financial resource allocation processes, capital formation, the mobilisation of savings, facilitation of trade, management of payment systems, diversification of risk and hedging (Alege & Ogunrinola, 2008; Okodua & Ewetan, 2013). Stylised views coincide with the assertion that the performance of the real sector is enhanced amidst an established financial sector, which acts as a catalyst for real sector growth. Such proclamations are galvanised by the narrative that an optimally developed financial sector, effectively allocates funds towards the real economy for the exploitation of investment prospects (Adeusi & Aluko, 2015:119).

Relationships between real and financial sectors can be explained by two schools of thought, the "supply-leading hypothesis", pioneered by Schumpeter (1911), and the "demand-following-hypothesis" by Robinson (1952). According to Schumpeter (1911), financial services are created by the real sector's demand for them, while Robinson (1952) posits that the demand for financial services within the real sector stimulates the creation of financial services by financial sectors. Simply put, Schumpeter (1911) convenes that financial sector development precedes the real sector development, whereas Robinson (1952) says the opposite. The real sector effects of the financial sector can be clarified according to transmission mechanisms of the balance sheet channel, the interest rate channel, uncertainty channel and the bank capital channel. In light of the interest rate channel, the increase in monetary policy rates stimulates an increase in banks' financing costs leading to their increase in the lending rates. This weakens household and business consumption and investment (Smal & De Jager, 2001:6; Owusu-Sekyere, E. 2016:3).

Under the balance sheet channel, declining asset prices, such as stock prices and housing prices, leads to a decline in the value of households and businesses' assets, may lead to the financial accelerator effect, which exacerbates reduced consumption and low investment (Ankargren, Bjellerup & Shahnazarian, 2017:1555-1557). Various forms of risk, under the bank capital channel, such as financing risk, credit risk, and market risk may worsen financial institutions' balance sheets by undermining the bank's value of assets and equity, which can stir reduced consumption and lower investment. More uncertainty, under the uncertainty channel, is generated in the form of financial market price fluctuations, such as higher volatility, stimulates heightened precautionary savings, reduced investment and consumption (Ankargren *et al*., 2017:1557).

2.5 TRADITIONAL VS. BEHAVIOURAL FINANCE THEORIES

The traditional theory on finance ascribes its theoretical intuition to neoclassical insights of the linkages between decision-making and economic outcome (Gippel, 2013:132-133). The theory is built on the primacy of presupposed underpinnings of perfect information, rationality, and self-interest (Kapoor & Prosad, 2017:50-54). In implicit terms, rationality assumes that individuals have an unlimited ability to both process and observe information (Daniel & Titman, 2000:3-4). These assumptions are the cornerstone of traditional finance theory. The underlying assumptions govern the traditional finance modelling approach to understanding financial markets based on their application that individual investors are rational and thereby have optimally diversified portfolios (De Vries, Erasmus & Gerber, 2017:1). Based on these assumptions, new information should be used by economic agents, involving individuals, groups and the general market to update their knowledge and use it to maximise their expected utility (Ackert, 2014).

Consequent to these views was the development of the primary concept of the expected utility hypothesis of the neoclassical theory. The premise of these assumptions is parallel to the notion that consumers always obtain maximised utility, or companies always attain maximum profit. The agents' well-diversified portfolios follow the portfolio selection model introduced by Markowitz (1952), which expounds on the optimal portfolio designing process of risk-free assets and securities, as envisaged in the capital asset pricing model of the three-factor model. The latter is formed on the assumption of an efficient financial market where security prices mirror available information. Collectively, economic agents gauge all incurred benefits and costs, then select the optimal option. Securities can be found in the form of futures, indexes, bonds, stocks, options, commodities, currencies, structured products or, simply any traded asset

that permits the specific evaluation of returns on a pre-established time (Turcas, Dumiter, Brezeanu, Farcas & Coroiu, 2017:14)

Many scholars (Simon (1955); Margolis (1958); Simon (1959); Cyert & James (1963)) have however uncovered findings of irrationality and recurring decision-making errors. These scholars have argued that the decision making processes of real people are not always rational where their everyday pragmatic behaviour is concerned. Market irregularities were further identified through the findings of various empirical studies (Cutler, Poterba & Summers, 1991); Jegadeesh & Titman, (1993); Mun, Vasconcellos & Kish (2000)) to be existing features of financial markets, which lead to the mispricing of market stocks. In such cases, the rationality of traders does not lead them to fix these irregularities instantaneously as portrayed in the efficient market hypothesis of neoclassical thinking. Despite having a well-constructed approach in providing calculated financial explanations, traditional finance frameworks were also incompetent in explaining financial market anomalies, such as market disruptions in the form of market underreaction or overreaction and market bubbles (Kishore, 2004:105).

The aforementioned inadequacies resulted in the advent of "behavioural finance" perceptions, which sought to derive behavioural explanations for such anomalies (Jurevičienė & Ivanova, 2013:54). The theory of behavioural finance has emerged as a form of analysis seeking to explain the influence of cognitive behaviour and emotions on decision-making processes as pertains to investment and finance decision making. Behavioural finance particularly deals with investors' derivation of financial judgements based on a background of social sciences, drawing mainly on psychology (Ricciardi, 2008:87; Byrne, 2013:3). According to Amin and Pirzada (2014:133), investor psychology deals with a threefold variant of psychology, in particular, cognitive psychology, emotional responses and social psychology. Cognitive psychology addresses behaviour brought about by mental thought-process and learning processes. Emotional responses are involved with the investors' manner of applying their emotions in decision-making processes. Lastly, social psychology resonates with the investors' consideration of societal conditions and their need of assurance from society. Table 2.4 summarises the prime distinction between traditional theory and behavioural theory.

Table 2.4: Distinguishing features between the traditional theory and behavioural theory

Traditional finance theory	Behavioural finance theory
Investors or decision makers:	
Seek to achieve financial objectives	Follow an emotional approach
Aim for optimal outcome	Strive for satisfactory financial outcomes
Have unbiased expectations	Biased expectations and possess limited knowledge of likely outcomes
Are rational decision-makers	Have bounded rationality

Source: Adapted from Lucarelli and Brighetti (2015); Muhammad (2009:2)

The precepts of behavioural finance contend that people's decisions and forms of judgement are driven by emotional influences which are based on simplifying rules or taking mental shortcuts referred to as heuristics; these may therefore result in deviations and systemic errors regarded as cognitive biases and emotional illusions (Yoshinaga & Ramalho, 2014:594-615; Sharma, 2016:3). Based on the above, irrationality within financial markets may lead to the so-called anomalies or irregularities. The established traits of systemic errors occur through investors' overestimation of opportunities, manifested as overconfidence (Dowie, 2014:8). Behavioural finance studies thus suggest the use of financial models that relax the assumption of the full rationality of individuals to be better mediums of understanding or explaining market anomalies. Further theoretical precepts of behavioural finance, such as the prospect theory which analyses investor judgments under risk and the regret theory as well as the overreaction and underreaction theories, have been developed in understanding financial market anomalies based on investor psychology and behaviour.

2.5.1 Traditional finance theories of investor behaviour

Enlisted in Table 2.5 are the various traditional finance theories in terms of the classical and neoclassical conceptual analysis of investor behaviour in finance.

Table 2.5: Traditional finance theories

Contributor	Period	Theory
John Stuart Mill	1844	Familiarised the idea of economic Man or *homo economicus*
Daniel Bernoulli	1738, 1954	Expected utility theory
John Von Neumann & Oskar Morgenstern	1944, 1947	

Contributor	Period	Theory
Jan Tinbergen	1932	Rational expectations hypothesis
John, F. Muth	1961	
Eugene, F. Fama	1965, 1970	The efficient market hypothesis
Samuelson, A. Paul	1965	
Jules Regnault	1863	The random walk hypothesis
Louis Bachelier	1900, 1914	
Burton Gondon Malkiel	1973	
Harry Markowitz	1952, 1959	Portfolio theory

Source: Author compilation

2.5.1.1 Expected utility theory

The expected utility theory (EUT), also known as the probability-weighted utility theory, is a normative and descriptive classical framework of individual investment decision making under risk and uncertainty (Tabata, 1983:357; Hansson, 1994:29). Original works of the expected utility theory may be dated as far back as the 18th century from the works of Daniel Bernoulli (1738) in his attempt to resolve the St. Petersburg paradox as pertains to the game of tossing coins (Sakai, 2015:173). The question surrounding the apparent puzzle of the latter was in regards to the price a rational individual needed to be equipped to pay to participate in a gamble. Conventional knowledge of the time insisted that a participant would be reasonably open to paying anything equivalent to the expected value or monetary payoff of a gamble (Starmer, 2000:333). Bernoulli (1738) however argued that most individuals would only be prepared to pay an amount relatively small to enter a game, the value of a gamble in the individuals' perspective is thus not, in general, equal to expected monetary payoff or value. Bernoulli (1738) further argued that individuals rather place subjective values known as utilities on the monetary outcomes and therefore the value of the gamble is in anticipation of such utilities.

In their book, *Theory of Games and Economic Behavior*, Von futures nature states (Muth formally developed the expected utility theory upon the development of game theory to form what is normally considered as the Neumann-Morgenstern utility function. Von Neumann and Morgenstern (1947) showcased that the hypothesis of the EUT can be formed from a combination of appealing preferences considered as axioms. These axioms, according to Starmer (2000:333), can justifiably be accepted as thorough ideologies of rational choice on which an expected logical person may subscribe. Mongin (1997:1) points out that the EUT is

expressed in two versions: the subjective EUT which pertains to situations of uncertainty and the Neumann-Morgenstern EUT with respect to the case of risk. Subsequently, Savage (1954) integrated the EUT with the theory of subjective probability, following the works on statistical foundations. Consequent to their work on risk aversion, Arrow, Cagan and Friend (1963) and Pratt (1964) demonstrated that the EUT has substantial analytical power, followed by Rothschild and Stiglitz (1971) who demonstrated such a phenomenon in their research on comparative risk. Under situations of uncertainty and risk, the expected utility theory remains the central focus and analytical foundation of many schools of thought and literature on the decision-making theory.

A decision is made between some subset of all available investments, lotteries and assets (which re considered to be synonymous) relative to the feasible weighted portfolios. It refers to the choice between the varying possible probability distributions of returns (Johnstone & Lindley, 2013:224). Von Neumann and Morgenstern (1953), thereafter suggested an axiomatic theory which stipulates how individuals need to decide amongst known probability distributions by proving that if decision making obeys the fundamental axioms of rationality or coherence, then the individual decision-maker implicitly acts as if their goal is to maximise expected utility.

Precepts relating to traditional decision theory postulate how personal decisions of logical and rational individuals should be made within a setting where choices or decisions are made by the "holder" of the utility function (Boutilier, 2003:285). Such a process underlines the prime facets of the *subjective expected utility theory*. The "normative" nature of the EUT is such that EUT of the decision making theory postulates how rational and logical agents should act or coordinate their decisions to maximise their expected utility by the selection of the decision option with the highest probability, resulting in an outcome which most corresponds with their norms, such as their personal values and beliefs (Starmer, 2000:334; Dowding & Thompson, 2009). On the perspective of the "descriptive" or the "prescriptive" aspect of the decision theory, the EUT highlights the manner in which decisions are actually made, or as a practical aid of choice (Kahneman & Tversky, 1979:263; Hansson, 1994:1-7). The decision-making problem is therefore structured by means of a decision tree in which the utility (value) and the probability associated with every outcome is determined, and the individual's best decision is calculated (Dowding & Thompson, 2009:103).

Bernoulli (1738) proposed the concept of declining marginal utility, also considered as risk aversion or concavity, as a crucial facet of decision theory. The assumption is that decision-

makers are risk-averse, implying that they possess positive, but rather diminishing marginal utility for money. Henceforth, the utility obtained from a pay-off or certain wealth is increasing and concave (Johnstone & Lindley, 2013:224-225). Bernoulli (1738) contends that the notion of linear utility in which Thiago (2014) draws out as a critical feature of Bernoulli's work where prior understanding of Bernoulli's work on utility assumed that individuals' decisions were conceived on the grounds of the anticipated value or linear utility.

Bernoulli assumed that individuals tend to maximise their expected utility as opposed to the expected monetary value (List, 2005:945). Bernoulli (1738) redefines expected monetary value by stipulating that the determination of an item's value must not be constructed on its underlying price; rather, on the satisfaction which the item yields. The item's price just relies on the item itself and is thus equal for all individuals. Utility, however, relies on the decision-makers' idiosyncratic circumstances. Bernoulli (1738) stipulated that decision making needs to be based on expected utility as opposed to the expected value, simply, since an increase in wealth, despite the significant increase, leads to a utility increase, which is inversely proportional to the quantity of already possessed goods. Such behaviour highlights the notion of declining marginal utility of the logarithmic utility function.

The EUT is considered the foundation for standard economic models on decision theory with regard to how individuals make choices (Von Neumann & Morgenstern, 1947). The theory implicitly posits that decision-makers possess stable and lucid preferences; that is, they are sure of their wants, while preferences or choices do not depend on the context. Henceforth, decision-making individuals assess all available alternatives prior to the selection of an alternative they consider to be best (Hedesström, 2006:2). The EUT proposes that gambles may be evaluated based on the utility function relative to one's wealth where marginal utility is inversely proportional to wealth, and not solely based on one's income flows (Bergstrom, 2016:2) thereby portraying a concave utility function (Kontek, 2010:1). The individual's attached utility towards wealth does not increase in a linear manner with the amount of wealth, but it increases at a decreasing rate (Hansson, 1994:29-30).

The EUT postulates that each decision maker's utility is an increasing function of their respective wealth and may differ according to various individuals (Hansson, 1994:30). Accordingly, rational utility-maximising individuals seem to desire the risky prospect or gamble, which maximises their utility or the prospect with the maximum expected utility, or expected value (Bell, 2017:1; Kontek, 2010:1; Moscati, 2016:219). The selection of a preference or alternative of the maximisation of subjective utility thus follows the so-called

maxim of maximising expected utility (Hansson, 1994:30). Their willingness to pay for a gamble is based on their initial wealth, indicative of the individual's risk-averse nature (Bergstrom, 2016:2).

The principle of the EUT is fundamentally tied to the suggestion that economic agents attempt to optimise their expected utility through the weighting of every probable outcome's expected utility which is aligned to a given plan of action. This involves the provision of a summation of every probable outcome of each strategy, and thereafter choosing the strategy exhibiting the largest anticipated utility (Levy, 1997:88). Thereof, the EUT assumes that the utility of a certain good for an agent is a function of the good's net asset levels and that preferences over outcomes are not reliant on current assets as current assets solely affect preferences over strategies and marginal utilities, not preferences over outcomes or terminal states (Levy, 1997:88).

Bombardini and Trebbi (2012:1350), as well as Zambrano and Stevens (2014:2), point out that the EUT showcases a good descriptive explanation of individual behaviour and choices under risk and allows for participating individuals to vary in their degree of risk or risk aversion respectively based on their wealth. On the basis of the EUT, the decision-maker chooses among uncertain or risky predictions via the comparison of values of expected utility, such as the weighted sums acquired through the summation of the utility values of the different outcomes, multiplied by the respective probabilities of the outcomes (Mongin, 1997:1; Moscati, 2016:219). An assigned weighted average is given to each alternative or preference, its utility values based on varying states of nature, and the probabilities of these states are utilised as weights (Hansson, 1994:29).

According to Kahneman and Tversky (1979:263-264), core features of the undertaking of the expected utility theory are founded on three subdivisions or tenets. Such tenets include, firstly, the expectation - which is associated with the prospects' overall utility or the outcomes' expected utility (possible outcome vs. probability). Secondly, asset integration - which is associated with how the individual's final state of wealth is affected. The second tenet suggests that the utility function is constructed on final states (consisting of the individual's asset position) and not gains or losses. Specifically, an outcome is adequate if the utility caused by merging the prospect with the decision maker's assets surpasses that of the assets alone. Lastly, risk aversion – the rational utility-maximising individual prefers certainty over risky prospects that provide the same potential outcome. The second tenet particularly highlights that the utility function concavity is correspondent to risk aversion which has a U-shaped curve in expected utility theory, the individual is therefore risk-averse if they prefer a specific prospect (x) to any

risky outcome having the anticipated value *x* (Kahneman & Tversky, 1979:264). The utility of outcomes as pertains to the EUT is measured based on their linear probabilities (Levin, 2006:6).

2.5.1.2 Rational Expectations Hypothesis

The central postulates of the Rational Expectations Hypothesis (REH) are drawn from the research works of Muth's (1961:315-335) *Rational Expectations and the Theory of Price Movements*, following earlier presumptions about expectations as initially introduced by Jan Tinbergen in his 1932 research studies. Scholars such as Lucas (1972, 1975) and Sargent and Wallace (1976) made notable extensions to the REH concerning new classical explanations in regard to output and inflation. The REH is a common expectations model; it maintains its position as a standard for expectations hypothesis in mainstream economics and hinges on how economic agents tend to forecast future events and form presumptions concerning potential effects of the expected outcomes. In his original work, Muth (1961:316) conceptualises the central idea of expectations, as informed predictions of future events. Simply, individuals' future predictions, as anticipations, are rooted at the level of the current information and the extent to which they exploit this information. Economic knowledge and available information are thus utilized during the moment of formulating expectations to construct forecasts of future states. Accordingly, errors in future expectations may thereby be corrected upon obtaining increased exposure to more information (Mlambo, 2012:7).

Another notable assertion to Muth's (1961:316) hypothesis is that individual expectations are rational forms of judgement which economic agents use to derive predictive assumptions. Precepts of rationality are consistent with the general neoclassical school of thought as well as other schools of thought, which have embraced the concept of the rationality of expectations in the scope of their theoretical presumptions. According to the REH, expectations, therefore, are formed based on information which is handled rationally (Wameryd, 1995:2). The theory also suggests that economic agents make decisions based on currently available information, which is, according to Lucas (1975), "optimally" utilised in formulating expectations. In contention, Ardalan (1996:25) asserts that establishing efficient predictions of future states of nature within an uncertain economy requires an efficient transfer of information in order to uphold the efficient allocation of resources. However, information held by different individuals differs accordingly and is scattered throughout the economy. This likely leads to inefficient resource allocation relative to the state in which information is symmetric for all individuals.

The REH makes the assumption that economic agents' average expectations of economic variables based on the agents' psychological and subjective expectations, equals the variables' mathematical conditional expectation. The variables' true values, therefore, simply equate to the agents' subjective average expectations. Despite the considerable differences in judgement, average expectations within the market are a more accurate means of portraying futures nature states (Muth, 1961:315-335). As an extension of the old optimising assumption by Marschak-Stingler, further reinterpretation suggests that on average, all individual agents are right, having collected information to form expectations (Ayala & Palacio-Vera, 2014:8). According to Au and Kauffirtan (2003:4), the financial market's stock prices tend to reflect elements of assumptions envisaged in the REH in a manner that stock prices at a given time are constructed on expectations formed by economic agents, considering all likely information about the company. Investors' decisions, involving the buying or selling of stocks, are based on future expectations of the respective company's performance. Mlambo (2012:7) highlights that average expectations of a random variable may be correct since the average expectations of individuals regarding the random variable are expected to have a value equivalent to zero, despite the fact that the random variable's value may not always be equal to zero as there is not always perfect foresight.

The REH has often been questioned on the grounds of its relevance and application to real-life states. The dynamic nature of economic markets is argued to be an implicating factor of the REH, in regards to the market's continuous processes of emotional outbursts, innovation, self-enhancement and uncertainty. Therefore, Bronk (2009:1) contends that amidst an uncertain economic atmosphere there are individuals led by their emotions, feelings, imaginations and intuitions as opposed to rational expectations or hypothetical future estimations. As such, future states cannot be evaluated based on rational expectations. Nevertheless, an important highlight by Muth (1961:316) noted that "…expectations of firms (or, more generally, the subjective probability distribution of outcomes) tend to be distributed, for the same information set, about the prediction of the theory (or the 'objective' probability distributions of outcomes)". Simply put, rational agents form expectations based on the most probable outcome while relying on relevant economic theory predictions. In this regard, forecasting may alternatively be interpreted based on a criterion of probabilities, other than unreasonable exact forecasting. Elliott (1986) highlights James Ramsey's (1977) assertion that economic predictions can be formulated essentially in terms of conditional probabilities and not as a definite occurrence of events, as macroeconomic series contain error and economics as a science is stochastic.

2.5.1.3 The efficient market hypothesis

The EMH was established in the 1960s by Fama (1965, 1970) and Samuelson (1965) following the emerging premise of efficiency in capital markets, addressing the resurging debate on the efficiency or inefficiency of markets. The notion of efficient capital markets implies that the markets are characterised by current market prices, which reflect all available information with no way to obtain excessive or unusual profits. As a general rule, competition amongst aggressive analysts ensures that market prices reflect available information (Sunde & Zivanomoyo, 2008:217). Reilley and Brown (2015:72-73) interpret the concept of an efficient capital market as a market characterised by security prices, which rapidly regulate and adapt to the entry of information, while current security prices fully mirror all information concerning the security.

Similarly, Fama (1965:3-4) emphasised that an efficient market is characterised by large numbers of rational profit-maximising individuals actively competing amongst each other by attempting to foretell future market prices of respective securities (stocks bonds, commodities, and currencies) and all participants have access to freely available pertinent information. Individual securities, at any point in time, already reflect effects of information relating to past events and future market expectations. At any moment in time, the price of the individual security is simply a perfect approximation of its intrinsic value (Fama, 1965:4). Walter (2003:4-5) states that the concept of "market efficiency" resembles the notion of economic equilibrium and likewise, the theory of efficient capital markets closely relates to the competitive equilibrium theory, but applied to the financial asset market rather than the economic side. Accordingly, Walter (2003:4-5) highlights that it may not be unreasonable to conceptualise the finance definition of efficient markets as a prerequisite for the neo-classical's equilibrium of Pareto efficiency within a competitive economy.

The EMH is founded on the basis of neo-classical assumptions that investors are unbiased with perfectly rational behaviour and are capable of instantaneously and holistically incorporating all newly available information that has been infused into the market (Pasca, 2015:152-153). Fama (1970:383) asserts that the capital market's principal role is concerned with the apportionment of proprietorship of the economy's capital stock. Therefore, an efficient capital market is one in which accurate signals for resource allocation are provided by market prices, such that investors can choose between securities which represent ownership of firms' activities and production-investment decisions can be made by firms, assuming that at any point in time, security prices "fully reflect" all available information. In such instance, a

completely effective market resembles a market in which investors have full access to the available information of informative indicators at a given time, and asset prices are fully accurate (Serin, 2017:10). In other words, an "efficient market" is simply characterised by security prices which are optimally priced and these prices entirely reflect all available information (Fama, 1970:383; Nwaolisa & Kasie, 2012:76).

Driven by the notion of "available information", Fama (1970) sought to distinguish between the general forms of market information into three information subsets, or sub-hypotheses, depending on the particular set of information involved. Information subsets thus include the weak-form EMH, semi-strong form EMH and strong-form EMH or perfectly efficient market, to establish whether particular subsets are fully reflected by security prices. According to Elbarghouthi, Yassin and Qasim (2012:140-141) and Reilley and Brown (2015:73-75), the weak-form EMH evokes information that current security prices merely reflect all historical information concerning past security prices, volumes and returns, as well as all additional previous security market data. The EMH's semi-strong form suggests that prices are reflective of historical information and all publicly available information and is able to rapidly adjust to the entry of all public information (Fama, 1970).

The semi-strong EMH also incorporates the weak-form's hypothesis, which considers that all weak-form market information is public: this includes trading volumes, rates of return and stock prices (Dupernex, 2007:169). Lastly, Elbarghouthi *et al*. (2012:140-141) and Reilley and Brown (2015:73-75) assert that the strong-form EMH contains all information known to market participants (private or public). This is reflected in market prices and therefore no investors have monopolistic access to information which can affect prices. As such, the strong-form EMH incorporates both the weak-form and semi-strong hypotheses. Figure 2.8 illustrates the different forms of efficient markets as defined by the EMH.

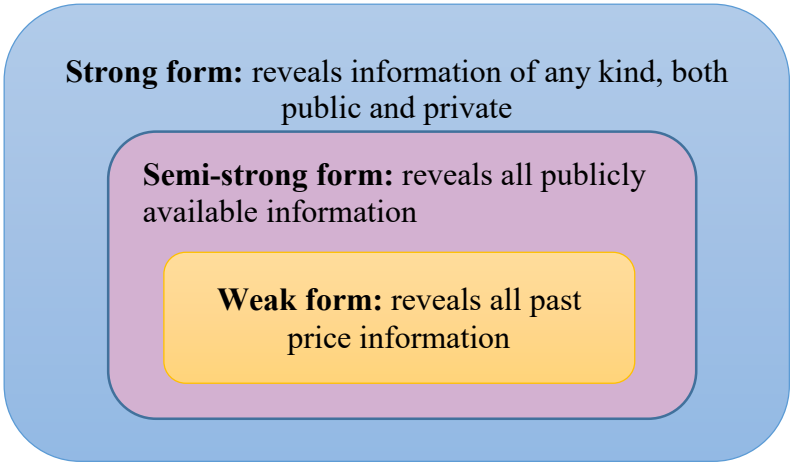


Figure 2.8: Forms of efficient markets

Source: Jordan and Miller (2009:210)

Conditions of the strong-form EMH fulfils the hypothesis of an efficient market. Such a market is ideally a perfect market where prices rapidly adjust to the infusion of new public information and all information is available to all investors at the same time and is cost-free. Efficient markets demonstrate a typically competitive market, investors rapidly respond to the entry of new information and one should not expect to earn abnormal returns when utilising information, considering that it is publically available and fully reflected in security prices (Ball, 2009:10). Moreover, a competitive market of bonds, commodities or securities, can also be regarded as efficient under the condition that all prices already reflect all relevant information available (Mandelbrot, 1971:225).

The level of prices is thus determined by the market's available information while potential changes are due to new information being introduced into the market. Consequently, any changes in price will be random, considering that the entry of new information is random by nature, and thus changes in price can be modelled as stochastic processes; therefore, financial series of volume and the number of transactions are characteristic of unpredictable future outcomes (Pasca, 2015:152-153). Chan, Beh, Chan, Chin and Liew (2013:3) also highlight that security prices are extremely sensitive to information, thus any information concerning the political or economic outlook will be reflected in the stock price. Given an inefficient market, certain investors in that particular market may obtain abnormal profits or losses as inefficiency prompts undue speculation within the capital market and may harm both the market and the economy (Chan *et al.*, 2013:9). Serin (2017:10) however, notes that the efficient market hypothesis does not imply that elevated excess returns cannot be obtained, but rather

individuals cannot expect to be fortunate enough each time in finding inefficiencies; therefore the expected value of excess return equates to zero.

According to Malkiel (2003:3), the EMH resembles the financial concept of a "random walk" which suggests that subsequent changes in price reflect random deviations from previous prices. Winful, Sarpong and Agbodohu (2013:206) further express the view that the random walk ideology means that if the flow of information is unhindered and instantaneously conveyed in stock prices, then changes in tomorrow's prices will be independent of the previous days' news or information, but will solely mirror tomorrow's news. Since information or news is random by nature, resulting changes in price will be random and unpredictable too.

2.5.1.4 Random walk hypothesis

The random walk hypothesis (RWH) projects that in a perfectly efficient market, following the efficient market hypothesis, prices follow a random walk and therefore past information concerning security prices and trade volume are inessential in predicting future market prices (Sunde & Zivanomoyo, 2008:217). The foundation of the RWH took shape in the early research works of the French economist, Regnault (1863), who established the basis of contemporary stochastic modelling of price behaviour. Sequentially, further developments and contributions on random walk behaviour were made by Working (1934), Cowles and Jones (1937), Kendall (1953), Roberts (1959), Osborn (1959), Bachelier (1964) and Fama (1965). However, Samuelson (1965) provided a more robust eventual explanation of the random walk concept founded on the rationale of a scientific and rational approach, based on the efficient market theory.

Dupernex (2007:168) cautions that the concept of random walks and the EMH should not be mistaken as amounting to the same thing nor used synonymously: a random walk does not insinuate that the market is efficient with rational investors. However, a random walk is driven by the understanding that changes in price are simply independent of each other (Brealey, Myers & Allen, 2005). Nevertheless, the RWH's focus on the question of predicting future prices is based on past prices, following its assumption of independence between successive price changes from historical closings (Joshi, 2012:1). This satisfies and relates to the weak-form efficient capital market with the RWH and not the semi-strong or strong-form (Sarkar, 2015:56; Tahir, Anni & Qazi, 2017:1). The RWH makes a clear statement that future security prices may not be predicted using available past information of prices (Habibah, Ghumro & Mirani, 2017:551-552).

According to Fama (1965), presumptions of the random walk in security prices present crucial challenges to adherents of both fundamental analysis and technical analysis. Malkiel (2003:59) posits that a random walk characterises a price series where all following variations in prices signify arbitrary departures from preceding prices if information flow is unhindered and information is immediately reflected in market prices. He goes on to state that tomorrow's prices will only reflect tomorrow's news and remains independent of today's changes in price. That is, market prices today have no relation with tomorrow's market prices. By nature, information or news is unpredictable, therefore changes in price are also unpredictable and thus, random (Malkiel, 2003:59). An argument by some econometricians and statisticians holds that price movement is impossible to predict, considering that it is subject to random movements, and repetitive patterns and schemes are nothing more than chance (Fama & French, 1995). This view projects that market inefficiencies and vulnerabilities cannot be used to earn anything more than expected profits.

The testing of the RWH in the financial market has witnessed copious works of research on the series of financial prices. The rejection of the random walk hypothesis, following a test of it, given either means of analysis, suggests the existence of intertemporal dependence at a particular lag and thereby, implies an existing trend in asset prices (Eitelman & Vitanza, 2008:1). This means that market price returns contain predictable components and present implications for speculators and investors in earning abnormal profits based on the forecasting of future prices, thus implicating an economy's allocation of capital (Tabak, 2003:269; Sunde & Zivanomoyo, 2008:217). If market prices are constituted by a random walk, it can be concluded that investors and speculators are prevented from consistently earning abnormal returns. It also implies that the pricing of stocks is being set at equilibrium values (Sunde & Zivanomoyo, 2008:217). In support of the efficient market hypothesis, it has been argued that market prices reflect expectations and judgements of investors based on available information, good information implies that the price instantaneously trends upward such that individuals have little to no time to act upon it (Agwuegbo, Adewole & Maduegbuna, 2010:342).

There is contention concerning the random walk's premise of lack of predictability by various authors. Amongst these, Lo and MacKinley (1999) argue that the serial correlations of the short-run are not zero as investors "jump on the bandwagon" upon seeing continuous intervals of like movements in the direction of prices; this applies in particular to securities and thus, markets can gain momentum. Nevertheless, Dupernex (2007:169) points out that subsequent similar periods do not progress in the long-run since negative autocorrelation or patterns of

“mean aversion" may be observed. Moreover, other scholars point out that seasonality or seasonal trends, Market Over- and Under-reaction, firm size and its return, dividend yields, and the relation between value and growth firms, provide the basis on which market and investor predictability can be assured (Fama & French, 1995; Fama, 1998; Hirschleifer, 2001:1533; Bouman & Jacobsen, 2002; Malkiel, 2003).

A commonly used test for random walk in security prices is the testing of the existence of the unit root. The rationale behind this approach is that the existing unit root signifies price disruptions are perpetual, such that any price movements perpetually changes the path of the price (Mishra, Mishra & Smyth, 2015:880). This means that it is impossible to form forecasts about price actions using past information on prices as price fluctuations are a result of accidental and unplanned shocks. Conversely, the existing unit root purports that prices are stationary and are therefore bound to eventually return to their natural mean over time enabling the potential forecasting of movements in price based on past data (Mishra *et al*., 2015:880).

The suggestion that security prices follow a random walk, as mentioned, relates to the EMH in a manner that increased efficiency in a market also implies increased random sequences observed in price deviations. Nevertheless, this does not infer that random walks and the EMH equate to the same denotation. Simply that existing random walks do not suggest that a market has rational investors and is efficient. A random walk implies an element of independence in price deviations where changes in today’s prices are independent of or uncorrelated to changes in yesterday’s prices (Brealey *et al.*, 2005). However, prices at least fully reflect available information and investors are instantaneously able to react to relevant accessible information established on the basis of random walks and the EMH (Lo & MacKinley, 1999).

2.5.1.5 Portfolio theory

The precepts of the classical portfolio theory, also referred to as the Modern Portfolio Theory (MPT), were constructed by Markowitz (1952, 1959) in his studies on portfolio selection and on the diversification of a portfolio, which is a composition of securities or assets (Levišauskait, 2010:51). The theory, at its core, accentuates that individuals may optimise their choice of a portfolio based on the overall dimensions of risk and expected return (Blume, 1970:152).

Essentially, as Levišauskait (2010:51) explains, the MPT is ultimately concerned with the selection of an optimal portfolio and the identification of an individual’s assets to manage risk and increase returns (Halpern, White, Lester, Costello & Gaines, 2011:1499). This implies creating a portfolio which maximises the expected return, provided that the degree of market

risk or minimising market risk delivers a specific degree of expected return through asset diversification of a portfolio (Van den Honert & Vlok, 2014:108). According to Markowitz (1999:5), the MPT is founded on the assumptions that (1) the expected portfolio return is a weighted average of individual securities' expected returns and (2) the risk or variance of the portfolio's return is a function of the variances and covariances between securities and their portfolio weights. It follows that the behaviour and response of individual assets, such as investment stocks, fish stocks, insurance policies, ecosystem services and species, tend to respond uniquely to changes in the system over time, thus risk or variance for a given aggregate level of return can be minimised by creating a portfolio of assets which have negative covariance or respond differently to system changes (Halpern *et al*., 2011:1499).

The MPT assumes that an investor is both risk-averse and rational, and has an array of investment choices to construct a portfolio where all investments opportunities are characterised by risk and reward (Rodrigues, 2010:18). Markowitz (1952) makes a distinction between inefficient and efficient portfolios, where a subsequent set of efficient mean-variance combinations is coined as the efficient frontier. Markowitz (1999:5) accentuates that statistical analysis estimates of means, variances and covariances can be used to derive the set of efficient mean-variance combinations and presented to the investor for the choice of the desired combination of risk-return. The assembled risk-return investment combination provides an efficient frontier which provides a given level of risk and return, including the most optimal reward combination (Persson, Lejon & Kierkegaard, 2007:13). Portfolio assets can be constructed to provide an efficient portfolio that provides the highest possible level of portfolio return for any level of risk involved, which is measured by the standard deviation or the variance, where portfolios are connected to provide the efficient frontier (Fabozzi, Markowitz, Kolm & Gupta, 2012:5; Abalkhail, 2017:4-5). Rodrigues (2010:19) accentuates that the efficient trade-off, according to the investors' preferences, will not be maximised by portfolios with a combination below the efficient frontier. The establishment of the efficient frontier makes the provision for decision making of deciding along the frontier.

Its assumptions of market efficient and investor rationality portray the asset’s return to be a random and normally distributed variable and thus recognises risk to be the standard deviation of return, which collectively demonstrates a portfolio (Lee, Cheng & Chong, 2016:60). The portfolio theory hopes to minimise total risk or variance of the portfolio return by combining heterogeneous assets with returns which are not perfectly positively correlated (Lee *et al*., 2016:60). The theory commends the construction of dominant portfolios, such as those with

minimum risks for any level of return, or maximum return for any level of risk: by definition, risk is considered as a variation in return, and not as a likelihood of failure or danger (Cardozo & Smith, 1983:110). The portfolio theory intuitively asserts that holding a portfolio, which is diversified, ultimately reduces volatility as individual asset price movements within a portfolio are partially offset. To express this simply, when the price of one asset goes down, the price of another asset may increase, and thus portfolio value tends to differ less relative to the suggested individual asset volatility (Jacobs & Levy, 2014:114). The overall risk associated with the diversification of a portfolio of assets may, therefore, be lowered compared to the risk of distinct assets (Delarue, De Jonghe, Belmans & D'haeseleer, 2011:12).

2.5.2 Behavioural finance theory of investor behaviour

The behavioural school of finance challenges the earlier precepts of the traditional finance theories through demonstrated departures from the bounds of rationality. Advocates of behavioural finance point towards behavioural biases inherent in human behaviour (Van Zyl *et al*., 2009:22). Behavioural finance sways against the claims of the traditional theory that individuals find it easy to, or at least are not perplexed by the large quantities of available information at their disposal and that furthermore that they are not distracted by their emotions. Henceforth, behavioural finance argues that traditional proponents should account for observed human behaviour. As previously discussed, the theory of behavioural finance hinges on aspects of human psychology and sociology (Ricciardi & Simon, 2000:2) taking into account behavioural or human biases which are at the core of its arguments and applied to the field of finance and economics (Byrne, 2013:3-4). These biases affect both novice and professional investors, understanding them might perhaps help investors reduce their influence and possibly help manoeuvre around them. Table 2.6 enlists some of the critical theories of behavioural finance.

Table 2.6: Behavioural financial theories

Author	Year	Finding
Daniel Kahneman & Amos Tversky	1979	Prospect theory
Amos Tversky & Daniel Kahneman	1992	
Tversky and Kahneman	1973, 1974	Heuristics
Andrew Lo	2004	The adaptive market hypothesis

Source: Author compilation

Behavioural finance contends that considerations of individuals' decision-making based on the traditional theory's grounds of rationality have no compelling effect on decision-makers. Investors' decisions are mostly inconsistent and governed by cognitive illusions, which are a centrepiece of modern theory. On these grounds, cognitive illusions categorised under "heuristics" and the "prospect theory" compels investors to divert their decision-making (Kahneman & Tversky, 1979:263–291). Some of the various cognitive biases are provided in Figure 2.9 in terms of heuristics and the prospect theory.

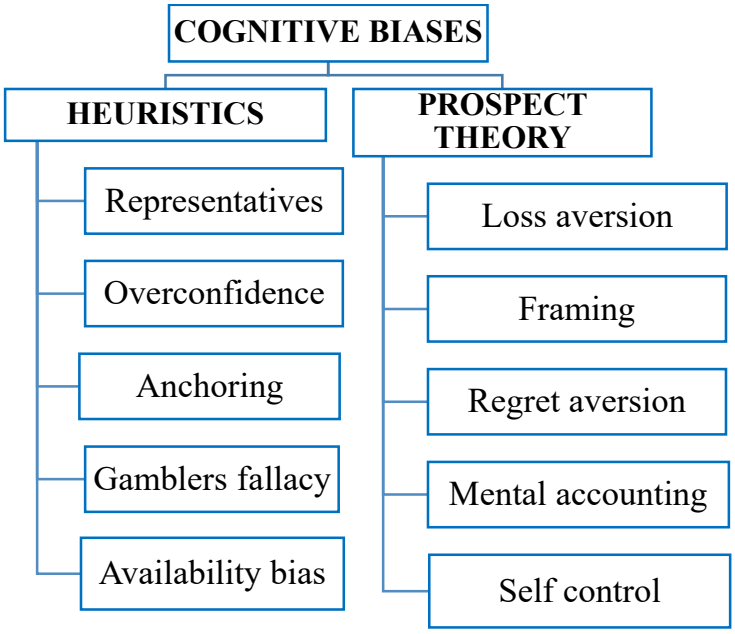


Figure 2.9: Cognitive Illusions
Source: Simon (1955)

2.5.2.1 Prospect theory

The Prospect Theory (PT), later refined as the cumulative prospect theory (Tversky & Kahneman, 1992), is another extension to the expected utility theory on decision making under risk, founded by Kahneman and Tversky (1979) derived from their work on the Prospect Theory, *An Analysis of Decision under Risk*. The PT identified a number of inconsistencies with the expected utility theory concerning explanations of decision-making under risk (Hlouskova & Tsigaris, 2012:555). Various scholars (Allais, 1953; Camerer, 1995; Ellsberg, 1961; Kahneman & Tversky, 1979; Starmer, 2000) have argued that humans are subject to varying cognitive and emotional biases, and psychologically, their preferences are inconsistent with expected utilities irrespective of the nonlinearities which may be used. In response, the PT incorporates behavioural tendencies based on psychological principles into the neoclassical expected utility preferences model (Rieger & Bui, 2011:291). Therefore, a prospect as

according to Kahneman and Tversky (1979:263), is a contract which exhibits the outcome x_i with probability p_i, whereas, decision making under risk is associated with the choice between such prospects or gambles. Simply put, people make choices from probabilistic alternatives which involve risk, and values are assigned to respective outcomes. It, therefore, describes the relationships between environmental contingency as pertains to losses and gains and risk propensity (McDermott, Fowler & Smirnov, 2008:335).

The traditional understanding of the expected utility theory is that a decision maker's preferences or utility for a specific good are driven by the good's absolute net or final asset or wealth levels (Levy, 1997:88; Dhami & Al-Nowaihi, 2007:173). People do not just make decisions based on the outcome's absolute value or the final outcome of wealth, but rather decisions are based on the coding of alternatives as gains or losses relative to a reference point (Levy, 1992:174; Taran & Betts, 2007:59-60). In contrast, Kahneman and Tversky (1979:277) emphasise that people are rather most sensitive to losses and gains and therefore encode choices in terms of deviations from some reference point than to levels of welfare and wealth. Therefore, risk preferences or sensitivity tends to differ in losses and gains in such a manner that the utility or value function is an S-shaped function, which is convex in the domains of losses and concave in the domains of gains (Dhami & Al-Nowaihi, 2007:173; Rieger, Wang & Hens, 2011:6).

The S-shaped value function, as portrayed in Figure 2.10, infers that the decision-maker will be risk-seeking beneath the reference point and risk-averse above it, meaning that there exists a negative association between return and risk below the reference point and positive above the reference point (Shen & Chih, 2005:2679). To put it in different words, when people accumulate gains, they incline to be risk-averse and risk-seeking when confronting losses (McDermott *et al*., 2008:335).

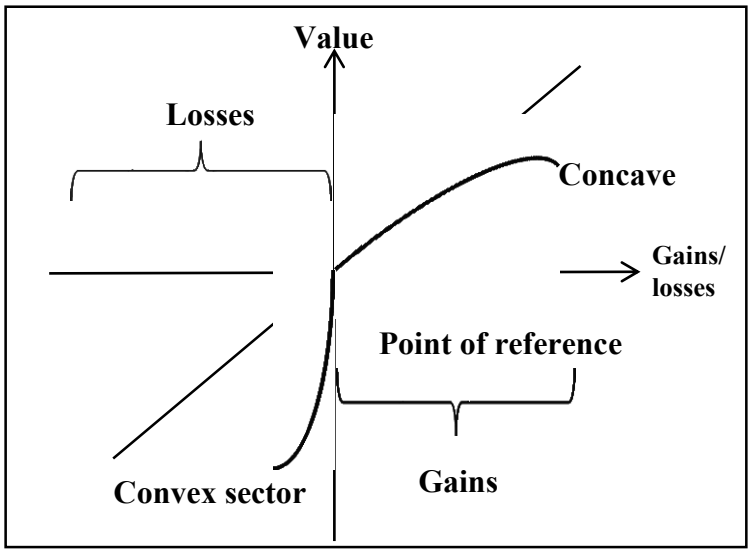


Figure 2.10: The value function of the prospect theory model

Source: Jacob and Ehret (2006:110)

According to Kahneman and Tversky (1979:263), decisions amongst risky prospects or gambles infer various pervasive effects or tendencies contrast to the tents of the utility theory. These effects include three biases, referred to as the certainty effect, the isolation effect and *loss aversion.* Where the certainty effect infers that agents tend to overweight alternatives, which are most certain and underweight outcomes which seem merely probable, resulting to risk aversion, while the isolation effect accentuates the tendency by agents' to act on information which is salient or stands out and differs from the rest in a manner that they discard components shared by all prospects. Lastly, loss aversion accounts for the instance when agents choose to avoid losses to acquire corresponding gains, which encompasses two stages known as the (a) editing phase and (b) the evaluation phase.

The decision-maker is considered to be risk-averse given that they prefer a certain or sure (gain) earning relative to a risky prospect with higher or equal expected value and risk-seeking when they prefer a risky (loss) prospect relative to a certain or sure earning of higher or equal expected, and risk-neutral if they are indifferent to a gamble and its expected value (Trepel, Fox & Poldrack, 2005:35). The PT also suggests that individuals treat gains and losses differently, such that they overvalue losses compared to gains, or rather, losses loom larger or more salient than gains, which is translated as loss-aversion (Dhami & Al-Nowaihi, 2007:173; Kahneman & Tversky, 1979:279). This results in a steeper value function in losses rather than in gains (Rieger *et al*., 2011:6).

The process of encoding choices or decisions consists of two phases. First, the *editing phase*, which consists of the identification of gains and losses constituted in the various options of outcomes and understanding them according to a neutral reference point (Trott, 2013:1). The process of establishing the first phase constitutes the PT's framing effect (McDermott *et al*., 2008:336), where decisions are framed as either losses (convex) or gains (concave) (Rieger & Bui, 2011:291), specifically, decision-makers are deemed more risk-averse in the gain frame and risk-seeking in the loss frame (McDermott *et al*., 2008:336). The second phase involves the evaluation phase, which incorporates the weighting function and the value function (McDermott *et al*., 2008:336), where the coded gains or losses are weighted based on the occurrence's perceived probabilities, forming a non-linear value function (Taran & Betts, 2007:59-60). Probabilities are weighted by an S-shaped value function in a manner that involves the underweighting of small probability events, and the underweighting of large or medium probability events (Rieger & Bui, 2011:291). Habitually, events marked by certainty or larger probabilities are interestingly underweighted and small probabilities have large decision weight, by treating highly improbable occurrences as though they are impossible and highly probable occurrences as certain (McDermott *et al*., 2008:336). This is expressed by the nonlinear probability weighting function (Rieger *et al*., 2011:6).

2.5.2.2 Behavioural biases

Proponents of behavioural decision theory believe there are core areas in which individuals seem to have erratic or inconsistent preferences, considered as biases. Virigineni and Rao (2017:449) describes the various biases recognised by behavioural theorists (such as Chaudhary, 2013:4; Jagongo & Mutswenje, 2014:95-102; Kahneman, D. & Tversky, A. 1979; Linciano & Soccorsio, 2012:7) as loss aversion, herding behaviour, regret avoidance, over-optimism, cognitive dissonance, limited attention, representativeness, status quo bias, familiarity bias, hindsight bias, over- and under-reaction, availability bias, disposition effect, conservatism, framing, self-control bias, randomness bias, self-attribution, recency bias, mental accounting, gamblers' fallacy, disposition, and endowment effect. Behavioural biases identified by behavioural theorists during individuals' decision-making processes are briefly reported in Table 2.7.

Table 2.7: Behavioural finance biases

Decision making under uncertainty: Behavioural cognitive biases	
Regret theory	When faced with different alternatives or payoffs, the individual considers both the outcome of the chosen prospect as well as that of the forgone prospect (Loomes & Sugden, 1982:808). He/she experiences *regret* or negative emotions when the outcome of the foregone prospect is more desirable than the chosen selected prospect (Diecidue & Somasundaram, 2017:88). Prospective behaviour of attempting to avoid risk makes them *regret averse*, and the intensity of regret is determined by the utility difference between the rejected and chosen action (Schran, 2013:46-47).
Theory of overconfidence	Overconfidence bias occurs in three forms of judgement biases identified as the (1) overprecision of one's beliefs, (2) overestimation of one's actual performance and the (3) over-placement of one's performance relative to others (Moore & Healy, 2008; Murata, Nakamura & Karwowski, 2015:47) with biased accuracy of judgements (Bruza, Welsh & Navarro, 2008:1499) underlining the difference between overall accuracy and the mean confidence (Kahneman & Tversky, 1996: 587).
Theory of over/under-reaction	Individuals are subject to irrationality and cognitive biases that misinterpret information by over/under-reacting (Nikoomaram, Rahnamayroodposhti & Yazdani, 2011:811). Agents habitually overly rely on certain details and anchor on pieces or traits of information in decision making (Amir & Ganzach, 1998:334; Nikoomaram *et al*., 2011:811). Under-reaction relates to the failure of individuals to react immediately and completely towards new information (Kaestner, 2006:2). Over-reaction is concerned with the excessive reaction or overweighting of dramatic and unanticipated information (Bouteska & Regaieg, 2017:209).
Herding theory	The tendency of individuals to act similarly or in alignment with thoughts or behaviour of others based on local interactions (Raafat, Chater & Frith, 2009:420; Toshino & Suto, 2004:4).
Availability bias	The ease with which information comes to mind influences individuals' judgement and assesses the probability, frequency, or likelihood of an incident based on the extent to which occurrences or instances of the incident are personally experienced or vivid or recent, thereby being readily available (Linciano, 2010:6).

Decision making under uncertainty: Behavioural cognitive biases	
Representatives	The probability of an uncertain outcome is judged by the subject based on (1) how similar or representative a single case or example of a population is to its origin or a particular group, category, or stereotype, and (b) the degree to which the outcome mirrors the noticeable characteristics of the procedure by which it is made (Zindel, Zindel & Quirino, 2014:13). A driving assumption is that small samples of people, events, etc., are akin to all members of the entire population of extraction (Zindel *et al*., 2014:13).
Mental accounting	Individuals create cognitive operations to organise, evaluate and monitor financial activities. Individuals establish an expected budget and attempt to stick to it and may utilise mental accounting to keep spending under control (Heath & Soll, 1996; Thaler, 2004; Thaler, 1990). Individuals group their financial activities into mental accounts and establish decisions according to the context of the narrowly established accounts (e.g. for self-control and restricted overspending) rather than incorporating all decisions in a single optimisation problem (Milkman & Beshears, 2009:385).
Anchoring and adjustment	A two-stage process inspired by Tversky and Kahneman (1974), where investors heavily rely on the initial piece of information, or value, offered (the anchor), and then make an estimate in relation to the often arbitrary initial value (Wesslen, Santhanam, Karduni, Cho, Shaikh & Dou, 2018:1). Individuals establish an "anchor" based on information offered and adjust their judgement or reference point by integrating additional information, and such an adjustment is often insufficient in line with the generation of the anchor and the adjustment process (Lieder, Griffiths, Huys & Goodman, 2018:323; MacEachren, 2015).
Heuristics	Individuals habitually use rules of thumb during decision making due to their inability to fully process information rationally and/or to time pressures such as restricted time (Toshino & Suto, 2004:2). In so doing, individuals tend to use simple rules, shortcuts, or often simplify alternatives prior to making decisions (Elliehausen, 2010:4; Ganesan & Bhuvaneswari, 2017:186) refer to the ease by which information can be captured by the mind, which ultimately leads to errors (Linciano, 2010:6; Stringer asset management, 2013:3-4).
Hindsight bias (or the knew-it-all-along effect)	Upon being cognisant of the outcome to the situation, individuals have the tendency of falsely believing they would have estimated a higher probability of occurrence or make predictions of the true outcome of

Decision making under uncertainty: Behavioural cognitive biases	
	the reported occurrence than estimated with foresight (Ash & Comer, 2007; Harley, Carlsen & Loftus, 2004:960). Hindsight bias results in the perception of the judgement of events to be more predictable than they really are (Linciano, 2010:8).
Confirmation bias	Individuals have the tendency to seek out and interpret information which is in line with their expectations and favours their current beliefs, expectations or hypothesis (Hernandez & Preston, 2013:178). Such behaviour conflicts the likelihood of rejecting the hypothesis and develops a sense of immunity against disconfirming information (Nickerson, 1998).

Source: Owner compilation

2.5.3 Adaptive Market Hypothesis: Bridging traditional and behavioural finance theories

The Adaptive Market Hypothesis (AMH) ascribes theoretical foundations laid out by Andrew Lo (2004) who attempted to reconcile theoretical assumptions of both the EMH with the behavioural economic theory of market inefficiencies. Lo (2004) offers the presumptions of the AMH which provide room for the co-existence of efficiencies and inefficiency (or rather the EMH and behavioural inefficiencies) in a rather consistent manner. The precepts of Lo's (2004) AMH are based on the application of biology's evolution approach and cognitive neurosciences to economic interactions. Upon which, markets under the AMH's ecological systems are characterised by heterogeneous "species" or groups competing for scarce resources (opportunities) where cycles of competition tend to deplete these resources, and new resources or trading opportunities appear (Neely, Weller & Ulrich, 2007:1-2). In such a market, agents are boundedly rational "satisfiers", and no longer "hyper-rational" beings (Neely, Weller & Ulrich, 2009:468).

The primary assumption of Lo's (2004) AMH is that markets are adaptable and at different points in time, they tend to switch between efficiency and inefficiency. As such, the AMH overlooks the EMH's all-or-nothing efficiency but rather deems the market as a feature of cyclical episodes of market efficiency and market inefficiency (Seetharam, 2016:2), where market efficiency rather only evolves over time (Urquhart & McGroarty, 2016:39). Thus, the AMH explains agents' adaptive nature and how markets consequently become adaptive (Hiremath & Kumari, 2014:1-2). According to Lo (2004:16), the institutional and individual

fortunes, the efficiency of markets, and the waxing and waning of financial institutions, investment products, are governed or determined by aspects of evolution, such as competition, reproduction, mutation, and natural selection.

Hall, Foxon, and Bolton (2017:285) distinguishes two forces which act against the reproduction and establishment of the EMH's "efficient" capital market as (a) investor cognition and (b) structural change. According to Hall *et al.* (2017:285), both forces co-evolve to produce the capital markets at a particular point in time for a given asset. Contrary to the EMH's assumption of a frictionless market, the AMH posits that market frictions do exist (Hiremath & Kumari, 2014:1), as pricing anomalies may be observed in an adaptive-efficient market's historical data (Seetharam, 2016:3).

According to Chan, Getmansky, Haas & Lo (2005:38), such frictions include borrowing constraints, transactions costs, costs associated with processing and gathering information, and institutional restrictions on short sales as well as other investment practices. Forces which drive prices to their levels of efficiency are weaker and operate over longer time horizons, and resultantly, these forces are governed by processes of learning and competition, and natural selection pressures (Neely, 2007:1). Presumably based on the notion of "survival of the fittest", Seetharam (2016:3) notes that if individual agents do indeed learn from the history of past prices, price anomalies will not persist for too long. Thus, the evolution of real-world markets' characterised frictions is determined by the laws of natural selection or survival of the fittest, unlike efficient market investors, AMH investors are erroneous and learn to adapt their behaviour accordingly (Hiremath & Kumari, 2014:2).

The ever-changing environment as pertains to business conditions, the type and magnitude of profit opportunities available, and the number of competitors exiting and entering the market, act as a stimulus for cycles of loss and profitability undergone by investment strategies (Lo, 2004:23). Influences of structural changes necessitate an environmental change of the operative investor market, compelling institutions and investor behaviour with the choice to evolve, or face extinction, as pertains to natural selection's principle of "survival of the fittest" (Hall, 2017:285). In line with biology's framework on evolution, natural selection thereby enforces "survival of the fittest" and drives the composition and number of market participants and trading strategies in a way that the more market participants conform and adapt to the ever-changing environment, the more they rely on heuristics to make investment choices (Urquhart & McGroarty, 2016:40). The developed heuristics seek to adapt to new realities in periods of

change or turbulence amidst a changing investment environment, along with investor behaviour, which also tends to change over time (Hall, 2017:285).

Lo's (2004) AMH principles on market and individual behaviours can be summarised according to the primary understanding that individual agents are neither irrational nor rational, but are biological entities whose behaviour and characteristics are modelled by forces of evolution. Consequently, individual agents exhibit behavioural biases and create suboptimal choices, but can learn from historical experiences and re-model their heuristics as a response to negative feedback (Svensson & Soteriou, 2017:6). Similar, but different from biological evolution, individual agents have the capacity for establishing abstract thinking, prediction making and establishing preparations, driven and based on past experiences, to respond to changes in market environments (Siegel, 2017). Thus, the dynamics of financial markets are driven and governed by agents' interactions as they behave, learn, and adapt to political, social, cultural and natural environments as well as the economic landscape and each other. But ultimately, survival is the main driving force for innovation, competition, and adaptation.

2.6 BUSINESS CYCLE THEORIES: THE CAUSES AND NATURE OF CYCLES

Main research paradigms of economic thought have presented substantial theoretical contributions on the explanation of business cycle mechanisms. The market-clearing model is used by New Classical proponents in explaining and understanding the business cycle, whereas the New Keynesian economists relate fluctuations in the business cycle to heterogeneous market failures, while intertemporal disequilibrium is used by Austrians to analyse the cycle (Dobrescu, Badea & Paicu, 2012:239). Accordingly, proponents of monetary business cycle analysis adopt monetary misalignment as the cause of disequilibrium in macroeconomic activities, as pertains to intertemporal resource allocation (Dobrescu *et al*., 2012:239). Causes of business cycle expansions and recessions, and whether they are random or systematic, remain an issue of contention. Institutionalists and post-Keynesians both believe conditions which lead to downturns are created by upturns. For Austrians and neo-classicalists, economic expansions could be a continuous outlook on the condition that there is an absence of misguided policy decisions and exogenous shocks (Harvey, 2017:1). Financial market frictions are a cornerstone of Austrian business cycle theories, labour market frictions within classical theories, and product market frictions for Keynesian based business cycle theories (Ekkehard & Stockhammer, 2003:1). Table 2.8 outlines the various business cycle theories and their stances based on the different schools of thought.

Table 2.8: Business cycle theories

Business Cycle Theories		
School of thought	**Stance**	**Discussion/Rationale**
Traditional classical theory	self-correcting	
Traditional Keynesian revolution	no self-correction	1950s and 1960s
Monetarist theory	money determines Y & employment	1960s and early 1970s
New classical theory	policy ineffectiveness	1970s
New Keynesian theory	contract-based wage & price stickiness	1970s and 1980s

Source: Ernst and Stockhammer (2003)

Figure 2.11 showcases the timeline and the transition of economic belief of one school of thought to the next, following the classics and Keynesian schools of thought as the different foundations for the new age or more recent understanding of business cycle theories.

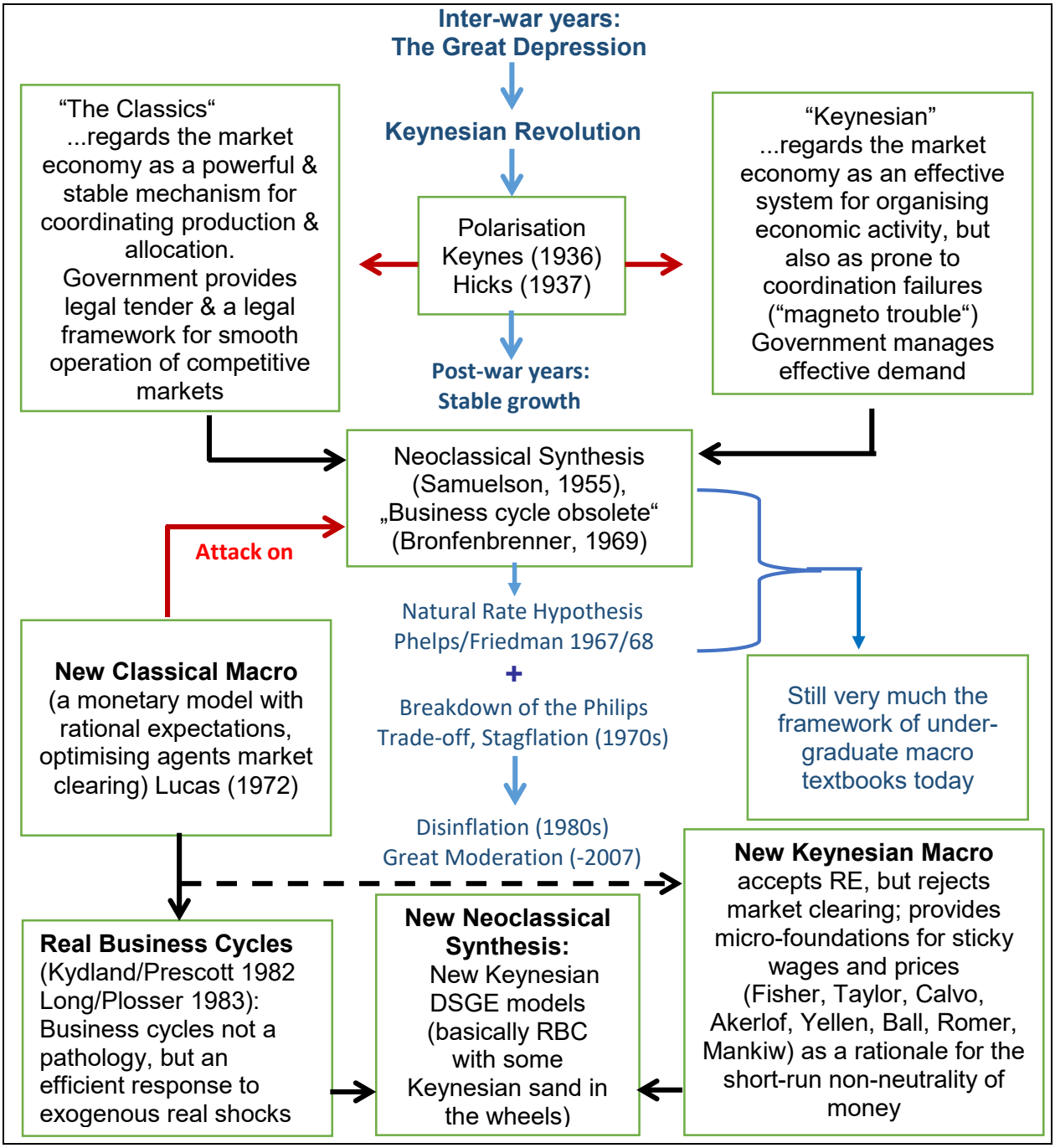


Figure 2.11: Business cycle theories

Source: Landmann (2014)

2.6.1 Classical business cycle theory

Understanding fluctuations of business cycles within macroeconomics has spiralled across explanations of the nature and causes of cycles. Most foundations of economic analysis which have set the precedence for establishing mainstream stylised facts hover over the debate surrounding concepts of exogenous (external) versus endogenous (internal) sources of macroeconomic cycles. The classical school, which has now resurfaced as the neoclassical

school, motivates for exogenous sources of business cycle booms and busts, advocating the economy to a "supply-side" environment (Dagum, 2010:581). This follows and extends upon the argument by Say's law, which contends that "supply creates its own demand". Much of the debate surrounding the reasons for business cycles as either being caused by exogenously or endogenously is often framed on the basis of either supporting or refuting Say's law (Doshchyn & Giommetti, 2013:4-5; Swanepoel, 2018:5).

Henceforth, classical or neoclassical proponents mostly contest for an economic system free from- or at least minimal - intervention or regulation by government policy, known as a *laissez-faire* approach, simply to let go. This form of literature is driven by the rationale that the market functions best when exogenous shocks are not present (Dagum, 2010:581). The market is perceived to have automatic economic stabilisers considered to drive the economy back into its full employment equilibrium without requiring external regulation (Ekkehard & Stockhammer, 2003:1). Proponents of neoclassical research contend that there is an extremely small or even negligible welfare cost of the business cycle, henceforth, policy authorities need not focus on stabilisation, but rather on long-term growth (Dagum, 2010:581). The 2007-08 recession reawakened debates surrounding Keynesian and neo-classical proponents.

Most economists abiding by the conventions of the neoclassical precepts as opposed to Keynesian economics have often perceived departures from equilibrium to be caused by exogenous factors such as market intervention by authorities, technological shocks, business market monopolies, labour unions, or natural causes. Whereas, other means of theory assign credit to be the cause of economic cycles. An increase in private debt or the total expansion of credit as a percentage of GDP, promotes business expansions, whereas a total contraction in credit, such as the bursting of speculative bubbles, yields recessions or even depressions. It thus considers banks or finance to be the centrepiece of business cycles (Dagum, 2010:581-582; Landmann, 201f4:3).

2.6.2 Keynesian business cycle theory

Classical research appeared to be the perverse form of explanation concerning business cycles booms and busts prior to the Great Depression. The wake of the Great Depression revived research interest in the economic cycle, which oversaw the emergence of the Keynesian revolution. The consensus within Keynesian economics was formulated based on two contrasting episodes. First, the 1930s decade which witnessed increased unemployment (the Great Depression), appeared to showcase the price system's weak equilibrating properties.

Second, the contrastingly low unemployment levels during World War II which seemed to showcase fiscal policy's usefulness in facilitating aggregate demand in controlling the level of employment towards its full level of employment (Hetzel, 2013:84). The then, newly found economic thought largely shunned the classical and neoclassical economic presumptions of exogenous causes of business cycles. Notwithstanding, a resurgence of some neoclassical arguments has resurfaced within the works of the Real Business Cycle (RBC) theory (Landmann, 2004:3-4). In contrast to the exogenous led business cycle of the classical view, precepts of the early Keynesian school of thought put forward the notion that cycles are caused by endogenous or internal factors, which can be explained through the "demand-side". Insinuating that inadequate effective demand may offset supply, resulting in a business cycle depression or recession. Keynesian economics, therefore, calls for fiscal or government intervention, in that, amid the absence of such regulation, economic markets will be vulnerable to transitions from one crisis to the next (Caporale, 1990:5; Dagum, 2010:581).

Keynesian economics is built around effective aggregate demand and explores the absence of economic stabilisers to steer markets back into full employment following a drift, and the lack of stability in the goods market. According to Keynes (1936), unemployment is an involuntary phenomenon in which aggregate demand shortages generate cycle unemployment. The theory suggests that aggregate demand and production do not match, thereby locking the economy in an underemployment trap. In such a case monetary and fiscal regulation are pertinent stabilisers in steering the economy back to full employment unlike the self-equilibrating economic mechanism described in the preceding classical presumptions (Ekkehard & Stockhammer, 2003:1). Policy authorities can smooth business cycles by the use of expansionary fiscal policy through the increasing fiscal spending or downsizing taxes, or increasing money supply based on mechanisms of expansionary monetary policy (Dagum, 2010:580-581).

Mouhammed (2011:104) highlights that firms make investments and hire workers given that future expectations are favourable. In the case that reality meets expectations, employment and investments persist until equilibrium is met when supply equates to aggregate demand, known as the point of effective demand, which can sometimes be less than the equilibrium of full employment. Otherwise, when economic expectations of the future are not favourable, firms create less investment and employment opportunities. Thereafter, equilibrium occurs when cyclical unemployment exists and is a result of aggregate demand shortages, mostly expenditures in investment.

2.6.3 Monetarist business cycle theory

Amongst the competing theories on the explanation of The Great Depression are the Keynesian and Monetarist models. At the centre of these models are the presumed causes and remedies of business cycles or economic fluctuations. The monetarist theory, epitomised by Milton Friedman (1963; 1968; 1977), following *The Debt-Deflation Theory of Great Depressions* by Irving Fisher (1933) and known to be the first form of monetarism. The monetarist theory contended against the activities monetary policy supported by Keynesian economics amid the Great Inflation, which occurred during the mid-1960s and 1970s (Snowdon & Vane, 1997:191).

According to Hetzel (2013:84), monetary policy at the time was activist, in that the Federal Reserve sought after objectives of both inflation and unemployment based on the Philips curve's presupposed trade-off. The Keynesian-Monetarist debate was focused on whether policy authorities should or could centre policy the suggested unemployment-inflation trade-off observed in Philip's curve empirical correlations (Hetzel, 2013:84). Keynesians argued that activist intervention is required at a macroeconomic level in that there exist substantive market failures (Snowdon & Vane, 1997:205). Monetarists contended that the monetary policy's central bank needs to fixate on the facilitation and management of money creation based on the objective of maintaining price stability (Hetzel, 2013:84). They believed that money, and thus monetary policies, are seminal factors that determine levels of output and employment (Bilgili, 2001:4).

The Monetarist consensus is based on two striking hypotheses. The first assumes that institutions involved in managing the creation of money are responsible for the behaviour of price levels as the price is a monetary phenomenon (Hetzel, 2017:1). Secondly, provided that monetary authorities follow a rule which permits market forces to regulate real variable and seeks to create a steady nominal anchor, the price system work is effective towards attenuating economic fluctuations or business cycles (Hetzel, 2017:1). Monetarists place emphasis on money stock as the prime cause of total spending or business cycles, where money's rate of growth rate is perceived as business cycle's impulse (Andersen & Carlson, 1970:7; Bilgili, 2001:2).

Henceforth, an expansion is a result of an increase in money growth, and a recession is caused by a decrease in money growth (Parkin, 1996:414). The monetarist projects that The Great Depression was a result of a decrease in money supply as of the early 1930s. In contrast, the

Keynesians perceive fluctuations in aggregate demand as the source of economic fluctuations and thereby believes that adjustments in government policy as an active stabiliser (Bilgili, 2001:1). Under the Keynesian model, a failure in autonomous spending was therefore presumed as the cause of The Great Depression, specifically, the overall collapse was due to a decrease in investment and housing (Bilgili, 2001:1). A critical assumption of the Monetarist consensus is that of rational expectations, in that firms will collectively behave or coordinate towards the relative price changes provided that the central bank performs in a credible and predictable way (Hetzel, 2013:93-94).

The Monetarists assert that aggregate employment can be affected by monetary policy based on its effect on conditions of aggregate demand. Meaning that control over inflation based on the Philips curve mechanism can be used by monetary policy. According to which, a combination of the level of inflation rates and employment is given on which monetary policy may choose from (Gottschalk, 2002:6). Meanwhile, demand stimulus based on the traditional Keynesian model in turn based on an expansionary policy, may lead to rising employment levels without causing further increases in inflation as nominal prices and wages are considered as exogenous (Gottschalk, 2002:6). Notwithstanding, a stimulus in demand may still cause increased employment and also rising inflation as mechanisms of the Philips curve provide linkages between nominal and real variables. Hence the Philips curve proposes that a trade-off is made by policy authorities between inflation rate and unemployment rate and set a balance between curbing inflation and sustaining vibrant economic activity (Gottschalk, 2002:6).

Considerations on the money stock as sources of fluctuations in overall economic activity under the Monetarist view highlights the business cycle as purely a monetary phenomenon. According to which, deflation, as in a severe decline in the quantity of money, compels economic activity to fall into a depressive state. On the other hand, money stock increases pronounce a stimulus in market activity or an upward phase in the cycle, thus inflationary pressures or an increase in prices (Ifrim, 2011:434). The rising phase in the cycle is accompanied by either an increase in money circulation velocity, or increased credit or money, or both. Inflation, therefore, denotes a type of economic expansion, while deflation denotes a kind of depression (Rőpke, 1936:112). The rationale behind such dynamics lies within the explanation that a decline in money stock resorts to a decrease in total demand; thus supply is compelled to decrease. There remains an accumulated amount of stock as suppliers had initially produced more according to their expected level of demand, and are now forced to restrict production.

Consequently, the resultant outcome is increasing unemployment levels, decreased incomes and wages, which ultimately, leads to an economic depression (Ifrim, 2011:434). Under inflation, the anticipated level of demand by producers is less than actual demand, as such, increased supply prompts a rise in the demand for the economy's available factors of production. Under these circumstances, monetary policy can, for instance, increase credit or money stock or the speed of money circulation during events to accompany the upward phase in the business cycle or expansion. A depression would thus be accompanied by reduced money supply. According to Bilgili (2001:3), the Keynesian model considers monetary policy a less effective tool for business cycle intervention than fiscal policy. Meanwhile, the monetarists place much emphasis on the direct influence of monetary policy as opposed to fiscal effects in influencing economic output cycles.

The Austrian School of Economics has been key in criticising the Monetarist theory in terms of the role of monetary policy. Under the Monetarist model which projects that monetary fluctuations are key stimulating both contractions and expansions, the Austrians consider the extension of credit as a prime responsible factor for expansions while the correction is nevertheless carried through by real factors (Ifrim, 2011:436). Furthermore, monetarists have received criticism as to their estimations having essentially focussed on the labour market, regarding the linkage between unemployment and inflation, but disregarding the capital market (Garrison, 1986, 1989).

2.6.4 New classical theory

The early 1970s marked the inception of new methods of interpreting business cycles presented in a body of research often referred to as the New Classical revolution, mostly challenging the views of the Keynesian body of research (Deng, 2009:7). The newly established foundation of work was pioneered by Lucas (1972), in accordance to the works on "rational expectations" by Muth (1961:315-335), with most researchers undertaking macroeconomic studies having embraced a new founded method of analysing business cycles based on the competitive equilibrium theory. Lucas (1972) proposes that business cycles are a result of unexpected monetary shocks. Lucas' (1972) theory of equilibrium business cycles incorporates the trend which he describes as the optimum position of equilibrium, according to which cycles are conceptualised as non-optimal temporary trend departures but within equilibrium positions.

The New Classical theory motivated the development of the real business cycle theory as well as the New Keynesian body of research. Most theoretical prepositions of early New Classical

economics abandoned precepts of the classical dichotomy whilst salvaging the central axiom on continuous market clearing (Dobrescu & Paicu, 2012:154; Mankiw, 1989:80). Opposite to the traditional Classical theory, the New Classical theory asserts that economic agents have imperfect information when it comes to market prices, where movements in overall price levels, which are considered as unimportant in the Classical theory, are confused with those in relative prices (Mankiw, 1989:80).

Nevertheless, Duarte (2012:198-202) projects that both the New Classical theory and the real business cycle theory follow the stance of the preceding Classical thought, contrary to the Keynesian agenda, that intervention by the government is not relevant as business cycle fluctuations are shock-responses by private individuals in the decision-making process. However, Lucas (1972) displayed a favourable aligning with the cycle's monetary cycle, whereas this was not the case for real business cycle frameworks as their models were mostly based on fluctuations steered by shocks in technology and not monetary shocks. In Lucas' (1972) terms, information was treated as imperfect, whereas scholars of the real business cycle considered the world to be characterised by perfect information or a perfectly competitive economy (Duarte, 2015).

According to Stadler (1994:1750), the New Classical theory accounts for rational expectations within economic cycles characterised by perfectly competitive economies. It places emphasis on imperfect information and considers monetary misperceptions as nominal shocks to be the cause of business cycles. Practically, an unanticipated money supply decline results in economic agents concluding that relative prices of their produced goods are temporarily low, prompting them to minimise the quantity supplied. Mankiw (1989:80) contends that the former narrative is hard to accept as this may not be sufficiently great enough to generate heightened modifications in observed quantities along the business cycle.

2.6.5 Real business cycle theory

The RBC theory, a class of new classical models, speak of the causes and behaviour of economic cycles based on Kydland and Prescott's (1982) work. Mankiw (1989:80) postulates that this theory embraces the classical dichotomy, contrary to the Keynesian and early approaches of the classical business cycle theory. It thus welcomes the irrelevance of monetary policy, in contrast to the formerly longstanding precedence upheld by most macroeconomists. In so doing, nominal variables in the form of price levels and money supply are considered to be irrelevant in explaining the fluctuations exhibited in real variables; i.e., employment and

output. The RBC theory extends views held by New Classical and rational expectations in response to the study of business cycles by Keynesian economics. It sought to extend and fill the gap presented within the neo-classical framework concerning the analysis of economic system dynamics and the possible cause of business cycles (Vecchi, 1999:159).

The RBC was formulated on the premise that economic cycles or fluctuations are outcomes of real shocks outside the decision-making process of individuals' optimal decision-making (Deng, 2009:10), with perfectly competitive and frictionless economies and complete markets (Stadler, 1994:1751). It is constructed on the grounds of expected utility maximisation and follows the proposition of the neoclassical's rational expectations, where agents are perceived to be rational maximisers (Stadler, 1994:1751; Deng, 2009:10). The presupposed cycles are inclined to be initiated by real shocks. These shocks are particularly thought to be caused by technological or innovation disturbance, as opposed to fiscal and monetary variations projected by earlier works on the equilibrium-approach (McCallum, 1988:1). In that, large fluctuations are inherent in the rate of technological progress (Gazda, 2010:42).

Under the RBC theory, business cycles are considered to be "real", in the sense that they epitomise the most optimal or efficient way of the economy's operation and do not embody the failure of markets to clear, provided the economic structure (Dagum, 2010:581). Kydland and Prescott (1982), and Nelson and Plosser (1982) claimed that relative to monetary shocks, real shocks are largely more pertinent factors in explaining the performance of aggregate output over time. Nelson and Plosser (1982) subsequently argued that such literature is in concordance with the declaration of a random walk, meaning that output follows a certain path.

The rate of technological change is inherent of large random disturbances, which individuals, *i.e.* workers and firms, respond by rationally altering their consumption, investment and labour supply levels ultimately affecting aggregate output. Henceforth, the RBC theory views the business cycle as an efficient and natural economic response to variations regarding present technological invention (Mankiw, 1989:79). The technology factor imposes sporadic fluctuations in the level of productivity which results in up and down shifts of the constant growth trend (Deng, 2009:10). Recessions within the business cycle are caused by an undesirable shock in productivity and thus economic restraints, provided these restraints, individuals make choices which maximise their expected utility likely to provide them with the possible outcomes. RBC literature argues that cyclical components of macroeconomic time series include deviations from a stochastic trend, thus techniques of trend specification should be established prior to further analysis of series (Gazda, 2010:43).

Individuals' optimal choices trigger an efficient market reaction exhibited in the form of a recession. Thus, cyclical activities of both economic recessions and expansions are forms of efficient reactions towards exogenous technological distortions within the real economy (Deng, 2009:10). Other response mechanisms, *i.e.* variations in monetary policy, coordination failures, fiscal policy, tax rates or preferences, waves of pessimism or optimism, and price stickiness, are considered by the RBC as displaying insignificant or minor influences on the economic cycle (Stadler, 1994: 1751-1752). Contrasting with the RBC theory are the Keynesian and Monetary theories of the business cycle, which project economic busts or recessions as the inability of markets to clear and not as a source of exogenous factors (Dagum, 2010:281).

Woodford (1999) argued that nominal frictions are also important because they help us understand how prices vary relative to the costs of production. Formally, the New Keynesian paradigm adds two elements to the RBC paradigm. First, there is market power, which on the side of firms allows them to set prices and on the side of workers allows them to set wages. Second, there are limits to firms' abilities to adjust prices and households' ability to adjust their demanded wages. These limits arise because adjusting prices or wages may be too costly. Alternatively, some firms or households might not have an opportunity to adjust prices or wages; for example, due to fixed contract terms. As the example from Galí (2015) makes clear, the extra ingredients of the New Keynesian model change how shocks affect observables, such as output, when compared with the RBC model. The model also provides the scope to think about new sources of shocks, such as monetary policy shocks to nominal interest rates. Estimated versions of these models have shaped how central banks today analyse business cycles.

These models are also referred to as dynamic stochastic general equilibrium (DSGE) models. Their dynamic nature is explained by how much people work or consume in the model depends on their assessment of past and current conditions and their expected future paths. They are stochastic because they are driven by random shocks. If the shocks are absent, the models imply that business cycles are predictable. And they are general equilibrium models because there is full feedback of the choices of individual firms and households onto one another. In a key breakthrough, Smets and Wouters (2007) showed that such a DSGE model could match state-of-the-art statistical models for forecasting. At the same time, DSGE models allow us to interpret the forces at play in the economy. Other models, such as a no-change forecast or a vector-autoregressive model, also often produce good forecasts. But compared with these purely statistical models, the DSGE model permits us to open up the black box of what had

driven an economic forecast and where the forecast fell short. Even in hindsight, this information is important for policymaking and for improving models. For example, as is discussed further on, the Great Recession prompted economists to look at shocks in the light of financial conditions.

2.6.6 New Keynesian business cycle theory

Despite its name being linked to Keynesian economics, the New Keynesian business cycle theory does not have much to do with the traditional Keynesian models. Instead, it adopts models of the preceding RBC theory, with just market frictions in the form of price and wage rigidities, in the process of wage and/or price adjustments (Kehoe, Midrigan & Pastorino, 2018:1; Kydland & Prescott, 2004:24). The conciliation between the RBC and New Keynesian proponents presented the decomposition of economic time series into cyclical and trend components, with the emphasis on nominal rigidities as the prime cause of real effects in the short run by the New Keynesian's Dynamic Stochastic General Equilibrium (DSGE) methodology (Duarte, 2015:2).

The early 1980s marked the founding of the New Keynesian theory in response to the former challenges posed by the New Classical theory, which criticised traditional Keynesian economics for not giving microeconomic explanations concerning price rigidity (Melmies, 2010:445; Stadler, 1994:1750). The New Keynesian theory thereby aims to justify market frictions in the form of price rigidity in regards to microeconomics, so as to explain the short-run non-neutrality of money, and therefore the occurrence of fluctuations in output as real effects following nominal shocks (Melmies, 2010:445). The perceived monetarist theory controversy, and Lucas' (1972) critique, which posed fundamental questions, also led to the development of the New Keynesian approach to macroeconomics. New Keynesian economics was established as an alternative to the RBC theory's competitive flexible-price framework, built around core fundamentals comparable with the original model proposed by Kyndland and Prescott (Goodfriend & King, 1997:246). Relative to the traditional Keynesian framework, the New Keynesian models rely heavily on microeconomic foundations. Models presented by the latter have become the benchmark by which monetary policy is analysed (Kydland & Prescott, 2004:4).

Subsequent research to Kyland and Prescott's analysis of supply shocks has prompted scholars to re-evaluate the sources of economic cycles as well as examine the relative significance of various other shocks. Results by the two former scholars were based on well-functioning

markets, whereas the following bodies of research, such as New Keynesian economics, focused on the implications of different market imperfections, giving prominence to shocks in both demand and supply (Kydland & Prescott, 2004:4). Thus, alongside the consideration of core precepts of Kydland and Prescott, is the New Keynesian theory's incorporation of market frictions.

While the New Keynesian theory accepts the rational expectations view, it stresses the prominence of the markets' imperfect competition, high adjustment costs of prices and externalities. It also looks at nominal shocks as being the prime impulse mechanism (Stadler, 1994:1750). Both the RBC theory and the New Keynesian economics consider technology to be of great prominence in causing the majority of economic fluctuations. Aside from the incorporation of various shocks and frictions, the RBC model remains the prime driving force for the New Keynesian model (Kehoe *et al*., 2018:10). Justiniano, Primiceri and Tambalotti (2010), Smets and Wouters (2007), all regard investment-specific shocks in technology to be demand shocks, for New Keynesian models, activist monetary policy is required to minimise output volatility as well as a counterbalance demand to cutbacks. This contrasts with models that have flexible prices, where the role of monetary policy is negligible (Kehoe *et al*., 2018:11).

Despite having its basis on the RBC theory in some segments, particularly the DSGE methodology, the New Keynesian theory upholds certain departures from the RBC theory. Specifically, it considers prime assumptions in the form of monopolistic competition, nominal rigidities and the non-neutrality of monetary policy in the short-run (Galí, 2015:5). Under the New Keynesian model, since goods markets are not perfectly competitive, it therefore assumes monopolistic competitive markets; thus, prices are configured by private agents with some monopolistic power (Van Hoang, 2015:2). These private economic agents set prices and/or wages based on their urge to satisfy their own objectives.

Additionally, prices are not fully flexible, in that prices are sticky or frictional, and there are nominal rigidities which cause wages and prices to adjust slowly (Ješić, 2017:169). Adjustment costs present potential business cycle social costs (Goodfriend & King, 1997:249). Firms are constrained by certain limits which inhibit them from rapidly adjusting prices, such limits are spring forth due to the high costs associated with changing wages or adjusting prices, these can be in the form of fixed contract terms (Drautzburg, 2019:3-4). Hence, firms can only make slow adjustments to their prices at random times (Kehoe *et al*., 2018:11). Workers, or their representative unions, also face resistance in the form of sticky wages (Galí, 2015:5). The

decision of wage and/or price setting is openly based on rational expectations and modelled as forward-looking, resulting in the Philips-curve model. Whereby, monetary shocks can potentially produce heightened effects on output, fluctuations in the short-run can be therefore be stabilised, or produced by monetary policy (Kydland & Prescott, 2004:24).

Additionally, in the short-run, collective monetary policy is non-neutral, implying that interest rate changes do not match or infer immediate changes in inflation expectations, as a result of nominal rigidities. In the New Keynesian's sticky-price models, monetary policy is considered to be central to the evolution of real activity (Goodfriend & King, 1997:231). The presentation of real and nominal rigidities introduces a platform on which the hypothesis of monetary policy inefficiency is rejected in the view of rational expectations (Dimitrijević & Fabris, 2007:141). This gives monetary policy authorities the leeway to make real interest rate adjustments and influence investment and consumption decisions (Van Hoang, 2015:2). The market returns to its natural equilibrium within the long-run as all wages and prices adjust, that is, a form of equilibrium which would triumph in the absence of nominal rigidities (Galí, 2015:6) The New Keynesian DSGE models, therefore, incorporates numerous supply and demand shocks, and the effects of such disruptions is decomposed within business cycles. Under monetary policy, based on the use of the New Keynesian DSGE models, authorities can pursue obligations such as full employment and price stability by using interest rates in the case of unanticipated demand increases (Drautzburg, 2019:5).

2.7 SYNOPSIS

This chapter discussed the theoretical avenues of some of the relevant theories and literature on the financial market and macroeconomic behaviour. Amongst the key avenues of financial market behavioural analysis is the traditional or Neoclassical Finance Theory, which has been roundly refuted by the behavioural finance theorist, one of the most recent theories in financial market analysis. Behavioural finance theory has arisen as a counter-intuitive theory to the former simulated assumptions of traditional finance. It challenges key assumptions of perfect rationality, perfect information and utility maximisation within a perfectly competitive market inscribed within theories such as the Efficient Market Hypothesis (EMH) and the expected utility theory (EUT). Such assumptions have come under heavy criticism from proponents of behavioural finance theory, who advocate for existing and potential market anomalies arising from imperfections of individuals' decision-making capabilities and market anomalies.

The notion of highly efficient economies relates to markets where the possibilities of earning abnormal profits or the mere prediction of the market is not possible as no one can beat the market since all agents aim to maximise their utility through full access to all information. Behavioural finance critiques these assertions based on the understanding that individuals incur "bounded rationality" when making decisions due to their cognitive limitations and limited time by which they can make fully rational and utility maximising decisions based on the neoclassical acclaimed "full-information". If the precepts of neoclassical finance theory hold, then there would be no opportunities for profit-making. Contrary to this, behavioural finance accounts for the existence of market anomalies such as "noise trading" and stock market bubbles, underreactions and overreactions. These theories provide inferences upon which the subsequent findings of the study were analysed in establishing informed and comprehensive deductions of whether business cycles have the capacity to predict or explain financial market behaviour. The following chapter examines South Africa's financial market environment together with the retrospective statistical performance of the underlying trends and patterns.

CHAPTER 3: TRENDS AND POLICY ANALYSIS OF THE FINANCIAL MARKET AND THE MACRO-ECONOMIC ENVIRONMENT

3.1 INTRODUCTION

Chapter 2 provided a theoretical basis of the finance and business cycle theories in relation to conceptualisations and associations of the monetary and real sectors. Both traditional and behavioural finance theories underpinned the prime frameworks for interpreting economic agents and market participants' behaviour within financial markets. Khetsi and Mongale (2015:156) note that the linkages between the monetary sector and real sector are mediated by and connected to the financial or capital markets, which smoothen growth processes for economic and real sector development. In turn, Shipalana and Moshoeshoe (2019:3) accentuate that deepening capital markets and financial systems in different regions can bolster the growth of funds through bonds, stocks, as well as alternative investment ventures. The financial market's capital markets can be defined as markets facilitating the trade of financial securities between sellers and buyers occurs amongst market participants constituting both institutions and individuals. Financial securities may include stocks and bonds, *inter alia* (The Economic Times, 2019).

Financial market developments, such as market fluctuations, play a crucial role in modern economies' macroeconomic dynamics (Strohsal, Proaño & Wolters, 2015:1). There is a substantial economic significance played by South Africa's capital markets in the country's overall economic landscape. Hassan (2013:1) highlights that the stock market alone is worth almost South Africa entire output, while the currency, derivatives and bond markets are also amongst the worlds' largest in terms of turnover. The 2007-08 financial crisis has raised increasing attention towards the cyclical behaviour of economic cycles such as those of the financial markets, most particularly at the International Monetary Fund (IMF), and the Bank of International Settlements (BIS), who have devoted a considerable amount of research analysing financial cycles (Strohsal *et al*., 2015).

This chapter pursues the achievement of the objective pertaining to the review of policy insinuations of the financial market environment and the historical or trend performance of financial market cycles relative to BCIs. Establishing a rigorous analysis of the financial market and business cycle environment necessitates the analysis of trends and policies relating to the prime factors within South Africa's finance and real sectors. Particularly, in relation to aspects of South Africa's financialisation processes, the financial market's regulatory framework,

characterisations of the stock, bond, commodity, and exchange rate capital markets. In regards to the real sector, the chapter presents an analysis of South Africa's macroeconomic environment in terms of the country's economic or business cycle climate.

3.2 FINANCIALISATION OF SOUTH AFRICA'S POST-APARTHEID ERA

Financialisation, in its simplest terms, can be explained along the lines of the proliferation and expansion of the overall financial markets in regards to the strengthening of the role of finance within the national and global economy (Fine, Bayliss & Robertson, 2016). Epstein's (2005:3) broad definition of financialisation has been used by various economists and has proved to be recurrent in the scholarly environment. Epstein (2005:3) defines financialisation as the heightening of the roles of financial markets, financial motives, financial participants and financial institutions within functions of international and domestic economies. For wealthy nations, financialisation is associated with elements of the financial sector's rapid growth and increased financial innovation which lead to short-term growth at the risk of increased financial vulnerability or fragility (Karwowski, 2018:416).

Moreover, Szunke (2014:98) relates the concept of financialisation to the increased degree of influence that market participants and market processes have towards the financial system framework and within company or enterprise operations and activities, whereas the economic system's operative function is influenced by both the micro- and macroeconomic perspectives. Szunke (2014:98) further propounds that increased financialisation tends to steer economic exposure to the flow of income within the financial sector from the real sector. This carries with it changes in the processes and the structure of the accumulation of capital, such as the shifts in the associations of financial institutions, households, and corporate business (Ashman, Mohamed & Newman, 2013:1). The financial sector constitutes the supply of financial services, amid a financial system which matches the demand and supply (Schmidt & Hryckiewicz, 2006:4). The real sector, on the other hand, encompasses non-government and non-financial sector production of goods and services (Oduyemi, 2013:5).

Understanding of financialisation at a macro level can be perceived as an advancement in the regime of accumulation (Ducastel & Anseeuw, 2018:556). Now, such a shift entails the shift of roles from financial institution's intermediary function between investing firms and household savers to the creation of liquid markets by which claims on corporate earnings can be bought and sold freely by household investors (Ashman *et al*., 2013:1).

McKenzie (2013:6) underscores that conditions to processes of financialisation include the following associated processes linked with the state of the world economy in playing a great role in the economic and social life:

- Liberalising controls on capital and trade;
- The deregulation of markets by the global economy and the rise in privatization; and
- The surge in the innovation of finance though Black-Scholes as well as the increase in information technology.

Researchers such as Aglietta and Breton (2001) as well as Lapavitsas (2009), further expand that financialisation, for developing countries, involves a shift from the financial system's bank-based nucleus towards a market-based financial system. Alternatively, the financial sector's rapid growth (Philippon, 2007) and aggressive market innovation within rich countries have been recognised to be amongst the features of financialisation (Lagna, 2015:283–300). The above citations provide a common feature of associating financialisation to the increase in the extent of direct access to capital markets and money, by major non-financial corporations along with their search for financing. The United Nations (2015:30) posits that the global economy's financialisation in the absence of sufficient domestic regulation of financial markets may leave economies more susceptible to ramifications of the capital markets' boom-and-bust cycles. The term financialisation is closely intertwined with the implementation of neoliberal policies. Such policies constitute the active advancement of the interests of the financial sector together with a shifting state obligation, specifically via the transition to privatization (Ashman *et al*., 2013:1).

During the apartheid era, South Africa's growth was mainly driven by intense state intervention in both financial and industrial development. This was focused on the development and promotion of sectors predominantly characterised by large scale capital intensiveness associated with extractive industries, specifically, the Minerals and Energy Complex (MEC) core (Newman, 2014:13). Such an industrial and economic structure laid the foundation for increased levels of the economy's deindustrialisation and financialisation ensuing the early 1990s. Newman (2017:10-11) argues that South Africa's financialisation and neoliberalism have reproduced the ills of the post-apartheid regime's inequality, with severe implications on employment. South Africa's first democratic elections of 1994 led to the country's re-joining the global drive of financialisation following the prolonged sanctions imposed on South Africa in the 1980s (De Janeiro, 2015:2). High levels of disinvestment and reduced investment in real terms, ailed the economy from the 1980s until the mid-1990s and witnessed growing levels of

short-term portfolios due to the financial market's heightened liquidity (Mckenzie & Mohamed, 2016:15).

The country's reintegration into the global economy saw its transition from being considered a net lender to a net borrower from the international economy (Karwowski, 2018:417). Mohamed, McKenzie, Mfongeh, Ncube and Strauss (2016:37) note that South Africa's financial markets are somewhat complex, deep, and large, with solid linkages with foreign capitalism. Literature suggests that the adoption of neoliberal policies in South Africa's post-apartheid era has instilled substantial influence on the economy's financialisation processes. Features of neoliberal processes in the form of deregulation, liberalisation and privatization which have occurred during the last decade's capitalist economies, allowing for the various market transformations. Banks' operations have been reinvented, by shifting their focus of operation towards financial mediation between financial markets and corporations, acting as a reinforcement of banking activities. Banking operations also focused on forwarding credit to individuals in a manner where new information technologies can present opportunities for establishing the confidence and trust for the expansion of banks within new markets (Mvelase, 2015:18).

South Africa's liberalisation of capital flows instigated the deepening of financial markets towards alluring foreign direct investment (FDI) inflows (Isaacs & Kaltenbrunner, 2018: 438-442). This, however, mostly came about in the form of the increase in short-term portfolio investment inflows due to the country's heightened interest rates, further resulting in South Africa's increased exposure to volatility in the face of any potential financial crisis (Mvelase, 2015:18). Amid the affirmative literature of positive growth patterns led by financial and capital market expansion, Bhorat, Naidoo, Oosthuizen and Pillay (2015:4) argue that South Africa's economy continues to experience surging behavioural patterns in unemployment and stagnant real wages, coupled with increased income inequality levels.

After 1994 South Africa inherited the MEC which instituted a system of accumulation providing a historical analysis of the country's economic development process. The mining sector, together with the state, played a critical role in the economy, with a relatively undiversified industrial base together with infrastructure centred on enforcing the mining and mineral businesses (Mohamed *et al*., 2016:15). This follows after South Africa's development of a national steel and iron industry, as well as a national industrial bank as an enforcement of the country's industrialisation in the 1940s, with big businesses and national interests

entrenched around mining (Nattrass & Seekings, 2010:27; Dondofema, Matope & Akdogan, 2017:7; Dondofema, 2018:43-39).

The former was also followed by the state-led expansion of the production of gold and energy (Sharife & Bond, 2011:279-280; Mvelase, 2015:19). Upon which, South Africa's social and economic systems were structured in the way that it met the needs of the mining sector and the persistence of the migrant labour system, with the mining sector still claiming a reasonable amount of the country's employed (McKenzie, 2013:3). Broad sectors of transport, construction, manufacturing and energy supply remain closely connected with mining, and reliant on servicing the needs of the mining sector (Daniel, Naidoo, Pillay & Southall, 2011:8). Moreover, Daniel *et al*. (2011:9) expands that globalisation may have heightened South Africa's dependence on the MEC as opposed to stimulating increased diversification. The former further implies that the MEC's long-term trend envisions enhancing capital intensive and present plummeting employment opportunities.

The previous three decades have encountered substantial modifications in the operations of financial markets, which Szunke (2014:99) explains to be a result of the industrial revolution, thus the financial revolution, being a significant source of the global financial market transformation while forming as a basis for the various social, legal, economic, technological and political agendas. Marais (2011) and the SARB (2017b) note that South Africa's financial sector has been an important economic aid, evidenced by the rapid growth of its share in the gross domestic product (GDP) as envisaged in the generation of at least one-fifth of the country's GDP. Thus, making financialisation a crucial contributor to output.

Consequently, South Africa's low stock of international liabilities which was led by the foregoing sanctions, and its subsequent liberalisation of the capital account, have made worthwhile contributions to the heightened inflow of net capital (de Janeiro, 2015:2). Having extended the country's global integration and investment relations, such inflows have been crucial towards rebuilding the positioning of international liquidity and backing the current account deficit. The current account shortfall has mostly mirrored decreased domestic savings towards augmenting the economy's demand for investment (de Janeiro, 2015:2). Some researchers (Karwowski, 2018:413-414; Szunke, 2014:98) regard financialisation in South Africa's economy as being associated with increased inequality and stagnant wages, as well as subdued rates of investment, heightened speculation and financial instability. Karwowski (2018:415) adds that unfavourable dynamics of financialisation are most detrimental to poor economies than rich ones.

Table 3.1 shows the degree of South Africa's financialisation during the period 1997 to 2015, relative to other emerging market economies (EMEs) and Anglo-Saxton countries based on six dimensions which provide insight on a country's financial positioning. Karwowski and Stockhammer (2017:29) list these countries beginning from the most to least financialised based on the stated dimensions over a range of low, medium-low (mlow), high and medium-high (mhigh). Table 3.1, as highlighted by the above-mentioned scholars reveals a high level of heterogeneity between EMEs. There is also a high level of financialisation among Anglo-Saxon economies across the measures, particularly, the United Kingdom (UK) and the United States of America (USA) which rank from medium-high to high across all dimensions.

For South Africa, as shown in Table 3.1, deregulation (measured by the financial reform index) is considered to be swift, whereas its asset prices are, however, extremely volatile with relatively high household debt. Foreign capital inflows have been moderately low. Moreover, the transition from bank-based to market-based finance as denoted by "MB vs BB financial system" is relatively low, meaning that the process towards developing a highly financialised economy is relatively slow in South Africa. In a market-based economy, capital is considered the most crucial source of external finance. Henceforth, financialisation coincides with the transition towards market-based finance from bank-bank financing. Lastly, non-financial companies (NFCs) debt, calculated in terms of the debt-to-GDP ratio for NFCs, suggest that South Africa's vulnerability of NFCs to the financial sector is moderately low.

Table 3.1: Dimensions of financialisation among EMEs and Anglo-Saxons (1997-2015)

Region	Country	Financial deregulation	Foreign financial inflows	Asset price volatility	MB vs. BB financial system	NFC debt	Household debt
Latin America	Argentina	mlow	mhigh		low	low	low
	Brazil	low	low	high	mhigh	mlow	mlow
	Mexico	mhigh	low	low	mlow	low	mlow
Emerging Europe	Czech Republic	mhigh	mhigh	low	low	mhigh	mlow
	Hungary	high	high	mlow	mlow	high	mhigh
	Poland	mhigh	mlow	mlow	low	mlow	mlow
	Russia	mhigh	mlow	high	mhigh	mlow	low
	Turkey	mlow	mlow	mlow	high	low	low
Africa	**South Africa**	mhigh	mlow	high	mlow	mlow	mhigh
Asia	China	low	low	low	mhigh	high	mhigh
	Hong Kong	high	high	high	high	high	high
	India	low	low	mhigh	mhigh	mlow	low
	Indonesia	low	mhigh	mlow	mlow	low	mlow
	Malaysia	mlow	mhigh	mhigh	low	mhigh	high
	Singapore	high	high	mhigh	high	mhigh	mhigh
	South Korea	mlow	mlow	mlow	high	high	high
	Thailand	mlow	mhigh	low	mlow	mhigh	mhigh
Anglo-Saxon countries	UK	high	high	mhigh	high	high	high
	US	high	high	mhigh	high	mhigh	high

Source: Karwowski and Stockhammer (2017:29)

3.3 SOUTH AFRICA'S CAPITAL MARKETS

While capital markets in some countries have been stagnant, or even collapsed, others have progressed into sizeable and liquid markets. International flows of most of the markets in emerging markets have been subject to volatility, resulting in questions pertaining to benefits of financial globalisation and financial deepening (Laeven, 2014:3). Insurance against idiosyncratic shocks is provided by optimally and well-integrated capital markets which provision countries to take advantage of comparative advantage as opposed to the diversification of production bases as a means of insurance (Xafa, 2017:5). Some of South Africa's capital markets constitute the equity, currency, bond, and commodity markets (Hassan, 2013; RMB, 2019).

3.3.1 The stock or equity market

South Africa's stock market is governed by the Johannesburg Stock Exchange (JSE). The JSE was established in 1887 following the discovery of gold at the Witwatersrand's goldfields. The JSE emerged as a platform to raise funding and investment aimed at steering operations of the mining industry (Hassan, 2013:2). Since its conception, the JSE has been considered as South

Africa's formal market for the country's listed shares. It thus regulates the formation of borrowers share capital within the primary share market as well as the trading of such securities or shares by lenders or investors within the secondary share market (Van Zyl *et al*., 2009:322).

Mahama (2013:14) asserts that a great portion of Africa's market capitalisation of its stock market is prominently controlled by South Africa's stock exchange. Since the establishment of the JSE, the number and various forms of entities have dramatically gained prominence since having been and increased listings on the JSE over the years. The country's gradual economic expansion and development witnessed the surge in the joining and listing of industrial firms with the inclusion of non-mining entities (Moolman & Du Toit, 2005:78). Moolman and Du Toit (2005:78) account for the rapid growth of the JSE in its listings which grew from 151 industrial, financial and mining companies, to 659 firms in 1998. Nevertheless, mining remains essential to the expansion and growth of the financial sector within South Africa. Table 3.2 provides an overview of the JSE's listed securities and corporations as of 2000 to 2006 in the early 2000s.

Table 3.2: The JSE's overall number of listed securities and companies

Period	Number of JSE listings					Securities
	Companies					
	New listings	Delistings	Foreign listings	Domestic listings	Total	
2000	14	66	24	592	616	914
2001	11	85	23	519	542	1141
2002	9	79	22	450	472	852
2003	8	54	21	405	426	745
2004	17	39	21	385	404	873
2005	19	35	24	364	388	984
2006	37	24	30	371	401	1047

Source: Van Zyl *et al*. (2009:322)

Moreover, the JSE's FTSE/JSE All-Share Index (ALSI), which is a price index of the JSE's listed shares' average price level over time (Van der Wath, 2015:5), was established in June 2002 (Miller & Ward, 2015:88). It is considered to be South Africa's equity market leading benchmark and consists of the JSE's 165 listed companies based according to market capitalisation (Hunkar, 2018). Since the JSE's establishment, the price of the FTSE/JSE All-

Share Index is witnessed to have been rising since conception. This is supported by the rising trend along the period as depicted in Figure 3.1.

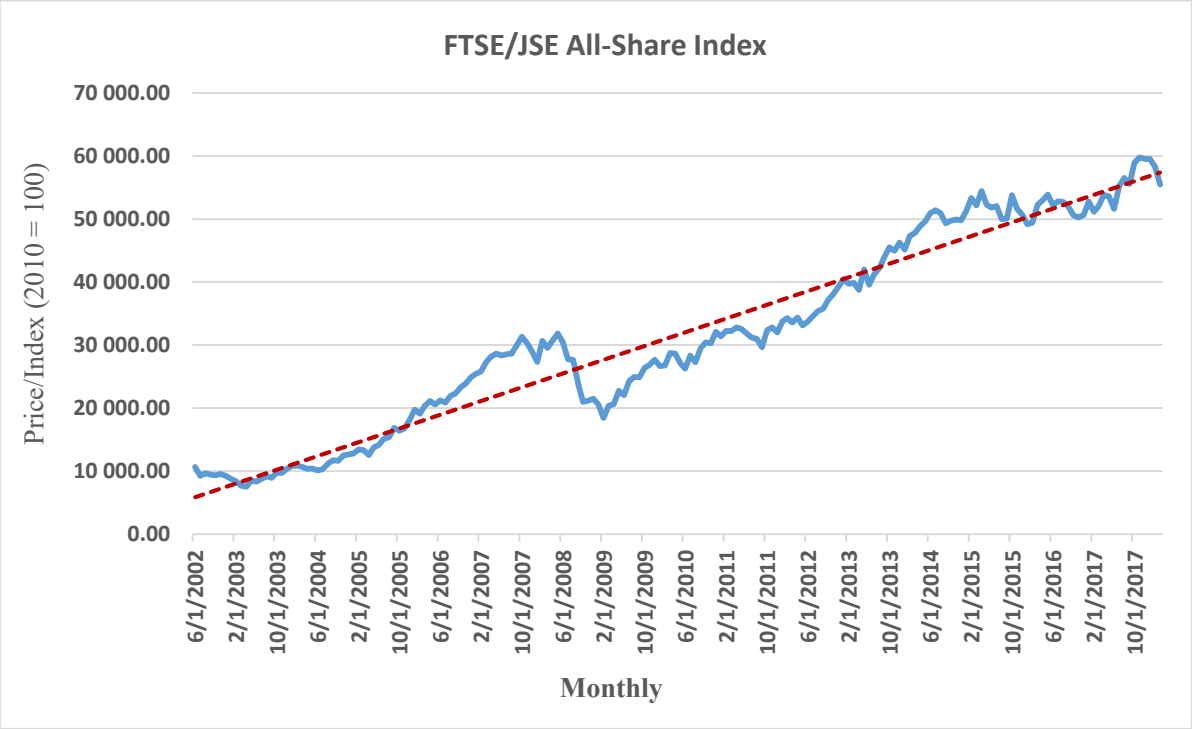


Figure 3.1: ALSI price movements (Monthly)

Source: Author compilation

3.3.2 The commodities market

South Africa's exchange, commonly known as the South African Futures Exchange (JSE/SAFEX) is a platform on which commodities are traded by farmers and traders considering its reduced transactional costs and increased market efficiency (Rashid, Winter-Nelson & Garcia, 2010:9; Rashid, 2015:14). UNCTAD (2009) posits that African commodity exchanges have not particularly succeeded, having recorded an increase in the rate of failure. However, the JSE/SAFEX has withstood the test of time and remains the largest commodity exchange on the continent (Mezui *et al*., 2013:93). The former oversees the trading of financial futures and agricultural commodities (Musiyarira, 2013:33). Table 3.3 outlines some of the characteristics of the various instruments comprising the South African market for commodities.

Table 3.3: The commodities market

Instruments			Turnover	The commodities market
Derivatives		Cash		
JSE	Over the counter	Over the counter	Differs per commodity	Trades in physical commodities, such as those displayed below, and trades in financial derivate instruments *i.e.* futures and options.
• Commodity options • Commodity for difference • Commodity futures	• Commodity options • Commodity swaps • Commodity forwards	• Industrial metals (Zinc, copper, lead, palladium, aluminium, nickel)		
		• Precious metals (Silver, Platinum, Gold)		
		• Energy (Unleaded gas, crude oil, natural gas, heating oil)		
		• Food & fibre (Rubber, sugar, cotton, cocoa, orange juice, lumber, coffee)		
		• Grains (Sunflower seed, wheat, oats, rice, soybeans, corn, maize)		

Source: Author compilation

Following 2002, South Africa's commodity prices have surged incredibly over the years consequent to the rising global growth and demand during the period. Figure 3.2 interprets South Africa's commodity price performance based on the price of the country's All-Commodity Index (ALCI), which registers the trends or performances of the national fuel and

non-fuel commodities. However, the 2008 global financial crises oversaw plummeting commodity prices due to decreased global demand. Nevertheless, this daunting period was eventually counteracted by a change in market sentiments following the late 2008 period up until the early months of 2011. Since then, the ALCI has witnessed cyclical downswings despite the general upward trend-line. Some of the reasons for the country's struggling market are the expensive and deep-level nature of its mines and the major focus on the country's precious metals such as platinum and gold.

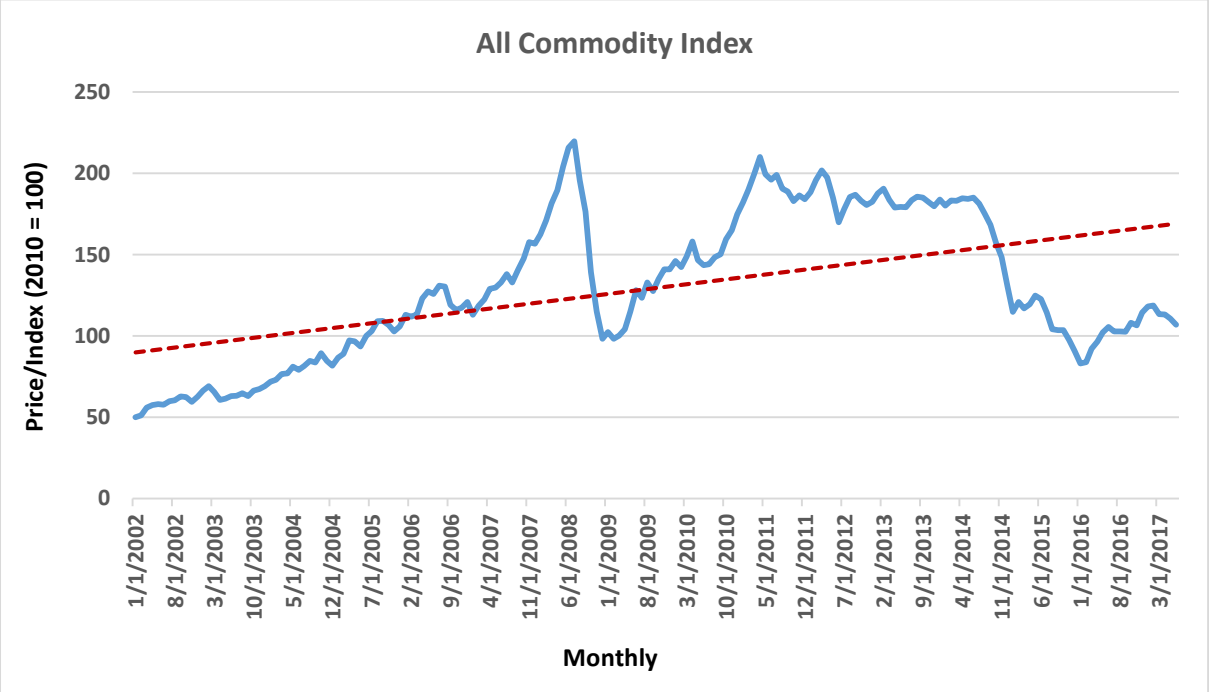


Figure 3.2: All-Commodity Index price movements (Monthly)

Source: Author compilation

3.3.3 The Bond Market

The bond market resembles the debt market in which the government and firms seek to raise financing for long-term activities where bonds are utilised as instruments for long-term borrowing by the issuer. Issuers of bonds within the market for bonds incorporates either governments, which offer "treasury bonds", in South African terms this may be referred to as government stocks which are primarily used to fund the fiscal budget (Oji, 2015:10; Van Zyl *et al*., 2009:322), and firms, as issuers of corporate bonds (Darškuvienė, 2010:52). South Africa's bond market is the most developed as compared to other emerging market economies, but notwithstanding this, it is characterised by an underdeveloped secondary bond trading market which makes it problematic for those hoping to buy and trade bonds (Oji, 2015:10).

The country's bond market is regularly monitored, regulated and modified within a centralised exchange referred to as the Bond Exchange of South African (BESA) (Liu, 2013:31). BESA operates as a licensed public exchange company that functions and regulates South Africa's long-term market for interest rate derivatives and debt securities (Oji, 2015:10). BESA seeks to protect both dealers and traders based on the foreseeing of standards of best practice and the regulation of traders and issuers' conduct based on the enforcement and supervision of quality controls according to standards of minimum disclosure mechanisms and operates within the parameters provided under the 2004 securities Services Act (Godza, 2013:23-24).

South Africa's Composite All-Bond Index (ALBI) serves as a measure of the bond markets' daily movements consisting of the market's top 20 vanilla bonds which are ranked according to average market capitalisation and liquidity over the averaging period (Bhownath, 2017:40). Figure 3.3 represents the trends and movement of South Africa's ALBI across the period 2003 to 2018. Indicated in Figure 3.3 are the cyclical phases of upward and downward movements, with a generally declining trend-line suggesting a plummeting behaviour of average prices in South Africa's bonds on an average rate. So far, the year 2008 marked the lowest recorded minimum price in South African bonds which corresponds with the weakening global demand ignited by the world financial crisis of the period. Despite the attempted to recover average bond prices, there has been continued downward pressure in subsequent periods.

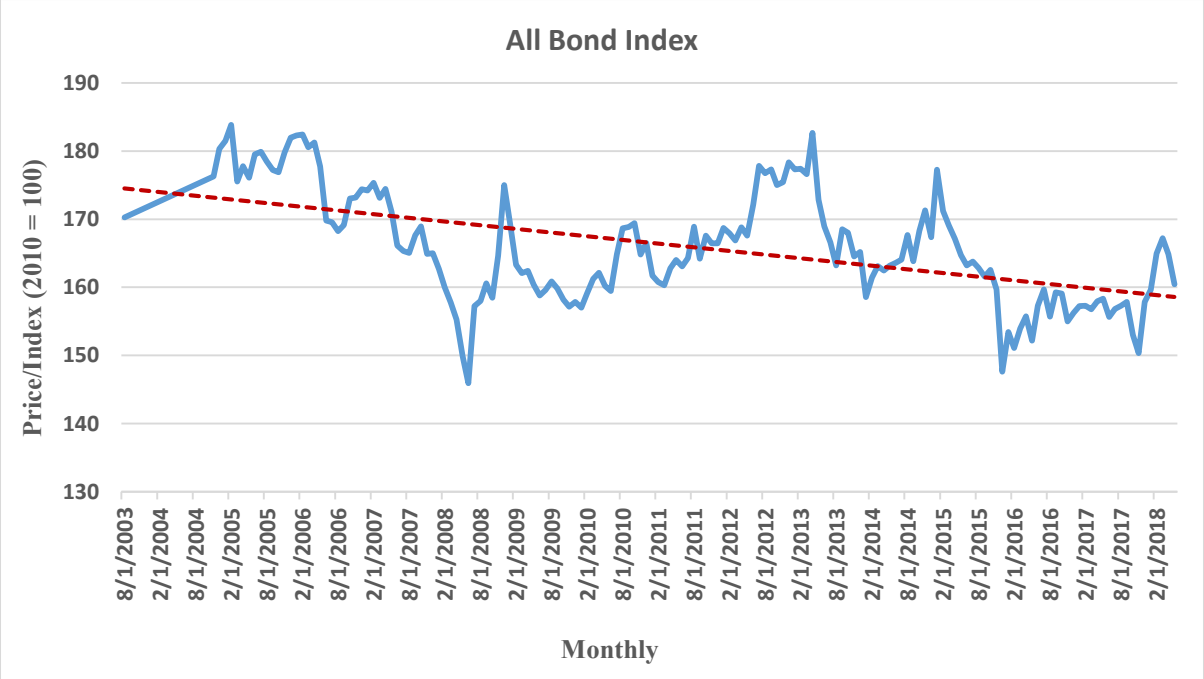


Figure 3.3: All-Bond Index price movements (Monthly)

Source: Author compilation

Table 3.4 displays the relative market size of South Africa's bond market as of December 2017. In 2017 about 67 133bn United States Dollars (USDs) worth of South African bonds were listed bonds on the global market, however, it only accounted for 0.3 per cent of the international bond market, which is relatively low. Correspondingly, South African bonds only constituted approximately 1.4 per cent of the total number of bonds traded in the global market, despite contributing about 12.5 per cent in value traded. Nevertheless, transactions in bond activities have produced great wealth and value in both domestic and international markets.

Table 3.4: South Africa's relative bond market relative size

Indicator	Measure	South Africa	World	SA % World
Value of bonds listed	ZAR bn USD bn	2 562 207	 67 133	 0.3%
Value of bonds traded	ZAR bn USD bn	27 041 1 974	 15 836	 12.5%
Number of trades in bonds	('000)	453	32 500	1.4%

Source: National Treasury (2018:32)

3.3.4 The exchange rate market

The foreign exchange market encapsulates the financial market's buying and selling of currencies. The exchange rate denotes the mechanism or the price at which these currencies are traded and facilitates financial transactions, investment and cross-border trade (National treasury, 2018:18). With the exchange rate, borrowers in the international capital market are provisioned to align their financing needs according to the currency which permits them to optimally meet their needs. According to Van der Merwe (2013:1-8), South Africa has transitioned from its 1960s and 1970s fixed exchange rate system towards the adoption of different forms of floating exchange rate systems along the periods 1980s and 1990s in efforts to secure a befitting regime. Since 2000, the country's exchange rate has been changed to a floating exchange rate system driven by economic forces of demand and supply (Van der Merwe, 2003:2).

Figure 3.4 shows the performance of South Africa's real effective exchange rate from January 2002 to December 2018. For the year 2017, South Africa's exchange rate market turnover was estimated at a daily average of USD19.1 billion. In terms of a spot and swap market, 2017's net daily turnover on average against the South Africa Rand, was respectively USD1.0 billion, USD3.2 billion and USD8.3 billion (National treasury, 2018:18). From September 2017 to

September 2018, South Africa's real effective exchange rate (REER) of the Rand plummeted by 5.0 per cent, representing a surge in the country's competitiveness of its domestic producers within international markets. A further increase in South Africa's domestic producers' competitiveness was found from June 2017 to June 2018, based on a decrease in the REER by 2.6 per cent.

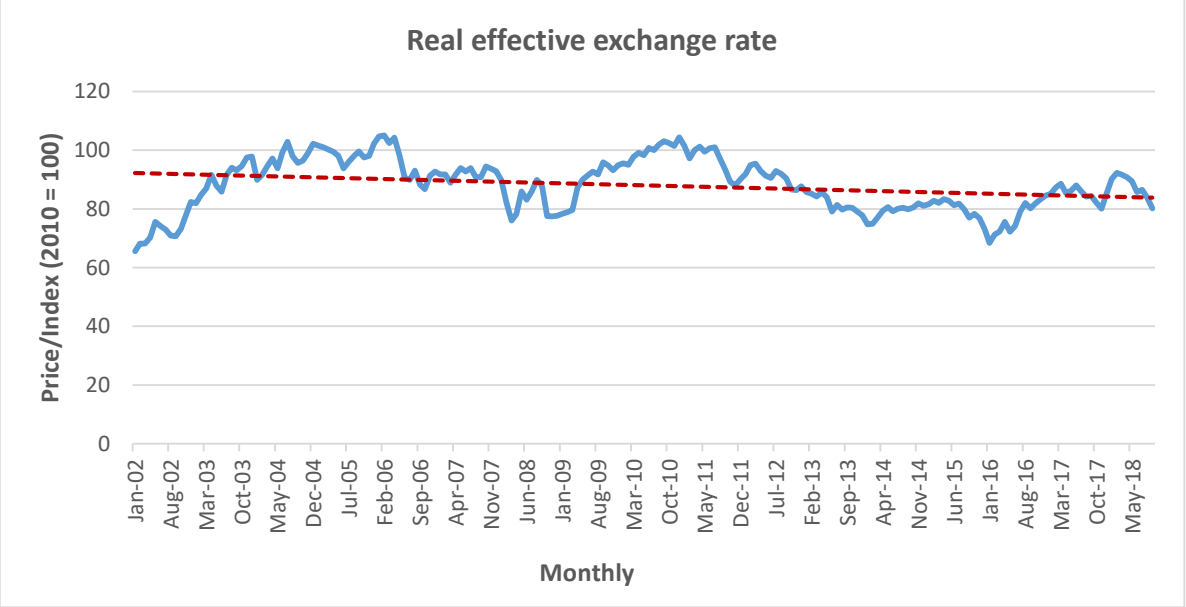


Figure 3.4: Performance of South Africa's real effective exchange rate

Source: Author compilation

In Figure 3.5, the relative performance of South Africa's real effective exchange rate and the South African Rand (ZAR)/USD headlines a relatively weaker ZAR/USD performance as opposed to its effective exchange rate. The Rand is shown to have weakened along the period with an overall upward trend-line indicative of a depreciating Rand against the USD.

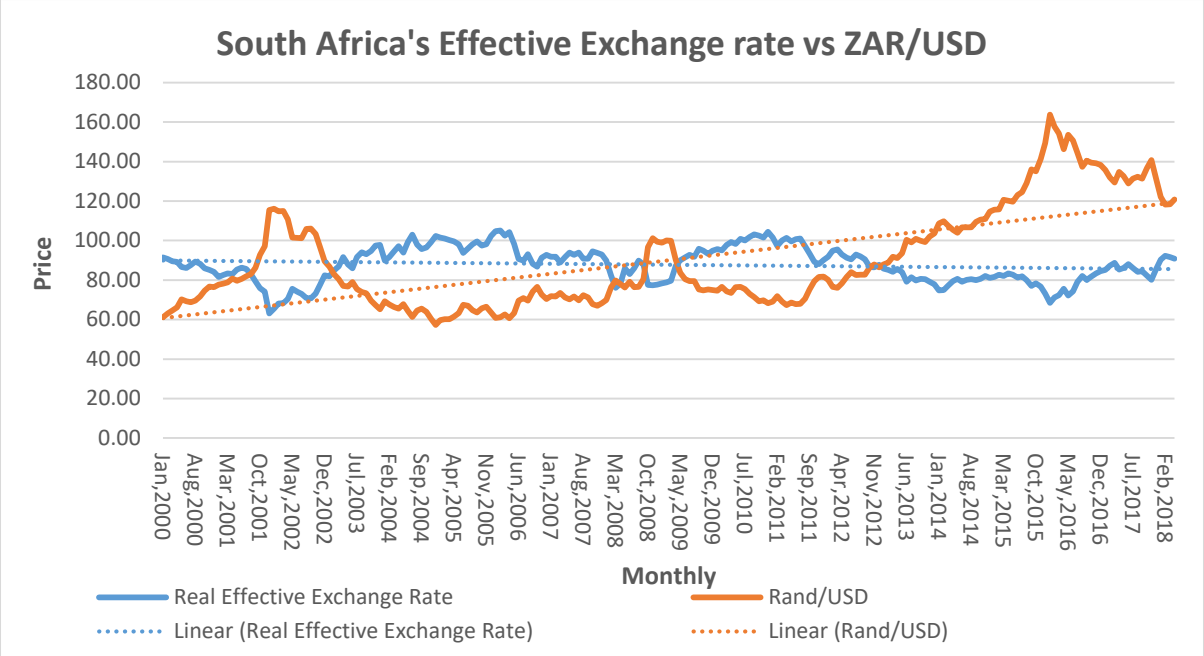


Figure 3.5: South Africa's real effective exchange rate vs ZAR/USD

Source: Author compilation

3.4 SOUTH AFRICA'S FINANCIAL MARKET: POLICY AND REGULATION

Financial markets are amongst the most regulated economic sectors, with the principal focus on addressing market failures and enhancing market stability (Van Zyl *et al*., 2009:20). Such a centralised focus is underscored by risks posed by contingencies of the financial crises, which accentuates the importance of situating adequate market supervision stability (Van Zyl *et al*., 2009:20). In South Africa, the regulatory authority for the Financial Markets Act (FMA) 19 of 2012, in terms of the Financial Sector Regulation (FSR) act, is considered to be the Financial Sector Conduct Authority (FSCA). Where the primary regulation of financial markets, market infrastructure and securities services are governed by the FMA (National Treasury, 2018:121).

The National Treasury (2018:121) outlines the role of the FMA in order to, firstly, ensure that South Africa's financial markets operate efficiently, fairly and transparently with a view to mitigate systemic risk, encourage investor confidence and promote the international competitiveness of the country's securities services. Secondly, their function is to ensure that South Africa's legislation and regulatory framework adhere to recommendations projected by the setting of international standard bodies, such as the Financial Stability Board (FSB), Group of Twenty (G20), International Organisation of Securities Commissions (IOSCO) and the Basel Committee on Banking Supervision (BCBS).

The regulation of South Africa's financial markets involves a balance between too little and too much regulation. The current trend favours less regulation as it pertains to widening the scope for innovation and the transition beyond traditionally functional and geographical boundaries by participants. Increased regulation oversees the maintenance of standards of corporate governance, risk management, and disclosure (Van Zyl *et al*., 2009:20). Figure 3.6 portrays South Africa's current high-level regulatory framework. In this framework, the FMA is the FSCA, held as the prime regulatory authority based on the FSR Act. Financial markets, market securities services and infrastructure are primarily governed by the FMA legislation.

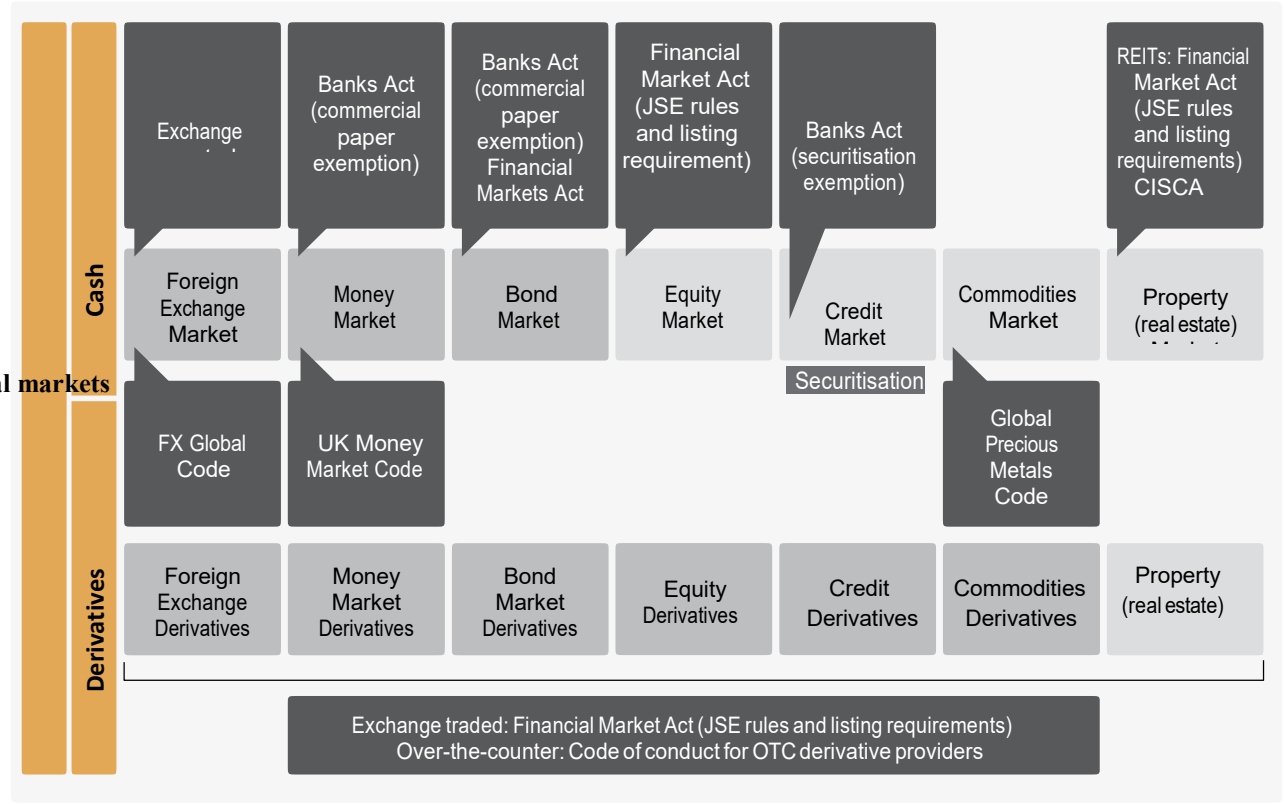


Figure 3.6: Current regulatory framework (including self-regulation codes of conduct)

Source: Goodspeed (2018)

Van Zyl *et al*. (2009:126) accentuates that South Africa's current regulatory structure of financial markets is based on a fragmented system, where different institutions regulate different market sectors. Several Acts have accordingly been put in place for each industry and even a part of an industry. Notwithstanding this, the central focus of the FMA is focussed on regulating and licensing exchanges, clearing houses, trade repositories, central securities depositories and market infrastructures, as well as the prevention of market abuses such as insider trading (National Treasury, 2018:121). Various principles for the development of the

regulatory framework have been set for the financial market by the National Treasury (2018:121) represented in Table 3.5.

Table 3.5: Principles for the development of the regulatory framework

Regulatory framework development principles	
Principle 1	Implement best-practice standards, appropriate for South Africa, conveyed by international standard-setting bodies, e.g. IOSCO
Principle 2	Align with current legislation i.e. the Banks Act and the Financial Advisory and Intermediary Services Act (FAIS Act) to assist in avoiding duplication and minimising regulatory arbitrage domestically and levelling the playing fields between domestic participants
Principle 3	The financial regulation Twin Peaks needs to be implemented (enactment of the FSR Act)
Principle 4	Mitigate market disruptions

Source: National Treasury (2018:121)

3.4.1 Regulation of South Africa's capital markets

Hassan (2013:2) describes South Africa's capital market variables as volatile and highly unpredictable instruments which affect fiscal and monetary policy outcomes and overall economic policy. According to Hassan (2013:2), the stock market constitutes the country's largest contributor towards economic growth, while the bond, derivatives and currency markets constitute some of the world's major markets when it comes to turnover. The currency market is considered a common speculative target, which tends to affect exchange rate dynamics. The Financial Markets Bill of 2012 (the Bill), and eventually, the FMA of 2012, substituted the Securities Services Act (SSA) code of conduct (No. 36 of 2004) which was headed by the Capital Markets Department (De Klerk, Fraser & Fullerton, 2013:34; Chitimira, 2014a:942). The 2007-08 financial crisis saw the regulatory revision of the SSA, which resulted in the updated Financial markets Bill. This Bill stresses the issue of market stability and ensures that various measures are in place to mitigate any potential market crisis (Van Wyk, 2012).

The SSA was established with the hope of aligning the security legislation with the best practice of the international regulatory and to bring about a balance between international competitiveness and investor confidence of South Africa's capital markets (National treasury, 2012:2). It was a legislative medium for upholding, maintaining and establishing a platform

that facilitated sellers and buyers of market securities and to match their orders. The licensing of various forms of exchange were also provisioned by the SSA, where compensation was ensured to prejudiced buyers through a compensation fund, a guarantee, or insurance, or alternative warranty (Van Zyl *et al*., 2009:126). A Directorate of Market Abuse was also put in place by the SSA, which is in control of monitoring practices related with manipulation, deceptive or false practices, improper conduct, or insider trading, as well as deceptive or falsified forecasts, statements, and promises (The Presidency, 2013:139).

The Financial Markets Act of 2012 was effective in 2013 and is geared at aligning South Africa with international standards and norms with provisions similar to those of the SSA. New provisions are chiefly centred on increasing regulation and regulatory oversight as well as reporting requirements aimed at enhancing investor protection and reducing systemic risk through regulation (PWC, 2013:1). In the SSA, the Financial Markets Bill and the Financial Market Act, forms of markets abuse, such as trade-based market manipulation, insider trading and disclosure-based market manipulation, were all outlawed. However, manipulative disclosures in the form of internet-based disclosures were not explicitly outlawed (Chitimira, 2014b:312-313).

3.4.2 South Africa's financial market integrity and effectiveness

The National Treasury (2018:12) asserts that market integrity is concerned with the degree to which a market operates. This includes the way that it is, and is perceived to be orderly and fair, and where operative rules are set and carried over by regulators to ensure that participation and confidence within the market are fostered. The National Treasury (2018:12) associates market efficiency with the ability for market participants to conduct business transactions conveniently. Where transaction prices reflect the markets' available information, constructs of market efficiency may include price discovery, liquidity, and transparency.

Austin (2017:218) asserts that the safeguarding of the security market's fairness and integrity is amongst the key justifications for the initial purpose of having securities regulation and securities regulators. Where the former and latter aspects envision the protection of investors, maintained fairness, order, and efficient markets, as well as the facilitation of capital information. Market integrity underlies the concepts of market efficiency and fairness and is crucial for choosing the market design, with market regulation being a single component of a market's overall design (Rydge & Comerton-Forde, 2004:7; Oliver Wyman & World Federation of Exchanges, 2018:3). Other elements associated with the overall market design

encompass facets of technology, instruments, information, and participants. Technology is amassed by distinct sub-elements ranging from routing, settlement, surveillance, and registry technologies. Participants in securities markets may involve developments such as multiple trading platforms (MTFs) which embody computer-operated algorithms and may pose to be either good or bad for market quality. Notwithstanding, MTFs pose various threats towards the "quality of liquidity" of the securities market due to increased order cancellations and reduced available size at the inside quote (Aitken & Harris, 2011:22).

The concept of integrity, according to Austin (2017:218), can, therefore, be confined to ensuring that security markets are sound, uncorrupted, and unimpaired, whereas fairness contextualises the act of making sure that markets exhibit characteristics of being equitable and impartial. Based on the above clarification, it stands to reason, therefore, that the central objective of providing evidenced-based policymaking should be founded on the assertion that regulatory and other market design changes need to pass dual efficiency and fairness tests. Practically, positive changes in the design should accompany enhancements in both market efficiency and market integrity (Aitken & Harris, 2011:22).

Table 3.6. presents the overarching principles needed to ensure that market integrity is upheld as provided by the National Treasury (2018:12).

Table 3.6: Principles of upholding market integrity

Market integrity establishment principles	
Principle 1	Participants act honestly, fair, and in the interest of South Africa's general financial markets in the broad aspects of business, with due diligence and care in regards to the expected market practice standards, and with knowledge and skills needed for the respective markets they operate.
Principle 2	Market practice standards – market participants need to understand and consistently apply the broad overarching principles of the specific practices needed in respective markets and the high standards of conduct in financial markets. This relates to participants' handling of confidential information, their communications, as well as the management of conflicts interest in their business conduct.
Principle 3	Markets need to be characterized by sufficient transparency and make provision for fair information access concerning prices and issuers market securities to strengthen assurance that market practice standards are upheld and to bolster processes of robust price formation.
Principle 4	Markets ensure open, fair and equitable or non-discriminatory access to services and products of the financial market directly or through intermediation, and are therefore competitively in support of choice and innovation to meet market participants varied needs.

Market integrity establishment principles	
Principle 5	Financial markets are characterized by robust trading infrastructures and trustworthy price-formation processes to deliver fair outcomes for heterogeneous market participants and to also ensure appropriate allocation and pricing of capital and risk within the economy.
Principle 6	There should be clear structures for accountability, governance, risk management and internal controls within financial institutions led by the premier senior level, and reviewed on a consistent basis to uphold consistency with international good practice.
Principle 7	Surveillance and enforcement mechanisms – regulatory authorities and financial institutions should effectively deter, detect and penalise abuse within the market, supported by a robust and sound legal framework.
Principle 8	Regulation and legislation are consistent, clear, proportionate and free from undue influence to ensure system stability, financial market fairness outcomes, and efficient capital allocation in support of economic growth. Also, financial regulators' supervision must be pre-emptive, outcome-focused and risk-based, and sufficiently intrusive and intensive to uphold these goals.

Source: National Treasury (2018:12)

Figure 3.7 provides an overarching framework by which quality in terms of the capital or financial market environment is gauged. Based on Figure 3.7, market quality is measured according to two constructs, specifically market integrity and market efficiency. Under which, market integrity is characterized by the degree of market manipulation, insider trading, and broker agency conflict. Whereas, market efficiency constitutes measures underlining transaction costs and price discovery.

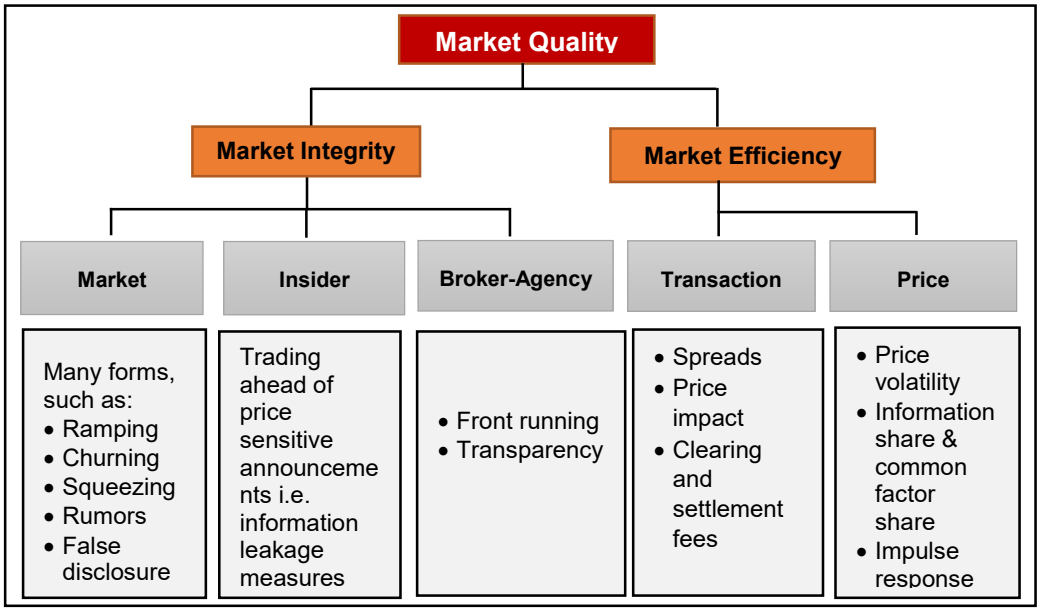


Figure 3.7: Market quality as the overarching concept of market efficiency and integrity

Source: Aitken and Harris (2011:22)

3.5 SOUTH AFRICA'S BUSINESS CYCLE/REAL SECTOR CLIMATE

The South African Reserve Bank (SARB) is South Africa's regulatory economic authority that monitors approximately 200 economic indicators which illustrate economic processes or the business cycle. These include sales, prices, production, and employment (Bloomberg, 2018). Business cycles are associated with fluctuations in the general economy's economic or production activity over a period. Such fluctuations are realised over a long-term growth trend and are characterised by shifts involving relative growth (boom or expansion) or relative economic decline (recession) (Muchaonyerwa & Choga, 2015:84). Moreover, Muchaonyerwa and Choga (2015:84) assert that the business cycle's economic indicators are instrumental measures for identifying South Africa's turning points in its economic cycles. Composite indicators are categorised as being either leading, lagging or coincident indicators. Table 3.7 exhibits South Africa's business cycle indicators (BCIs), and their underlying components, as identified and compiled by the SARB.

Table 3.7: South Africa's composite business cycle indicators

Component time series of the composite business cycle indicators		
Leading indicator	**Coincident indicator**	**Lagging indicator**
Job advertisement space in the *Sunday Times* newspaper: percentage change over twelve months	Gross value added at constant prices, excluding agriculture, forestry and fishing	Cement sales (in tons)
Number of residential building plans passed for flats, townhouses and houses larger than 80m'	Total formal non-agricultural employment	Value of non-residential buildings completed at constant prices
Interest rate spread: 10-year government bonds less 91-dat Treasury bills	Value of retail and new vehicles sales at constant prices	Ratio of gross fixed capital formation in machinery and equipment to final consumption expenditure on goods by households
Real M1 money supply (deflated with CPI)" six-month smoothed growth rate	Industrial production index	Ratio of inventories to sales in manufacturing and trade
Index of commodity prices (in US dollar) for a basket of South African-produced export commodities	Utilisation of production capacity in manufacturing	Nominal labour cost per unit of production in the manufacturing sector: percentage change over twelve months

Component time series of the composite business cycle indicators		
Leading indicator	**Coincident indicator**	**Lagging indicator**
Composite leading business cycle indicator of South Africa's major trading partner countries: percentage changes over twelve months	n/a	Predominant prime overdraft rate of banks
Gross operating surplus as a percentage of gross domestic product	n/a	Ratio of consumer instalment sale credit to disposable income of households
RMB/BER Business Confidence Index	n/a	n/a
New balance of manufacturers observing an increase in the average number of hours worked per factory worker (half weight)	n/a	n/a
Net balance of manufacturers observing an increase in the volume of domestic order received (half weight)	n/a	n/a
Number of new passenger vehicles sold: percentage change over twelve months	n/a	n/a

Source: SARB Quarterly Bulletin (2015b) (description of variables as obtained from the SARB (2018)).

With regards to the country's economic indicators (leading, lagging & coincident indices) as exhibited in Figure 3.8, it can be gleaned that there is non-concordance between South Africa's economic indicators. Movements in the leading indicator, which are mostly negative, are portrayed as most divergent from the lagging and coincident indicators, especially from the latter. As an outlier, South Africa's leading indicator can be interpreted as an inefficient tool for interpreting future economic movements. The South African market insights (2019) indicate that such non-concordance may be influenced by the BMR/RMB business confidence index, which has revealed unfavourable sentiments in South Africa's business confidence. It also raises questions about the calculation of the coincident indicator following the lack of correlation with other indicators, given its relatively high discrepancy from the lagging and leading indicators.

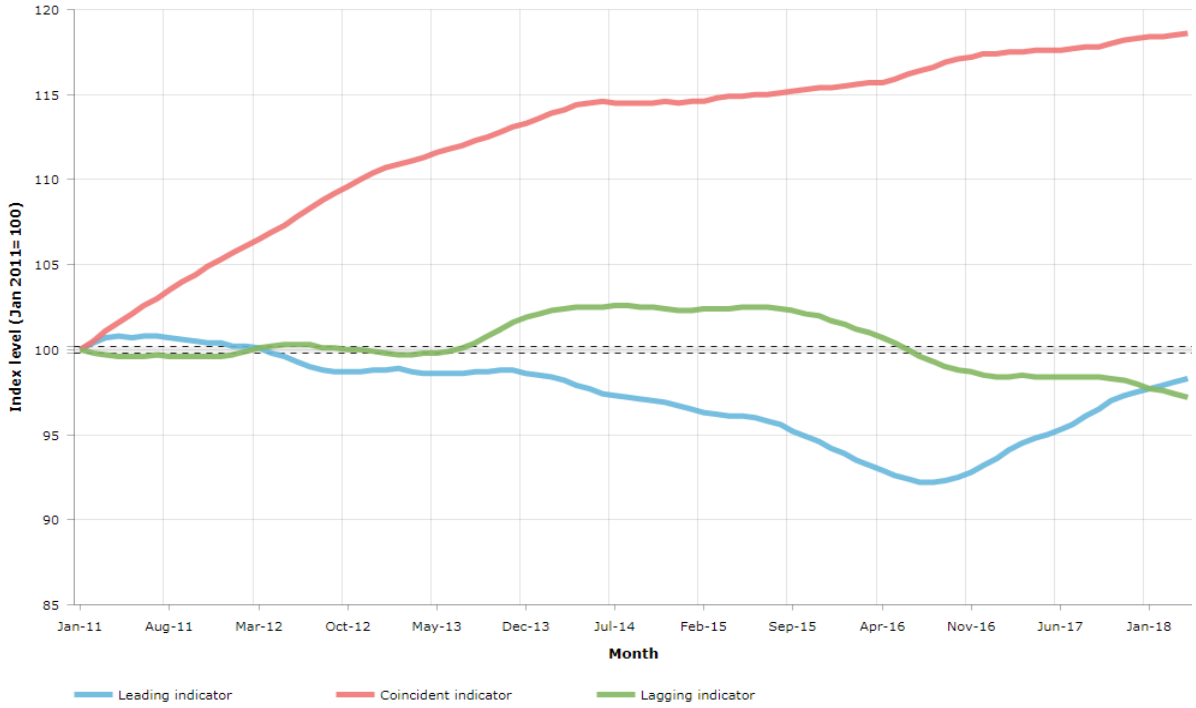


Figure 3.8: South Africa's business cycle indicators 13-month moving averages

Source: South African market insights (2019)

Over the past years, South Africa's economic climate has witnessed continued cyclical movements in its business or economic cycles. The transitioning into the post-apartheid era, and the subsequent periods have experienced a range of domestic and international economic pressures or shocks. Figure 3.9 illustrates the performance of South Africa's economy in terms of the business cycle under the various national presidents. The pre-democratic era was a period amassed by a relatively closed economy due to numerous internal sanctions.

Represented in Figure 3.9 is a series of continued downswings and upswings in South Africa's business cycle, which has been vulnerable to a number of crises such as the East Asian financial crisis (1997-1998), the Dotcom bubble burst (2000-2002), and the Subprime mortgage crisis (2007/08) with further effects translated as far as 2010 (Wollscheid, 2012; Duca, 2013; South African market insights, 2019). The late 1990s were amassed by recessionary pressure in South Africa's coincident indicator as a result of Asia's financial sector collapse which relatively affected South Africa's businesses (Venter, 2009:65). The year 2000 was marked by a recovery which was stimulated by numerous economic reforms, such as the country's charters which were implemented in its different economic sectors during the period between 2000 and 2005. The recovery continued with an onward upward trend until 2007 (South African market insights, 2019). The economy then experienced a recession following the world financial crisis

of 2008 which was driven by the United States' housing market crash (Rena & Msoni, 2014:21).

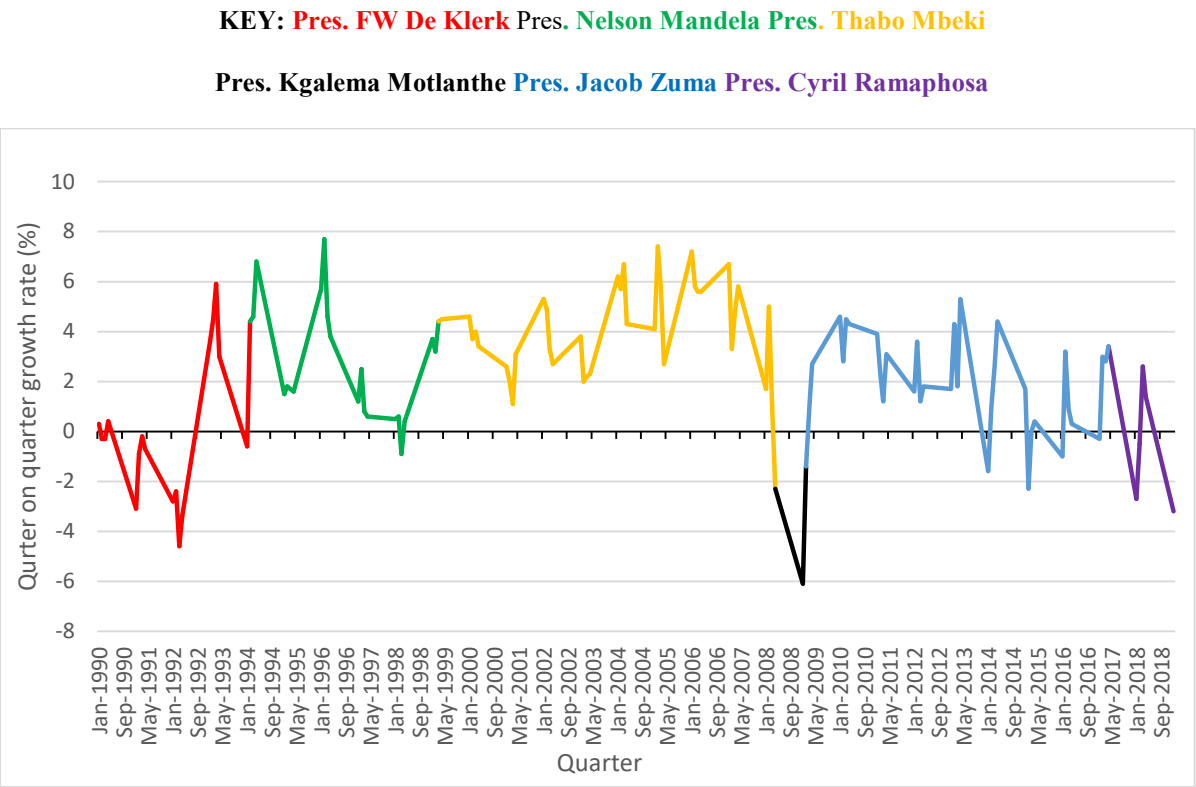


Figure 3.9: Quarterly economic growth (GDP) as per South African president

Source: South African market insights (2019)

The various economic shocks have prompted some of the country's recessionary pressures with long-lasting negative effects, which have continued to impair the economy and its social structures. So far, as depicted in Figure 3.9, the 2007/08 world financial crisis has presented the worst effect on the country's business cycle since the democratic transition. Fin24 (2016) highlights that economic growth was registered at an average rate of 2.5 per cent from May 1994 to June 1999 (during President Nelson Mandela's reign). Additionally, average GDP was at 3.25 per cent as per quarter on the quarter rate (President Thabo Mbeki) (Sehloho, 2018), at -2.2 per cent from September 2008 to May 2009 (President Kgalema Motlanthe), and at 2.1 per cent from May 2009 to February 2018 (President Jacob Zuma). GDP for Q2:2018 was recorded at -0.7 per cent, and -2.6 per cent for the first quarter, which was revised downwards from -2.2 per cent indicative of a technical recession (Stats SA, 2018; Mail & Guardian, 2019).

The drop in South Africa's GDP following the dotcom crisis also corresponds with a decrease in its levels of inflation as projected in Figure 3.10 from 2002 until late 2003. However, both inflation and GDP began to rise during the last quarter of 2003 until the first quarter of 2004

(South African market insights, 2019). The subsequent movements, likewise, continued to present similar fluctuations in the two economic components. In December 2018, South Africa's inflation rate dropped to 4.5 per cent, landing on the mid-point of the SARB's target range (3 per cent to 6 per cent), relative to the preceding month's 5.2 per cent. This was a testament to the country's decrease in the costs of transportation which fell sharply as a result of low crude oil prices and the strengthening of the Rand (BusinessReport, 2018; Stats SA, 2019).

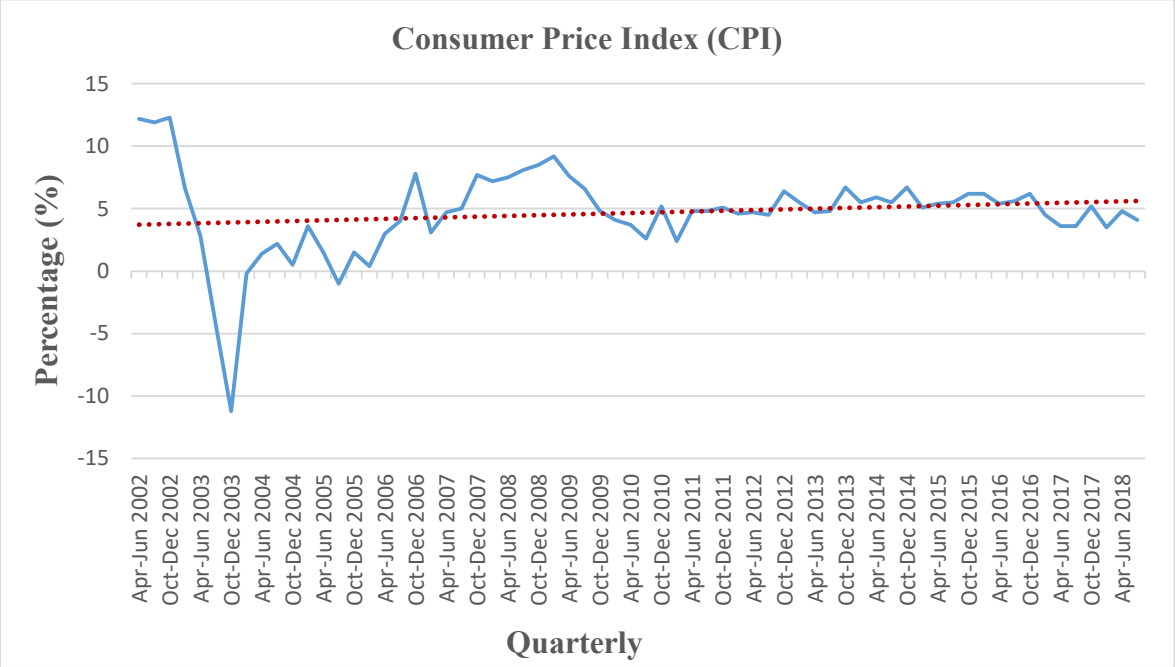


Figure 3.10: Trends in the consumer price index

Source: Author compilation

Figure 3.11 demonstrates South Africa's unemployment rate for the period 2008 to 2018. Over the past two decades, South Africa's unemployment rate has been rising. De Villiers (2018) purports that nearly 75 per cent of South Africa's labour force consists of low-skilled or semi-skilled employees. The year 2018 was marked by a surge in South Africa's official unemployment rate to 27.2 per cent within the second quarter, following the first quarter's 26.7 per cent (EWN, 2019). A continued increase in unemployment was further observed in 2018 from the second to the third quarter, following an increase of 0.3 per cent within the four months, to 27.5 per cent in the third quarter (Fin24, 2018). 2018's last quarter, however, ended with a slight decrease in unemployment to 27.1 per cent, putting South Africa's unemployment rate at a 0.4 percentage point lower than the preceding quarter's 27.5 per cent (SAnews, 2019). Despite the slight percentage point drop in unemployment accounted for in the fourth quarter,

the country's unemployment rate remains relatively high. The period 2008 to 2018 showed a positive and upward slope of South Africa's official unemployment rate. This exhibits the country's ailing labour force market.

Figure 3.11: Trends in the unemployment rate

Source: Author compilation

3.6 SYNOPSIS

This chapter shed light on South Africa financial market environment in terms of the country's financial market policy and the historical performance of both capital markets and the real side macroeconomy. The chapter revealed that South Africa's post-apartheid financial market has inclined more to neoliberal economic policies following the uplifting of economic sanctions and the widening of its borders to the global market. Accordingly, South Africa's market prices have experienced surging prices consistent with upward trend patterns. On the one hand, market performance patterns have been characterised by relatively fluctuating price movements over the course of the period. Moreover, the real side of the country's macroeconomy showcased deteriorating economic performance characterised by rising consumer prices and unemployment levels, including unsatisfactory economic growth trajectories. Some of the most monumental disruptions to the country's economic and financial market performance included disturbances emanating from the 2007/08 financial crisis, amongst others.

Chapter 4 provides an analysis of pre-existing findings on the relationships between the pure economic variables and components of the financial market's capital market, specifically, the stock, bond, commodity and exchange rate market. Existing literature was analysed to provide a comparative assessment of studies conducted in developed countries and those from developing countries. Such an analysis assists in establishing informed inferences by taking into consideration the developmental aspects of the host country upon which the empirical findings of the present study could be gauged.

CHAPTER 4: EMPIRICAL ANALYSIS OF ECONOMIC INDICATORS AND FINANCIAL MARKET RELATIONSHIPS

4.1 INTRODUCTION

To acquire an understanding of policy and environmental implications in which markets operate, Chapter 3 presented South Africa's market policies and the nature of the different component markets of its capital markets. Chapter 3 also presented an analysis of historical patterns of various capital markets in light of the country's quest to financialisation, as well as insights on the general macroeconomic climate and trends. The analysis of linkages between financial cycles and business or macroeconomic cycles has received limited attention in the African context, specifically for South Africa. Analysing these interactions is necessitated by the constraints surrounding a relatively small and open economy, with growing financial institutions and the overall financial market. Prospective dynamics in South Africa's economic context may differ from documented findings for advanced nations, i.e. the United States of America (USA) and the United Kingdom (UK), which are both considered as relatively large economies. Prior to establishing the study's empirical findings, the forthcoming analysis in the current chapter reviews existing literature on the linkages pertaining to the stock, bond, commodity and the real effective exchange rate market relative to business cycle indicators (BCIs) or macroeconomic fundamentals. Specifically, the study evaluates previous studies on the relationships of the underlined components in terms of their interactions, cyclical movements, causality, correlations, and predictability within various countries and research centres.

On the merits of the efficient market hypothesis, various scholars (Cohen, Maier, Schwartz & Whitcomb, 1986; Keim & Stambaugh, 1986; Lo & MacKinlay, 1990; Conrad, Gultekin & Kaul, 1997; Lo & MacKinlay, 1997) contend that market prices do not adjust instantaneously and do not reflect all available information. This is due to market frictions such as limited channels for information dissemination, nonsynchronous trading and high transaction costs. Other factors such as irrational investment behaviours and psychological biases, in the form of overconfidence, conservatism and self-attribution bias, are associated with autocorrelations of stocks and thus implied predictability (De Bondt & Richard, 1985; Daniel, Hirshleifer & Subrahmanyam, 1998; Veronesi, 1999; Barber & Odean, 2001). Amihud and Mendelson (1986a, 1986b), as well as Glosten, Jagannathan and Runkle (1993), posit that these factors compel investors to overreact to lagged information, later translated as inadequate responses

by investors and information autocorrelations. Instances of existing autocorrelation imply the rejection of facets of unpredictability esteemed by the efficient market hypothesis. This chapter reviews the literature and empirical findings on the relationships between BCIs and the equity market, the bond market, the exchange rate market and the commodity market, as per set objective of the study outlined in Section 1.3 of Chapter 1.

4.2 THE STOCK OR EQUITY MARKET AND ECONOMIC INDICATORS

The stock market, also known as the equity or shares market, involves the trading of intangible assets of common shares and other equity-related instruments expected to provide future cash benefits (Darškuvienė, 2010:7; Lenee & Oki, 2017:70). Previous studies aiming at establishing whether the above-suggested autocorrelations in stocks exist; that is, if current stock prices are dependent on past movements, suggest the existence of positive autocorrelations in the New York Stock Exchange (NYSE) indices (Poterba & Summer, 1988; Conrad & Kaul, 1988). First-order weekly return autocorrelations in the CRSP index (Lo & Mackinlay, 1988). Significant but weak autocorrelations exist in listed securities of the American Stock Exchange (AMEX) and the NYSE (Lehmann, 1990). Significant and positive autocorrelations are also found in common stock indices of the NYSE, AMEX and the National Association of Securities Dealers Automated Quotations (NASDAQ) (Campbell, Lo & MacKinley, 1997). Positive autocorrelations are present in the Dow Jones Stock 600 index (Baur, Dimpfl & Jung, 2012), and similar positive autocorrelations in 423 UK stocks (Gębka & Wohar, 2013). Harvey (1995a; 1995b) also reports that serial correlation and market predictability of developed markets are much lower compared to emerging stock markets. These findings are relatively consistent with results by De Santis and Imrohoroglu (1997), who revealed significant autocorrelations in first lagged returns of emerging markets, whereas developed markets' individual securities portrayed weak positive or negative autocorrelations.

MacFarlane (2011) examined the explanatory power of South Africa's macroeconomic factors that have a bearing on the movements in the country's stock market. Macroeconomic factors, which included the CPI, GDP, exchange rate, money supply, and the 10-year government bond yield, were selected on the basis of their local and international precedence. Using the Johansen multivariate cointegration, Granger causality and innovation accounting, from the period 1965 to 2010, MacFarlane (2011) established that future movements in the FTSE/JSE All-Share Index returns are not significantly influenced by the respective macroeconomic factors conclusively implying that past movements do not significantly explain future stock market

movements and the respective explanatory variables do not possess meaningful predictive information for South Africa's ALSI.

Moreover, on the analysis of explanatory variables of the stock market, Bilson, Brailsford and Hooper (2001) examined the interactions between the former with money supply and the consumer price index (CPI) within emerging markets. Results suggested that the CPI and money supply have explanatory power over stock market returns. Other studies by Glen (2002) and Ritter (2005)) showed evidence of gross domestic product (GDP) being a leading indicator of movements in the stock market, implying that GDP growth tends to lead the growth in the stock market along subsequent periods. This correlates with findings by Vassalou (2003) who revealed that any news or information pertaining to the future of GDP has explanatory abilities in leading the present movements in the stock market. Based on the Vector Autoregressive Model (VAR), Gjerde and Saettem (1999) examined a number of countries (Australia, Canada, Norway and Sweden) and established that stock market returns are positively affected by real economic activity. Nevertheless, Gjerde and Saettem (1999) noted that responses to changes in GDP by stock market movements were delayed. A study by Errunza and Hogan (1998) posited that money supply and industrial production have explanatory power over the volatility in the European stock market, although not for all countries in Europe, particularly for the UK, Belgium and Switzerland.

Based on Johansen cointegration and Granger causality approaches, Dritsaki (2005) analysed the Greek stock market and found that interest rates, industrial production and inflation have an explanatory influence on the stock market. Nevertheless, a bidirectional relationship was revealed for stock returns and industrial production. Bivariate VAR models were used by Patra and Poshakwale (2006) who revealed an existing negative influence of money supply and inflation on stock returns along the period 1990-1999. Leon and Filis (2008) also studied the cyclical features of Greece's stock market and macro-economic indicators during the period 1989-2005 using quarterly data based on a VAR analysis. Results suggested that GDP exhibits a negative impact on the stock market. Moreover, Hsing (2014) used the regression and the GARCH model to test the relationship between Estonia's stock market and relevant macroeconomic variables from 2000.Q1 to 2013.Q3. Results yielded positive effects of real GDP, debt/GDP ratio and the German stock market on Estonia's stock market index. Negative effects were observed concerning the exchange rate, expected inflation, the domestic interest rate, and the yield of the euro area government bond on the Estonian stock market.

Using quarterly data, Ikoku (2010) analysed the causal linkages of Nigeria's real GDP, stock market prices and the industrial production index (IPI) between 1984Q1 to 2008Q4. Results revealed bidirectional causal relationships between GDP and stock prices; however, no causality was found between industrial production and stock prices, or GDP and industrial production. Results also revealed that GDP and stock prices were cointegrated. Based on the ARIMA, structural ARIMA and the vector error correction models (VECMs), Ikoku (2010) further suggested that stock prices obtain inherent properties which can be used to enhance GDP forecasting capacity.

Based on monthly data of stock returns on the S&P 500 price index, Chen (2009) investigated whether the United States' stock market recessions, or bear markets, can be predicted by macroeconomic variables such as money stocks, aggregate output, interest rate spreads or yield curves (the difference between the 3-Month Treasury Bill Rate and the 10-Year Treasury Constant Maturity Rate), inflation rates, federal government debt, federal funds rates, unemployment, and nominal exchange rates. The study considered the period 1957M2 to 2007M12, and two methods were used for conducting in-sample and out-of-sample tests, which were Clark and West's (2007) Markov-switching model, as well as Diebold and Rudebusch's (1989) Bry-Boschan Method or the probit regression model. Parametric and non-parametric methods were used to establish the stock market's periods of recession in consideration of in-sample and out-of-sample analyses for examining the predictive capacity of variables. Findings revealed that inflation rates and the yield curve were the most useful predictors amongst the considered variables for both the in-sample and out-of-sample forecasts. The study also found that in terms of the bear market, or expansions of the stock market, macroeconomic variables best predict expansions of stock market returns.

Tripathy (2011) used weekly data covering the period 2005 to 2011 to investigate the market efficiency and causal relationship of India's stock market and macroeconomic variables. Using the Ljung-Box Q statistics and Breusch-Godfrey Serial Correlation LM Test, Tripathy (2011) reveals the existence of autocorrelation in India's stock market as well as macro-economic variables. Also, Granger causality tests were used and these further suggested that fluctuations in India's stock market are influenced by the exchange rate, interest rate and inflation rate. Tripathy (2011) concluded that the Indian stock market is not weak-form efficient, alluding that rational investors can obtain abnormal profits based on the use of stock price historical data as well as information of macro-economic variables. Table 4.1 presents a summary of

established past findings on the linkages and explanatory power of macroeconomic factors on the stock market covering the perspectives in developed countries.

Table 4.1: Summary of reviewed relationships of the stock market and macroeconomic variables in developed nations

Developed countries			
Study	**Method used**	**Country(s)**	**Findings**
Chen (2009)	Markov-switching model, probit regression model. Parametric & non-parametric methods	USA	-Inflation rates & the yield curve were the most useful predictors - Macroeconomic variables predict expansions of stock market returns
Gjerde & Saettem (1999)	VAR Model	Australia, Canada, Norway & Sweden.	Real economic activity affects the stock market
Hsing (2014)	Regression & GACH	Estonia	- the stock market is negatively affected by the expected inflation rate, the exchange rate, the euro area government bond yield, and the domestic interest rate. -The stock market is positively affected by the German stock market index, real GDP and debt/GDP ratio.
Dritsaki (2005); Leon & Filis (2008)	-Johansen cointegration & Granger causality -VAR analysis	Greece	- Interest rates, industrial production & inflation have an explanatory influence over the stock market - GDP negatively impacts the stock market
Errunza & Hogan (1998)	Vector Autoregressive Model & Granger causality	Italy & Netherlands	Industrial production is a significant factor
		Germany & France	Monetary instability is a significant factor
		UK, Belgium & Switzerland	*Money supply & industrial production does not have*

Developed countries			
Study	**Method used**	**Country(s)**	**Findings**
			explanatory power over the volatility in the European stock market

Source: Author's own compilation (Note: *Italics indicative of no effect, relationship, or explanatory power*)

Table 4.2 presents a summary of established past findings on the linkages and explanatory power of macroeconomic factors on the stock market covering the perspectives in developing or emerging economies.

Table 4.2: Summary of reviewed relationships of the stock market and macroeconomic variables in developing nations

Developing / Emerging economies			
Study	**Method used**	**Country(s)**	**Findings**
MacFarlane (2011)	Johansen cointegration, granger causality, & innovation accounting.	*South Africa*	*Past information on macroeconomic variables doesn't affect the ALSI.*
Ikoku (2010)	Cointegration tests & Granger causality	Nigeria	Existing cointegration & bidirectional causal relationships between GDP & stock prices
			No causality between industrial production & stock prices.
Bilson *et al*. (2001)	Multifactor model	Emerging markets	Money supply, goods prices, real activity and exchange rates were significantly associated with emerging equity returns
Glen (2002)	Bootstrapped distributions	Emerging Markets Database	Aggregate economic activity (GDP) and currency devaluation size are important in explaining return behaviour
Ritter (2005)	Siegel model & Gordon	Sixteen countries representing	There was a negative correlation between real

Developing / Emerging economies			
Study	**Method used**	**Country(s)**	**Findings**
	dividend growth model	about 90% of world market capitalization	equity returns & per capita income growth
Tripathy (2011)	Ljung-Box Q statistics & Breusch-Godfrey Serial Correlation LM Test & Granger causality	India	The exchange rate, interest rate & inflation rate affect the stock market

Source: Author compilation (**Note:** *Italics indicative of no effect, relationship, or explanatory power*)

4.3 THE BOND MARKET AND ECONOMIC INDICATORS

The bond market is defined by the trading of debt-related instruments of intangible assets anticipated to provide future cash benefits (Darškuvienė, 2010:7; Lenee & Oki, 2017:70). Regarding the analysis of economic indicators and the bond market, Chowdhury, Bayar, and Kiliç (2013) examined the bond market effects of macroeconomic indicators or fundamentals based on a panel analysis of bond index spreads of 25 emerging markets as well as macroeconomic indicators covering the period 2000 to 2009. The econometric modelling particularly consisted of the regression model according to the ordinary least squares model. A positive association was found for foreign direct investment (FDI) and inflation with the bond index, and a negative relationship for GDP and the reserve in total debt with the spread of the bond index. Equally so, Costantini, Fragetta and Melina (2013) performed an analysis on the European Monetary Union's (EMU) determining factors of sovereign bond yield spreads. Fiscal imbalances, particularly, liquidity risks and the differentials of government debt-to-GDP, were identified as the main long-run determinates of the spreads of sovereign bond yield. A cointegration econometric analysis was conducted composed of monthly data series spanning from 2001 to 2011 for nine euro-area countries. Counties under assessment included the Netherlands, Portugal, Austria, Finland, Belgium, Greece, Italy, France and Spain.

Furthermore, Nieto, Novales and Rubio (2015) used the GARCH-MIDAS multiplicative two-component model of volatility to capture any explanatory power of the United States' standard financial and macroeconomic indicators on the volatility of corporate bond returns by distinguishing the short-term dynamics from the long-run component of volatility. A distinction was made between the volatility of high-rating and low-rating corporate bond

returns. Data series were composed of daily observations from December 31st 1996 to January 31st 2012. Findings indicated that macroeconomic variables such as employment growth, aggregate consumption, industrial production, and financial variables such as the default premium, the term structure slope and the volatility index (VIX) were significant determinants of volatility across all corporate bond categories as regards to the long-run component of volatility. Subsequently, market-wide illiquidity shocks and inflation also proved to be significant determinants of junk-bonds, as well as for other low credit rating bonds.

According to Nieto *et al*. (2015:1-53), the estimation or prediction of volatility for high-rating bonds in both normal times and in recessions was most significantly explained by macroeconomic indicators. On the other hand, financial indicators were particularly good in providing anticipated volatility estimates during recessions. Similarly, Francová (2018) used linear regression analysis to examine the effects of the United States' selected economic factors on the bond market performance along the period 2001 to 2017 using the ordinary least squares method with fixed effects. Results indicated that economic variables (interest rates, and currency movements) have predictive power on the bond return. These findings resonate with those of Ludvigson and Ng (2009) who established that the return of the United States (US) government bonds could be forecasted by "inflation" and "real' factors based on the dynamic factor analysis methodology.

Moreover, Naidu, Goyari & Kamaiah (2016) set out to determine the emerging economies' proximate determinants of sovereign bond yields during the period 1980 to 2013, based on dynamic ordinary least squares tests and Pedroni panel cointegration tests. Findings revealed a significant and positive relationship between the bond yields and the coefficients of the real interest rates, government debt to GDP, volatility index and the 10-year benchmark bond yields. On the other hand, coefficients for the oil price and the Federal Reserve rate were significant and negative. Results for inflation were negative but not significant. Cavallo and Valenzuela (2010) examined emerging markets' (Argentina, Brazil, Chile, Colombia, Indonesia, Malaysia, Mexico, Philippines, Panama, and Thailand) corporate bond yield determinants. The study established that corporate bond spreads are determined by sovereign risk, bond characteristics, global factors, firm-level specific variables and macroeconomic factors. However, the largest share of variance in corporate bond yields was revealed to be accounted for by firm-level characteristics. The empirical methodology was concluded by the option-adjusted spread (OAS) analysis according to a normal panel regression and variance decomposition. Quarterly data was used for the period 1999 to 2006. Table 4.3 presents a

summary of established past findings on the linkages and explanatory power of macroeconomic factors on the stock market covering the perspectives in developed countries.

Table 4.3: Summary of reviewed relationships of the bond market and macroeconomic variables in developed nations

Developed countries			
Study	**Method used**	**Country(s)**	**Findings**
Costantini *et al*. (2013)	Cointegration tests	Netherlands, Portugal, Austria, Finland, Belgium, Greece, Italy, France & Spain	Liquidity risks & differentials of government debt-to-GDP determine sovereign bond yields
Nieto *et al*. (2015)	GARCH-MIDAS multiplicative two-component model	United States	Employment, consumption, industrial production, & financial series i.e. default premium, term structure slope & the VIX are determinants of volatility of corporate bond categories in the long-run.
			Market-wide illiquidity shocks, & inflation are determinants of junk-bonds & low credit rating bonds.
Ludvigson & Ng (2009)	Dynamic factor analysis	United States	"Inflation" and "real' factors had predictive power for the return of Government bonds.
Francová (2018)	Linear regression analysis	United States	Economic factors have predictive power on the U.S. bond return.

Source: Author compilation (**Note**: *Italics indicative of no effect, relationship, or explanatory power*)

Moreover, Nkwede (2017:88-97) analysed the effect of Nigeria's macroeconomic factors on the development of the bond market. The study encompassed 32 years of time series data and used ordinary least squares regression based on multiple regressions. Findings revealed that Nigeria's bond market capitalisation is negatively affected by the exchange rate, banking sector development, inflation and the interest rate. Nkwede (2017) further asserted that these macroeconomic factors are key determinants of Nigeria's bond market development. Similarly,

Suriani, Majid and Nazaruddin (2018) demonstrated that Indonesia's economic factors, particularly, the exchange rate, interest rates and price level, were key determinants of Indonesia's bond market. The study was conducted using the VECM, cointegration test, and multivariate causality methods. The period ranged from January 2010 to November 2017. Table 4.4 presents a summary of past findings on the linkages and explanatory power of macroeconomic factors on the stock market covering the perspectives in developing or emerging economies.

Table 4.4: Summary of reviewed relationships of the bond market and macroeconomic variables in developing nations

Developing / Emerging economies			
Study	**Method used**	**Country(s)**	**Findings**
Cavallo & Valenzuela (2010)	Normal panel regression, option-adjusted spread analysis & variance decomposition	Argentina, Brazil, Chile, Colombia, Indonesia, Malaysia, Mexico, Philippines, Panama, & Thailand	Sovereign risk, bond characteristics, global factors, firm-level specific variables & macroeconomic factors affect corporate bond spreads
Nkwede (2017)	Ordinary least squares regression	Nigeria	Bond market capitalisation is negatively affected by the exchange rate, banking sector development, inflation and the interest rate.
Suriani *et al*. (2018)	VECM, cointegration test, and multivariate causality methods	Indonesia	The exchange rate, interest rates and price level, were key determinants of Indonesia's bond market
Chowdhury *et al.* (2013)	Ordinary least squares model	25 emerging markets	A positive relationship between FDI & inflation with the bond index.
			A negative relationship between total debt with the bond index.
Naidu *et al*. (2016)	Pedroni panel cointegration tests & dynamic	Twelve emerging economies	Gold price, US bond yield, exchange rate, federal reserve rate, oil price & the real interest rate are

Developing / Emerging economies			
Study	**Method used**	**Country(s)**	**Findings**
	ordinary least squares tests		proximate determinants of bond yields.
			Government debt to GDP, volatility index & the 10-year benchmark bond yields have significant & positive relationship with bond yields.
			Oil price & the Federal Reserve rate have a negative effect on bond yields.

Source: Author's own compilation (**Note**: *Italics indicative of no effect, relationship, or explanatory power*)

4.4 THE COMMODITY MARKET AND ECONOMIC INDICATORS

Schaling *et al*. (2014) examined the concordance of South Africa's commodity prices and the country's currency or exchange rate during the period 1996 and 2010 based on nominal data usage. Results established that the two series were not cointegrated, whereas a negative correlation was revealed. A significant and strong unidirectional causality was revealed from commodity prices to the nominal exchange rate. The study also noted that the established relationship was relatively weaker than the commodity prices of countries from the Organisation for Economic Co-operation and Development (OECD).

Research in the USA conducted by Karali and Power (2013) based on the period 1990-2009 analysed the components of high- and low-frequency volatility for eleven commodities in relation to macro-economic indicators. The study used the spline-GARCH framework established by Engle and Rangel (2008), as well as the generalised least squares (GLS) - detrending procedure. Karali and Power (2013) revealed that the macroeconomic variables' effect on commodity prices was much greater during the bull-and-bear cycle than prior to it. Also, Karali and Power (2013) noted that common effects on macroeconomic variables on commodity prices were observed from 1990-2005, whereas the effects covering 2006—2009 were commodity-specific. Consequently, inventories, industrial production, inflation, and the short-term and long-term interest rate spread were revealed to have affected most commodities'

low-frequency volatility. Both negative and positive changes in the IPI, inflation and the interest rate spread caused an increase in volatility for most commodities.

Using monthly averages of daily values for the S & P Goldman Sachs Commodity Index (GSCI) commodity price index, Smolík, Karas and Rejnuš (2015) analysed the macroeconomic determinants of volatility in the former index. The study used data from January 2000 to September 2013 and used the Boosted Trees method. Results revealed that changes in selected macroeconomic determinants explain 75.74 per cent of variations in the S & P GSCI. The nominal effective exchange rate of the USD and the United States' short-term interest rates were the most significant factors. Accordingly, a weakening of in the US dollar suggested an increase in the value of the S & P GSCI. Smolík *et al.* (2015) justify these results based on the notion that speculations on the highly financialised and current commodity exchanges are short-term and correspond with investors' psychological behaviour as well as economic development. Table 4.5 presents a summary of past findings on the linkages and explanatory power of macroeconomic factors on the stock market covering the perspectives in developed countries.

Table 4.5: Summary of reviewed relationships of the commodity market and macroeconomic variables in developed nations

Developed countries			
Study	**Method used**	**Country(s)**	**Findings**
Karali & Power (2013)	Spline-GARCH framework by Engle & Rangel (2008) & GLS-detrending procedure	United States	Macroeconomic variables affect commodity prices during the bull- & – bear cycle than prior to it
			Inventories, industrial production, inflation, & the short-& long-term interest rate spread affect most commodities' low-frequency volatility
Smolík *et al.* (2015)	Boosted Trees method	United States	Macroeconomic determinants explain 75.74 per cent of variations in the S & P GSCI commodity price index. Effective exchange rate of the USD & the United States' short-term interest rates were the most significant factors

Developed countries			
Study	**Method used**	**Country(s)**	**Findings**
Frankel and Rose (2010)	The "overshooting" model	United States	Microeconomic fundamentals (volatility, spot-forward spread, & inventories) had consistent & strongest effects on real commodity prices. Macroeconomic fundamentals (global inflation & output) had positive effects on real commodity prices

Source: Author's own compilation (**Note**: *Italics indicative of no effect, relationship, or explanatory power*)

Bangara and Dunne (2018) studied the effects of commodity prices on macroeconomic indicators in Malawi. The study used a structural vector autoregressive (SVAR) method and quarterly data sets spanning from 1980Q1 to 2012Q4. The study established that a positive tobacco price shock significantly and positively impacts gross domestic product (GDP), induces an appreciation in the real exchange rate and a decrease in the CPI. On the other hand, causality was recorded to extend from tobacco prices towards the respective macroeconomic factors. Furthermore, upon using macro-and-microeconomic factors as explanatory variables of commodity prices, Frankel and Rose (2010) established that commodity prices are impacted by microeconomic factors (volatility, spot-forward spread, and inventories) and macroeconomic factors or fundamentals (global inflation and output). The most effect arising from the former, and positive effects exhibited by macroeconomic factors. Table 4.6 presents a summary of past findings on the linkages and explanatory power of macroeconomic factors on the stock market covering the perspectives in developing or emerging economies.

Table 4.6: Summary of reviewed relationships of the commodity market and macroeconomic variables in developing nations

Developing / Emerging economies			
Study	**Method used**	**Country(s)**	**Findings**
Schaling *et al*. (2014)		South Africa	*Commodity prices & the exchange rate are not cointegrated. But negatively correlated.*
Bangara & Dunne (2018)		Malawi	Tobacco commodity price affects GDP positively, induces the

Developing / Emerging economies			
Study	**Method used**	**Country(s)**	**Findings**
	structural vector autoregressive method		trengthening of the real exchange rate & a decrease in the CPI.
			Causality solely ran from tobacco prices to macroeconomic factors.
Jena (2016)	ARDL and ECM	India	Macroeconomic series had a long-run association with the agricultural price index. Macroeconomic variables had a positive long-run relationship with the energy price index. The exchange rate & the IPI showcased positive effects on the agricultural price index and significant effects on the energy price index.
			There were no long-run linkages between macroeconomic series and the metal price index.
Yin & Han (2016)	FAVAR model	China	Macroeconomic factors were significant in affecting commodity markets but outperformed by the U.S.
Li *et al*. (2017)	Zero-inflated poisson model	China	Inflation, economic growth & money supply had positive influences on commodity price bubbles and negative effects by interest rates. Money supply & economic growth had the greatest impact on commodity price bubbles

Source: Author's own compilation (**Note**: *Italics indicative of no effect, relationship, or explanatory power*)

Yin and Han (2016) studied the commodity market effects of China's macroeconomic and financial series relative to the U.S., using the factor-augmented vector auto-regression (FAVAR) model. Findings established that China's macroeconomic factors were significant in affecting its commodity markets, and was most significant for the U.S., outperforming China's macroeconomic and commodity market nexus according to significance levels and the size of coefficients. Also, results established in the U.S. also outperformed those of China in terms of the magnitude and direction of directional spillovers of returns. These findings are similar to

those by Li, Chavas, Etienne and Li (2017), who established that inflation, economic growth and money supply contribute positively to China's commodity price bubbles, and a negative effect is caused by interest rates. Among the macroeconomic series, Li *et al*. (2017) concluded that money supply and economic growth constituted the greatest impact on commodity price bubbles. This study encompassed the period 2006 to 2014 and used the Zero-inflated poisson model.

Accordingly, Jena (2016) observed the relationships between India's macroeconomic time-series and commodity index prices from January 2001 to June 2012 based on the error correction model (ECM) and the ARDL model. Findings revealed a long-run connection between macro-economic variables and the agricultural price index. A negative relationship was also suggested between macroeconomic variables and the energy price index. Nevertheless, no long-run linkages were identified between macroeconomic time-series and the metal price index. On the other hand, the exchange rate and the IPI exhibit significant and positive effects on the agricultural price index, as well as significant effects on the energy price index.

4.5 THE EXCHANGE RATE MARKET AND ECONOMIC INDICATORS

Kibritcioglu, Kose and Ugur (2001) examined the predictability and the determinants of a currency crisis founded on the leading indicator method in the case of Turkey. The study encompassed monthly data sets from 1986 to 1998. Results revealed that the leading signals of the currency crisis index were identified to be the terms of trade, respective survey data and market-determined exchange rate in forecasting the official exchange rate. However, results by Kibritcioglu *et al*. (2001) also revealed that the ratio of the current account balance to GDP and the ratio of the budget deficit to GDP were insignificant determinants of currency or exchange rate crisis.

The former findings parallel results by Frankel and Rose (1996), Kaminsky *et al*. (1998), Kruger *et al.* (2000) and Sachs *et al.* (1996). In furtherance, Kibritcioglu *et al*. (2001) purports that no relationship between the currency or exchange rate crisis index was established with the ratio of M2 (money supply) to gross international reserves, growth of national credits of bank deposits, growth of imports, the ratio of current account balance to industrial production, growth of exports, the ratio of M2 over gross international reserves and the ratio of short-term capital flows to industrial production. Kibritcioglu *et al*. (2001) also noted that the reliance of such methodologies to form a future expectation of financial crises may not be sufficient;

however, the examination of the patterns of important indicators may prove to be beneficial to assist the authorities to adapt their decisions accordingly.

Palombizio and Morris (2012) sought to observe the predictability of the foreign exchange rate by means of leading economic indicators using quarterly data ranging from 1999Q1 to 2008Q4 in the case of Canada. The study used in-sample and out-of-sample forecasts founded on the autoregressive model, and subsequently, correlogram tests were conducted to determine the correlation between the variables. Economic indicators used in the study included GDP, unemployment rate, the trade balance, money supply (M2), CPI of raw materials and the consumer confidence index (CCI). Findings of the out-of-sample model did not reliably present significant predictive power in the exchange rate throughout the sample period. In-sample forecasts exhibited significant coefficients for the CCI and wheat.

According to Palombizio and Morris (2012), indicators that had the most significant effect included the unemployment rate, the CCI, oil price and wheat prices. In a study conducted on the European Union (EU) members using the threshold autoregressive conditional heteroscedasticity (TARCH) model, Stancık (2006) investigated the causes of exchange rate fluctuations and established that economic openness is associated with lower exchange rate volatility in certain nations with the exclusion of Poland, the Czech Republic, Hungary and Slovakia. Nonetheless, it was found to have a significant effect on the volatility of the exchange rate in Slovenia and Slovakia. Poland and the Czech Republic were slightly affected by the findings.

In Pakistan, Raza and Afshan (2017) considered the period spanning from 1972 to 2013 and used the Juselius and Johansen co-integration methods, the autoregressive distributed lag bound testing co-integration method and the Hansen structural break co-integration method. Long-run results suggested a significant inverse association between the exchange rate, with terms of trade, economic growth and trade openness. Nevertheless, a positive relationship was identified between the exchange rate with the money supply and inflation rate. In the short-run, the error correction model revealed a significant and positive association for the exchange rate with trade openness and terms of trade; however, the rest of the series was not significant over the short run. Tests for granger causality were also conducted by Raza and Afshan (2017) and the results suggested a bidirectional causal association between trade and economic growth with Pakistan's exchange rate. Nevertheless, an existing unidirectional relationship was revealed between money supply, inflation and terms of trade towards the exchange rate.

Similarly, Yuan (2011) found that fundamentals or macroeconomic determinants have significant effects on the exchange rate dynamics in a nonlinear manner, channelled through the Markovian process as according to transitional probabilities. Yuan's (2011) analysis was conducted based on the Time-Varying Markov-Switching Autoregressive Conditional Heteroscedasticity (ARCH) model. It made use of quarterly series of four bilateral exchange rates of their respective countries, particularly, the British pound (GBP), the Australian dollar (AUD), the Canadian dollar (CAD), and the Japanese yen (JPY). Explanatory variables included the money supply, real gross domestic product, trade balance, CPI, short-term and long-term interest rates, encompassing quarterly observations spanning from 1973Q1 to 2007Q2. Results revealed that macroeconomic fundamentals (Money supply, real gross domestic product, trade balance, CPI, short-term and long-term interest rates) affect the evolution of dynamics of the countries' respective four bilateral exchange rates in a nonlinear way, through on transition probabilities.

Mirchandani (2012) determined the macroeconomic determinants of India's exchange rate volatility based on annual data, as of the period 1991 to 2010. Macroeconomic determinants included FDI, interest rate, inflation rate, the balance of trade, and GDP. The basis of the econometric background was grounded on Pearson's correlation analysis. Results suggested a negative and high correlations between interest rates and the exchange, a negative and moderate correlation between inflation rate and the exchange rate, and a moderate and positive correlation between GDP and the exchange rate. Also, a moderately positive relationship was revealed between the exchange rate and FDI. Nevertheless, no significant relationship was found between the exchange rate and the current account.

Using leading economic indicators as a proxy for anticipated economic conditions, Finnerty, Owers and Creran (1987) sought to analyse whether the former can be used to provide relative forecasts of exchange rate movements between Canada and the USA. In accordance with the econometric models proposed by Granger and Newbold (1977), the study used the leading economic indicator approach through the detection of patterns which may be utilised to foretell future performance. Results indicated promising findings for forecasting the foreign exchange rate using the leading indicator approach. Six models were used, including four variables for the leading economic indicators, the interest rate and the martingale. The most significant was the martingale model, followed by the leading economic indicators. The interest rate model showcased poor exchange rate forecasting ability. Finnerty *et al.* (1987) explain that this could

have been due to the intervention policy by the Bank of Canada in the market for foreign exchange, independent of Canada's monetary policy.

Similarly, Vidyavathi, Keerti and Pooja (2016) assessed India's exchange rate and macroeconomic economic influences by analysing potential determinants based on the correlation matrix. The latter included annual observations of the inflation rate, interest rate, FDI, external debt, GDP and the current account deficit for the period 2006 to 2016. Accordingly, five out of six explanatory variables suggested an inverse or negative relationship with the exchange rate. Such variables induced GDP, inflation, external debt, current account deficit and the lending interest rates. Meanwhile, there was a positive association revealed between the exchange rate and FDI. Table 4.7 presents a summary of established past findings on the linkages and explanatory power of macroeconomic factors on the stock market covering the perspectives in developed countries.

Table 4.7: Summary of reviewed relationships of the exchange rate market and macroeconomic variables in developed nations

Developed countries			
Study	**Method used**	**Country(s)**	**Findings**
Palombizio & Morris (2012)	Autoregressive model	Canada	Unemployment rate, the CCI, oil price & wheat prices were significant indicators of the exchange rate.
Stancık (2006)	Threshold autoregressive conditional heteroscedasticity model	EU members	Economic openness is related to reduced exchange rate volatility for certain countries except for Poland, the Czech Republic, Hungary & Slovakia. News exhibited a great effect on exchange rate volatility in Slovenia & Slovakia.
Yuan (2011)	Time-Varying Markov-Switching ARCH model	UK, Australia, Candian & Japan.	Macroeconomic fundamentals (Money supply, real gross domestic product, trade balance, CPI, short-term & long-term interest rates) affected the evolution of dynamics of the countries' respective four bilateral exchange rates in a nonlinear way, based on transition probabilities.
Finnerty *et al.* (1987)	Leading economic indicator approach	Canada & the USA	The martingale model was the most significant in predicting the

Developed countries			
Study	**Method used**	**Country(s)**	**Findings**
			exchange rate, followed by leading economic indicators.
			The interest rate model showcased poor exchange rate forecasting ability.

Source: Author's own compilation (Note: *Italics indicative of no effect, relationship, or explanatory power*)

Table 4.8 presents a summary of past findings on the linkages and explanatory power of macroeconomic factors on the stock market covering the perspectives in developing or emerging economies.

Table 4.8: Summary of reviewed relationships of the exchange rate market and macroeconomic variables in developing nations

Developing / Emerging economies			
Study	**Method used**	**Country(s)**	**Findings**
Kibritcioglu *et al*. (2001)	Leading indicator approach	Turkey	Terms of trade, respective survey data & market-determined exchange rate were leading indicators of the currency crisis index.
			The ratio of the current account balance to & budget deficit to GDP were determinants of the exchange rate crisis.
			No relationship between the exchange rate crisis index with domestic credits of deposit banks, imports, the ratio of the current account balance to industrial production, exports, the ratio of M2 over gross international reserves, the ratio of M2 to gross international reserves & the ratio of short-term capital flows to industrial production.
Raza & Afshan (2017)	Juselius & Johansen co-integration methods, the autoregressive distributed lag bound testing co-	Pakistan	Terms of trade, economic growth & trade openness exhibited a significant negative relationship with the exchange rate in the long-run. - Money supply & inflation rate positively affected the exchange rate in the long-run. – There was a

Developing / Emerging economies			
Study	**Method used**	**Country(s)**	**Findings**
	integration approach & the Hansen structural break co-integration approach		significant & positive effect of trade openness & trade openness in the short-run, *remaining variables were not significant.*
Mirchandani (2012)	Pearson's correlation analysis	India	Interest rates have a negative & high correlation with the exchange. The inflation rate had a negative & moderate correlation with the exchange rate. GDP had a moderate & positive correlation with the exchange rate. FDI had a moderately positive relationship with the exchange rate.
			No significant relationship was exhibited for the exchange rate & the current account.
Vidyavathi *et al*. (2016)	Correlation matrix	India	GDP, inflation, external debt, current account deficit & the lending interest rates had an inverse relationship with the exchange rate.
			The exchange rate had a positive relationship with FDI.

Source: Author's own compilation (Note: *Italics indicative of no effect, relationship, or explanatory power)*

4.6 SYNOPSIS

The above findings shed light on the valued insights into the major nuances between the interactions of economic time-series with financial market components. Most studies showed that the financial market's capital markets have existing interrelationships with basic economic variables notwithstanding the few selected economic variables within certain countries. Such findings suggest the increased likelihood of establishing existing co-movement between South Africa's component series of the composite BCIs with the stock, bond, commodity and the exchange rate market. The occurrence of such a phenomenon contradicts the projections of traditional or neoclassical finance theory. This could imply that fundamentals are key indicators or signals that can be used for interpreting not only the real side of South Africa's economy but also the patterns of capital market behaviour by individual consumers, investors, scholars and policy-makers. The following chapter furthers the present analysis of existing literature by

establishing a methodological framework upon which empirical or statistical analysis of the interrelationships and co-movement between South Africa's individual component series of the composite BCIs and stock, bond, commodity and exchange rate market can be tested.

CHAPTER 5: RESEARCH DESIGN AND METHODOLOGY

5.1 INTRODUCTION

The previous chapter detailed the various empirical estimations on the linkages between macroeconomic variables and capital market variables established in both developed and developing countries. Findings revealed that some macroeconomic variables tend to have explanatory power over the various capital markets (Bilson *et al*., 2001; Nieto *et al*., 2015; Cavallo &Valenzuela, 2010). On the other hand, other variables do not exhibit such properties in explaining respective capital market performance (MacFarlane, 2011; Schaling *et al*., 2014). Most of the findings demonstrate significant interlinkages between capital markets and macroeconomic or real sector variables relative to those that established no such relationships. These findings at least provide a foundation upon which the business cycle component series can arguably be tested to verify any potentially significant explanatory capabilities towards heterogeneous capital markets according to the study's set empirical objectives.

In order to fulfil the set of empirical objectives, quantitative econometric methods were utilised. The methods consisted of the cross-correlations test, Granger causality test, variance decomposition, the generalised autoregressive conditional heteroscedasticity (GARCH), the Autoregressive Distributed Lag (ARDL) model, as well as graphical charts. Cross-correlations and Granger causality tests were used simultaneously to identify whether business cycle subcomponent indicators exhibited lead, lag or coinciding properties with heterogeneous capital markets of the financial market. Variance decomposition test was used to verify whether identified leading variables of each capital market did indeed have the capacity to explain variations in respective capital market input variables. Moreover, the GARCH model estimated to account for the conditional volatility in both input (explanatory or independent) and output (response or dependent) series.

To verify potential short- and long-run effects of business cycle subcomponents on heterogeneous capital market output series, the ARDL model was used. This model was selected due to its reputation of establishing fairly robust estimations and its inherent flexible nature when dealing with conflated orders of integration for both level I(0) and first difference I(1). To name a few, a number of scholars to have used the ARDL model including Adamu (2014) and Sakyi (2011). In this chapter, the study delineates the methodological composition, properties and foundations of the various time-series and econometric tests. Outlined and

discussed in the subsequent sections of the chapter includes background and description of the utilised data, model specifications, and diagnostic estimations.

5.2 DATA SELECTION, SAMPLE PERIOD AND VARIABLE DESCRIPTION

5.2.1 Selection of data (indicators) and sample period

The study was founded on a quantitative research approach and made use of the time-series monthly dataset. A monthly timeframe was used spanning from June 2003 to November 2017 and consisted of approximately 174 monthly observations. The selected timeframe was chosen on the basis of data availability with emphasis on South Africa's (SA) post-colonial era to exclude economic embargos which were inherent to SA's apartheid era. All time-series were pre-adjusted for seasonality as retrieved from their respective data sources. The study's dataset consisted of the All-Share index (ALSI_t), All-Bond index (ALBI_t), All-Commodity index (ALCI_t) and the real effective exchange rate (REER_t) as the dependent (output, or reference) variables. Moreover, the independent (input, explanatory, or component) variables included the subcomponent indicators of the leading, lagging and coincident business cycle composite indicators. The reference series declared as the capital market series for the present study serves as the target variables whose movements are to be predicted by the component series (Nilsson & Brunet, 2006:16; Nasiri, Taghizadeh, Amiri & Shaghaghi Shahri, 2017:80). Time-series observations for the ALCI, the REER and the business cycle subcomponent indicators were retrieved from the South African Reserve Bank (SARB). The ALSI and the ALBI were obtained from the Johannesburg Stock Exchange (JSE). All the data utilised in the study were already seasonally adjusted from their respective sources.

5.2.2 Selection of economic time-series as capital market indicators

The rationale behind the identification of business cycle composite series as leading, lagging and coinciding indicators for SA's heterogeneous capital markets is predicated on whether these explanatory properties account for the latter in the same or separate function or nature as the business cycle. The subcomponents of the business cycle composite series were selected as reference cycles to denote turning points pertaining to peaks and troughs of the ALSI, ALBI, ALCI and the REER. Driven by the financial and business or macroeconomic linkages presented in Section 2.4 of Chapter 2, the chosen indicators were, at least, expected to lead, lag and coincide with the turning points of heterogeneous capital markets. This is also based on the notion that the real and financial economy does not operate in isolation, and decision-making actors of the financial sector are actively engaged in the real economy. The

characterisation of individual reference series in terms of the capital markets enforced the construction of composite series as leading, lagging and coinciding series for each capital market. The constructed composite series were subsequently tested against respective capital markets to verify their explanatory power against the latter, using charting tools and with a prime interest on the cyclical phases underlying the peaks (expansions) and troughs (contractions).

For such classifications to hold, various properties for the selection of legitimate indicators must be adhered to based on the set criteria with reference to Carriero and Marcellino (2007:224-225). These are:

- The times-series needs to have conformity to the target series and good forecasting properties;
- The time-series should have economic significance as to reflect general economic movements;
- The time-series needs to be long and continuous, must be reliable, up to date and timely;
- Time-series should prompt availability without major revisions or modifications;
- The cyclical patterns of time-series must have consistent timing in anticipating target turning points; and
- The time-series needs to be smoothed, such that it should be free from undue irregular movements.

In accordance with the above criteria, the study selected 23 composite business cycle subcomponent series based on their role and statistical significance in explaining SA's business cycle performance. Eleven of the series are among as SA's leading series individual time-series of the business cycle, seven were lagging individual time-series and five were coincident component time-series. These were as explanatory candidates of the All-Share index, All-Bond index, All-Commodity index and the real effective exchange rate.

5.2.3 Description, adjustments and transformation of variables

All capital markets were pre-indexed with the base year being 2015 in terms of their monthly South Africa Rand (ZAR) real prices (2015=100), where 2015 is denoted by the SARB's as the current and updated base year,. Selected capital markets included SA's ALSI, ALBI, the ALCI and the REER. The ALCI constitutes some 150 of registered companies on the JSE and is considered to be the largest index with respect to its overall value and size with a representation of about 99 per cent of full market value (JSE, 2013a; FTSE Russell, 2019). The

ALSI constitutes all stocks which are traded on the main board, its representation gives it the ability to additionally reflect less efficient stocks' relative efficiency (Heymans & Santana, 2018:6).

The ALBI is classified as a composite index of SA's top 20 vanilla bonds ranked according to the dual components of average market capitalisation and average liquidity (JSE, 2013b). The latter serves as a measure of the bond market's daily movements. Moreover, SA's commodity price index, also referred to as the ALCI, includes both fuel and non-fuel (food, beverages and industrial inputs) commodity prices (Index Mundi, 2019). Lastly, the REER is classified as a representation of SA's REER of the Rand against 20 currencies of the country's major trade partners. Relative to the basic bilateral exchange rate such as the commonly used Rand vs. the United States Dollar rate, the real effective exchange rate is considered as a much broader proxy for SA's general trade movements as it considers the country's overall competitiveness in terms of its currency within the foreign trade market (Motsumi *et al*, 2008:61).

All selected pre-seasonally adjusted individual variables of the business cycle composite indicators are represented in Table 1.1 in Section 1.4.2 of Chapter 1. To secure a consistent and uniform dataset and to minimise size residuals, both time-series constituting the capital market series and the individual series of the BCI indices were transformed into their natural logarithmic forms. This was also done to adjust for potential scale effects of the different time-series included, and to make possible the estimation of elasticity or growth. For time-series constituting negative values in their original data forms, the study applied the method by Osborne (2002:3) and Osborne (2010:3), which transforms all negative values for logarithmic transformations to be made possible. For such a process, Osborne (2002:3) and Osborne (2010:3) detail that a constant can be added to the distribution of each individual time-series carrying negative values by anchoring the lowest value (-ve) to the positive value 1.00. The prescribed method results in a shift of distributions and not necessarily a change in the trends and cycles. The resulting outcome is followed by negative values eventually carrying positive values, and the pre-existing positive values carry a higher positive as similarly shown by Chipeta (2018:91).

5.3 MODEL SPECIFICATION AND ECONOMETRIC MODELLING

In the face of a dynamic global economy, the need for legitimately robust econometric techniques for economic and market analysis is unprecedented. The current study provides a noble addition to the understanding of the financial market and business cycle behaviour. In

doing so, the cross-correlations test and the Granger causality test were concurrently used to verify the concordance between financial and business cycles in correspondence with the variance decomposition test (similar to Döpke, 1998; Takala & Tsupari, 2000; Graff & Etter, 2004; Burger, 2010; Damos, 2016). Typically, a cross-correlation test is a test of the relation between two variables (Mahan, Chorn & Georgopoulos, 2015:100). It indicates the sequence of variations in the input series gap compared to variations in the gap of the reference or output series (Burger, 2010: 29). During the concurrent usage of cross-correlations and Granger causality tests, the latter provides a clearer indication of the sequence of variations between two time-series, and not necessarily its projection of causality between the two series (Burger, 2010:29). Figure 5.1 illustrates the prime methodological procedure which was undertaken in the study. The process involved the selection of pertinent variables based on Carriero and Marcellino's (2007:224-225) proposed criteria, the pre-filtering of variables in removeing potential outliers and trends, including the further analysis of cross-correlations and Granger causality, cyclicality, volatility and cointegration. The last steps involved the aggregation of the identified leading composite indices for each capital market, followed by performance testing of each index with its capital market based on effgxtracted turning points. Pre-analysis to the set process

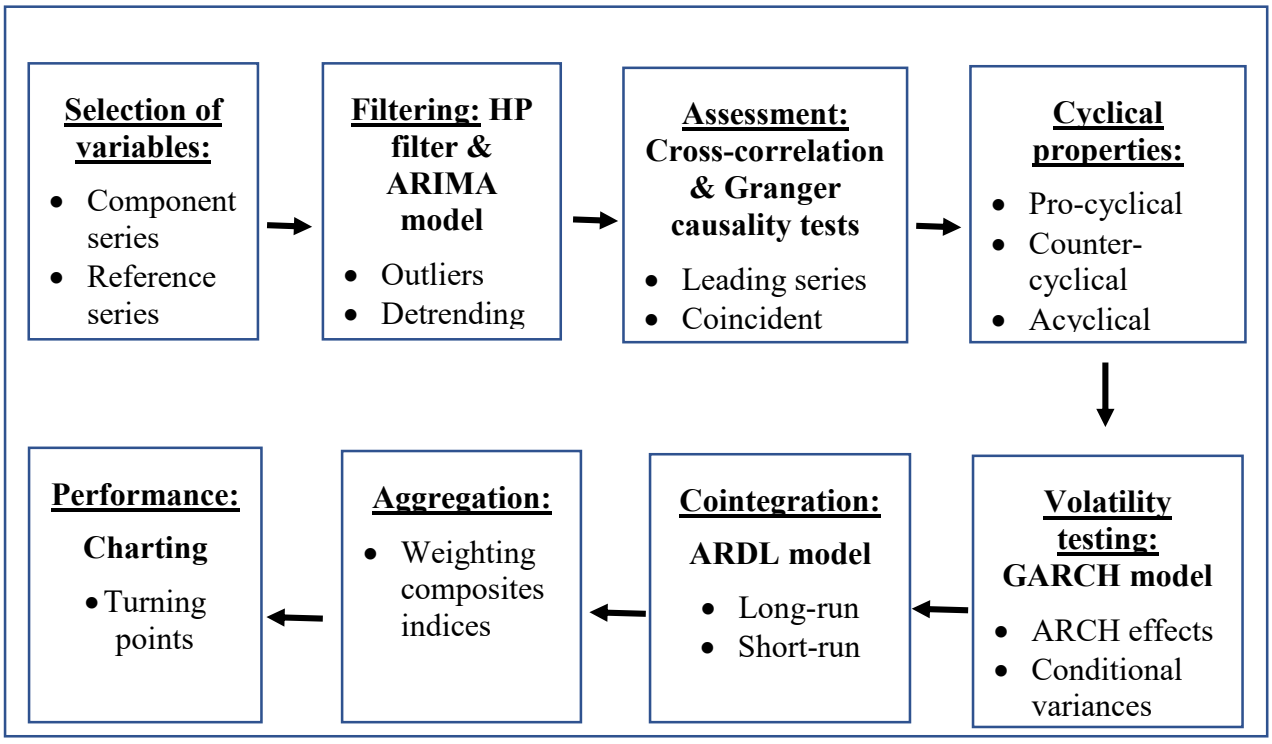


Figure 5.1: Model framework steps

Source: Author compilation

5.3.1 Tests for stationarity and unit root

The identification of data as being either stationary or non-stationary is crucial and was based on the tests for unit root or stationarity (Perron, 1989). Stationarity tests are prerequisite estimates for econometric analysis specifically as these relate to cross-correlations and cointegration estimations (Gujarati & Porter, 2008:762). The study used the Dickey and Fuller's (1979) Augmented Dickey-Fuller (ADF) test to ensure that each time-series in the study dataset were stationary or free from the unit root. Mushtaq, Ali Shah and Zia ur Rehman (2012:7390) emphasise that using non-stationary series for econometric estimations can result in spurious estimations or simply misleading results. The study proceeded further with the estimation of econometric models having secured the stationarity of the dataset. The ADF test is an upgraded version of the autoregressive unit root test or Dickey-Fuller (DF) test improved by Said and Dickey (1984) prompting that autoregressive moving averages (ARMA) to be accommodated based on orders *p*,*q* within instances with unknown orders. Abdalla and Murinde (1997:28) provide a simplification of the ADF model under a standard regression equation with a constant and expressed as follows:

$$\Delta Y_t = a_0 + \beta_1 + \lambda_3 Y_{t-1} + \sum_{n=1}^{\infty} a_1 \Delta Y_{t-i} + \varepsilon_{3t} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (\text{eq. } 1)$$

Such that: Δ denotes the first difference operator;

X is the natural log of each variable in the study, being $\Delta Y_t = X_t - X_{t-1}$;

t denotes the time trend; and

$\varepsilon 1$ $\varepsilon 2$, $\varepsilon 3$ and $\varepsilon 4$ represent the white noise errors.

Finally, the following hypothesis provides the basis for the ADF test:

- H_0: $\lambda 1 = \lambda 2 = \lambda 3 = \lambda 4 = 1$
  If H_0 is met, implies that Y_t has a unit root, thus *I*(1); else
- H_1: $\lambda 1 = \lambda 2 = \lambda 3 = \lambda 4 < 1$
  Means that Y_t series are stationary, thus *I*(0).

Under the null hypothesis, H_0: ($\lambda = 1$), the variable has a unit root *I*(1) and is there deemed non-stationary. On the other hand, under the alternative hypothesis ($\lambda < 1$), the variable is stationary as it does not have a unit root *I*(0).

5.3.2 Cross-correlations

The Cross-correlation test or cross-correlation function (CCF) seeks to define the time-lagged (gap) interrelation between two time-series (McCoy & Blanchard, 2008:5) in terms of the lead, lag or coinciding relationships (Mohanty, Singh & Jain, 2003). The study used prewhitened cross-correlations in testing the responsiveness of capital market output variables to subcomponent business cycle composite input indicators. Analysis of cross-correlations requires that time-series variables are (i) stationary in their variance and mean, and (ii) prewhitened, to avoid bias (Gröger & Fogarty, 2011:596). Extension of detail to these underlying conditions is made in the following Sections 5.3.2.1 and 5.3.2.2 of the current chapter. In a cross-correlation, the time-series with the influential effect is considered the "input" series, whereas the time-series being influenced or affected is the "output" series (Probst, Stelzenmüller & Fock, 2012:673).

The CCF allows for the assessment of responsiveness and sensitivity of a specific state to particular pressure (Probst *et al.*, 2012:671). Analysing the co-movement between datasets proceeds in the domain of time relative to the degree at which two variables move collectively specific to dissimilar time lags. The absolute value of the CCF gauges the strength of co-movement and the sign indicates whether the series move in the opposite or same direction (Rua & Nunes, 2005:506). Cross-correlations can be used in measuring the strength of comovement based on the separation of the lagging, leading and coincident variables between the potential component series and the reference series at different lags/leads, where the calculation of the cross-correlation coefficient at time *t* ensues the following model (McCoy & Blanchard, 2008:5).

$$r_t = \frac{n^* \sum y_1 y_2 - \sum y_1 \sum y_2}{\sqrt{[n^* \sum y_1^2 - (\sum y_1)]\,[n^* \sum y_2^2 - (\sum y_2)]}} \quad \text{..... (eq. 2)}$$

Such that: r_t denotes the coefficient of the cross-correlation at time lag t;

t denotes the time lag between two time-series according to months;

n^* denotes the number of overlapping observations or data points;

y_1 denotes the input series (composite business cycle subcomponents); and

y_2 denotes the output series (capital markets – ALSI, ALBI, ALCI, or REER).

A variable is considered a leading, coincident and lagging indicator based on the peak of the cross-correlation.

Moreover, Mohanty *et al.* (2003) note that the application of detrended (trend eliminated), deseasonalised and smoothed datasets to the CCF provides a much fairer conceptualisation of the stability and strength of concordance between cycles, minimises the potential for false signals and elevates the precision of turning point predictions. Rua and Nunes (2005:9), as well as Burger (2010:30), assert that when assessed contemporaneously, information is given relating to the extent of collective movement of the time-series given the same time. The lead and lag relationship are provided according to the value of τ where the CCF is maximised. The cross-correlations between the gap of the component and reference series are determined according to time (t), the lags (t + 1 to t + 20), leads (t – 20 to t – 1) and contemporaneous (t = 0) values of the two series.

Clarification of the cross-correlation signs yields insight into the type of occurring patterns. If the cross-correlations of the component variable exhibit positive (+) values while resembling the pattern of the reference series, it is said to be pro-cyclical. A component series with a negative (–) sign whose cross-correlation pattern is inverse to the reference series is deemed counter-cyclical. Cross-correlations indicative of no definitive cross-correlating patterns between the component and reference series assume an acyclical pattern (Napoletano, Roventini & Sapio, 2006:87-118).

5.3.2.1 Time-series decomposition (Filtering)

A prerequisite to cross-correlation analysis is that time-series data is detrended to uphold the first condition which ensures that the mean of time-series data is stationary and thus homoscedastic or stationary in their variance (Gröger & Fogarty, 2011:596). Time-series decomposition involves the separation of the trend (μ_t), cyclical (c_t) and irregular shock (ε_t) when y_t is not adjusted for seasonality, it also captures the seasonal and calendar components) components from economic series where $y_t = \mu_t + c_t + \varepsilon_t \ldots$ (Conference Board, 2017:243). According to the Conference Board (2017:243), most time-series, over time, tend to have upward trends thus nonstationary, implying that they lack a constant mean upon which they revert to. Henceforth, to understand whether changes in a series are permanent or temporary or simply reflect either cyclical or trend movements, researchers often detrend the series. Also, diverse models seek to identify if the trend component is either changing and thus unpredictable (stochastic) or rather constant and thus predictable (deterministic) in time.

The detrending of time-series data is, however, a crucial method of reducing distortions resulting from trend and irregular movements through the growth cycle analysis method (Klein, 2019:218). When detrending economic time-series such as GDP, economists look for and refer to the c_t component as the "growth cycle", also known as the "deviation cycle", where $\mu_t + c_t$ is the "trend-cycle" by particularly conflating the long-term (trend) and medium-to-long-term (cycle) movements while discounting for irregular, seasonal and calendar components (Conference Board, 2017:244). Most recent methods of business cycle dating have deviated from Burns and Mitchell's (1946) classical interpretations of the business cycle based on classical analysis towards growth cycle analysis by which the former looks at levels of expansions and contractions of aggregate time-series without adjustments for the trend component. On the other hand, growth cycle analysis conceptualises and considers fluctuations, not in absolute levels of slowdowns, but the medium-to-long-term growth rates in the slowdowns or declines measured as deviations or fluctuations in a time-series around a their trend-line, in both severed (prolonged) and short slowdowns (Rua & Nunes, 2005:504; Zarnowitz & Ozyildirim, 2006:1718).

The growth cycle analysis considers the cyclical component of time-series data from its long-term trend in terms of accounting for, and the exclusion of the permanent trend component within time-series data (Laubscher, 2014:2). It is argued that results of econometric estimations specific to business cycle time-series rely significantly on the detrending method (Döpke, 1998:1). The present study employed the Hodrick-Prescott (HP) filter by Hodrick and Prescott (1997), similar yet not limited to Burger (2010), Phillips and Jin (2015), to isolate and extract diversions from the trend component by considering the cyclical components of both the log-transformed capital market variables and subcomponent variables of the business cycle composite indicators. The HP filter is amongst the common approaches of detrending data through trend and cycle decomposition based on the estimation of cyclical fluctuations of economic activity in measuring business cycles (Phillips & Jin, 2015:3; Conference Board, 2017:252). Probst *et al*. (2012:674) assert that input time-series with dominant long-term trends may suggest significant cross-correlations which may not be present, or correlations may be hidden between the input and output series within short-term fluctuations.

5.3.2.2 Prewhitening: Autoregressive Integrated Moving Average

The second condition is followed by the declaration that time-series are white noise (uncorrelated) processes in precluding potential bias or the generation of false signals. Prewhitening of time series is an important step of removing autocorrelation before conducting

cross-correlation analysis (Dean & Dunsmuir, 2016:787). Probst *et al.* (2012:674) caution that time-series estimations based on cross-correlations analysis can be affected by spurious correlations which can lead to misleading output of results resulting from temporal dependencies of adjacent values of the input or independent variable and eliminates of the output variable. False signals can stem from concurrently alike trends and the data's sequential order which do not project an accurate reflection of the relationship between two variables (Gröger & Fogarty, 2011:596).

It is common practice for variables to be characterised by non-stationarities that occur in the form of trends or drifts for a time horizon. In such a scenario, the estimation of the cross-correlation function for two variables characterised by either non-stationarities or autocorrelation will provide misleading estimations where the correlation between variables in inflated, yet there is actually no correlation (Mahan *et al*., 2015: 100). To circumvent these issues, time-series are modelled based on the prewhitening method. Ramos (1996:6) and Mahan *et al*. (2015:97) define a prewhitened time-series as a white noise process which is a continuous time-series containing random values characterised by no autocorrelation or uncorrelated series, has a constant mean and variance, with independent and normal distributions.

Such a step involves first fitting an Autoregressive moving integrated moving average (ARIMA) model to each input series, distinctly applying each of these models to the output variables, then using the residuals of each applied model to cross-correlate them distinctly with the respective output series (Razavi & Vogel, 2018:109). To recover the white noise series, prewhitening can be achieved by fitting ARIMA filter to the input or independent variable, followed by the application of the fitted models to the dependent or output series. Residuals for each of the fitted models are then cross-correlated to the output series (Gröger & Fogarty, 2011:596). The application of such a model involves conflating the autoregressive (AR) and moving average (MA) models in a particular model with the option of differencing the series (Probst *et al*., 2012:674). Having done so, white noise variables filtered through ARIMA processes can then be cross-correlated with each other (Ramos, 1996:6). This application of ARIMA models as a prewhitening measure involves three parameters of the orders p, d, and q, which respectively denote parameters of orders of the AR, differencing, and MA expressed as the abbreviation ARIMA(p,d,q) (Probst *et al*., 2012:674). Accordingly, the present study's time-series data were differenced in ARIMA processes only where it deemed was necessary.

5.3.3 Granger causality

A limitation in assessing the synchrony between two variables based on the cross-correlations test is that correlation does not imply causation (Sugihara, May, Ye, Hsieh, Deyle, Fogarty & Munch, 2012:496). Potential occurrences of correlation may be a result of chance or may be caused by a mutual cause and not simply based on a cause and effect relationship. Therefore, implementing rules of causality may yield a more accurate mechanism by means of which variables can be assessed in terms of whether there is existing interaction or the correlation is by mere chance, or whether there is a common variable causing them both (Damos, 2016:2). Granger's (1969) Granger causality test is a plausible test of causality which gives an indication of whether a time-series is significant in providing forecasts of another variable with means by which causation is indicated than mere correlations of lead and lag relationships.

Freeman (1983:328) explains the Granger causality test as a means by which an individual time-series can be said to either Granger cause another time-series or not. Particularly, in a case where the incorporation of historical values of X enhances the forecasting of present values in Y, then Y is Granger caused by X (West, 2013:1080). Lin (2008:1-2) highlights the prime assumptions underlying the Granger causality test which suggest that the past cannot be predicted by the future; however, the future or present moment can be caused by the past. Also, the cause is inherent of information concerning the effect which cannot be found elsewhere. According to Lin (2008:2), Granger causality can be expressed as follows:

Under the condition that if for all $h > 0$, then X_t does not Granger cause Y_t.

$$F(Y_{t+h} \mid \Omega_t) = F(Y_{t+h} \mid \Omega_t - X_t) \ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(eq. 3)}$$

Such that: F denotes conditional distribution;

Ω_t signifies all the detail pertaining to the series; and

X_t and Y_t represent the two time-series variables.

Simply, equation 3 illustrates that X cannot assist in predicting future values of Y. Similar to Gan, Lee, Yong and Zhang (2006) as well as Burger (2010), the study employed the Granger causality test to ascertain the lead, lag and coinciding relationships as a post estimation to the cross-correlation test. Burger (2010:30-31) propounds that if an output variable shows a maximum value of the CCF with the input series, while results of the Granger causality test provide statistically significant findings, this is evidence that variations in the output series either lead or lag variations in the gap of the input series. Nevertheless, if high cross-

correlations are displayed, and neither of the Granger causality findings are statistically significant, then the gaps of variations between the two time-series are considered to be contemporaneous or coinciding with one another.

5.3.4 Variance decomposition

The study extended the analysis of interrelationships between capital market series and the subcomponent series of the business cycle composite indicators, using Sims' (1980) forecast error variance decomposition (or innovation accounting) test. Just like the Granger causality test, the variance (dispersion) decomposition test is a well-accepted means of examining comovement (Stock & Watson, 2001:11). Both methods showcase the historical dynamics of the association between variables in light the percentage of variation in a variable caused by shocks emanating from pertinent determinants (Chen & Patel, 1998:116). Specifically, a variable's proportion of forecasts error variance which is explained by another time-series for specific historical time periods (Tang, 2008:112). This is depicted in terms of the percentage of relative effects or contributions of the variance of the error made by a variable towards explaining another variable, in terms of a particular shock at that time (Stock & Watson, 2001:106; Cha, 2009:162; Zou, 2018:7). Analysing the variance decomposition sheds light on the dependent variable's granger endogeneity or exogeneity by examining its response to a variable-specific shock in a system (Tang, 2011:10). Thus, a truly exogenous variable tends to explain its own shocks in terms of the variable's forecast error variance (Tang, 2010:8). For the exogenous variable, its forecast error variance is simply explained by its own innovations compared to other variables in the system (Narayan & Smyth, 2004:32).

5.3.5 Autoregressive Distributed Lag (ARDL)

Generally, there is a need for taking into account the cointegration relationship between involved time-series when assessing their comovement. The study employed Pesaran, Shin and Smith (1999), as well as Pesaran, Shin and Smith (2001) ARDL bounds test in analysing the short-and long-run cointegration between the explanatory and response variables. Findings of the long-run and short-run can be concurrently established, respectively based on estimations of cointegration and the error correction model (ECM). Aside from securing knowledge of cointegration about the long-and short-run relationships, the ARDL model was used in order to justify the results presented by the cross-correlations and Granger causality tests. Cakan (2017:74) underscores that the ARDL model to cointegration provides better estimations for small sample properties compared to other methods to cointegration.

Upon conducting the bounds test to cointegration, the following steps are included within the ARDL method: (a) analysis of cointegration of the long-run between the variables, (b) optimal lag selection for the dependent and explanatory series in order to secure the *'conditional (restricted)'* ARDL model, and (c) the presentation of the equation for the long-run equilibrium expressed in terms of the ARDL model (Pesaran & Pesaran, 1997). Based on the optimal lag selection order free from heteroscedasticity, serial correlation of residuals while observing the normality of the model. Specifically, each variable is estimated based on a number of regressions to retrieve the lag length expressed as $(p + 1)^k$. Such that k and p present the number of variables as well as the maximum lag order, respectively. The study employed the bounds test to cointegration based on the following model:

$$\Delta lY_t = a_0 + \sum_{i=1}^{k} \beta_i \Delta lY_{t-1} + \sum_{i=0}^{k} \delta_i \Delta lLEI1_{t-i} + \sum_{i=0}^{k} \sigma_i \Delta lLEI2_{t-i} \dots\dots \sum_{i=0}^{k} \eta_i \Delta lLEI11_{t=1}$$
$$+\eta_1 lCM_{t-1} + \eta_2 lLEI1_{t-1} + \eta_3 lLEI2_{t-1} \dots\dots\dots \eta_{12} lLEI11_{t-1} + \varepsilon_t \dots \text{(eq.4)}$$

$$\Delta lY_t = a_0 + \sum_{i=1}^{k} \beta_i \Delta lY_{t-1} + \sum_{i=0}^{k} \delta_i \Delta lCOI1_{t-i} + \sum_{i=0}^{k} \sigma_i \Delta lCOI2_{t-i} \dots\dots \sum_{i=0}^{k} \eta_i \Delta lCOI5_{t=1}$$
$$+\eta_1 lCM_{t-1} + \eta_2 lCOI1_{t-1} + \eta_3 lCOI2_{t-1} \dots\dots\dots \eta_6 lCOI5_{t-1} + \varepsilon_t \dots\dots \text{(eq.5)}$$

$$\Delta lY_t = a_0 + \sum_{i=1}^{k} \beta_i \Delta lY_{t-1} + \sum_{i=0}^{k} \delta_i \Delta lLAI1_{t-i} + \sum_{i=0}^{k} \sigma_i \Delta lLAI2_{t-i} \dots\dots \sum_{i=0}^{k} \eta_i \Delta lLAI7_{t=1}$$
$$+\eta_1 lCM_{t-1} + \eta_2 lLAI1_{t-1} + \eta_3 lLAI2_{t-1} \dots\dots\dots \eta_8 lLAI7_{t-1} + \varepsilon_t \dots\dots \text{(eq.6)}$$

Such that: Δ represents the variables' first difference operator; ΔlY_t represents, from equation 4, equation 5 to equation 6, each capital market (ALSI, ALBI, ALCI and REER) in their natural log as the response or dependent variable; $lLEI1, lLEI2, \dots\dots lLEI11$ denotes the natural log of the subcomponents of the business cycle composite leading series from the first to the eleventh leading series repeatedly presented for each capital market; $lCOI1, lCOI2, \dots\dots lCOI5$ denotes the natural log of the subcomponents of the business cycle composite coincident series from the first to the eleventh coincident series repeatedly presented for each capital market;

$lLA1, lLAI2, \ldots \ldots lLAI7$ denotes the natural log of the subcomponents of the business cycle composite lagging series from the first to the seventh lagging series repeatedly presented for each capital market; ε_t denotes the white noise error term; the series β_i, δ_i, σ_i, η_i represent coefficients of short-run associations between independent and dependent variables η_1…..to…..η_{12} represent long-run cointegration between independent and dependent variables.

Regarding each of capital market dependent variables, equation 4, equation 5 and equation 6 are subsequently and repeatedly conducted in estimating potential cointegration between the explanatory and dependent variables according to the following hypothesis:

- H_0: η_1=η_2 = η_3 = η_4 = 0 (Null; long-run cointegration is not present)
  else
- H_0: $\eta_1 \neq \eta_2 \neq \eta_3 \neq \eta_4 \neq 0$ (Alternative hypothesis; long-run cointegration is present)

According to the null hypothesis (H_0), there is a suggested non-existent cointegrating relationship between the dependent and explanatory variables. To test this, the bounds test is estimated where the F-statistic value, as in the coefficient restriction test, is paralleled to the upper and lower bounds critical values on the basis of Pesaran *et al* (2001). In the case that the F-statistic is greater than the upper bound critical values, then cointegration is present, thus there is a rejection of the null hypothesis of no cointegration while the alternative hypothesis of existing cointegration is favoured. In contrast, where the critical value of the lower and upper bounds is lower than the F-statistic value, implies the existence of cointegration between underlying variables; therefore, the null hypothesis of no cointegration may be rejected. Meanwhile, findings showcasing F-statistic critical values within the different ARDL bounds imply indecisive estimations (Dube & Zhou, 2013:203).

5.3.5.1 Error Correction Model (ECM)

The error correction model (ECM) is estimated based on the error correction term (ECT) in estimating the ARDL cointegration bounds test as to analyse the disequilibrium adjustment speed of the short-run variations towards reaching equilibrium in the long-run (Alimi, 2014:106-107). The confirmation of such a transition requires that the ECT has a negative sign with a statistically significant p-value (Paul, 2014:3). The understanding behind such convergence can, therefore, be expressed according to Equation 4, Equation 5 and Equation 6 as derived in the following equations:

$$\Delta lY_t = a_0 + \sum_{i=1}^{k} \beta_i \Delta lY_{t-1} + \sum_{i=0}^{k} \delta_i \Delta lLEI1_{t-i} + \sum_{i=0}^{k} \sigma_i \Delta lLEI2_{t-i} \ldots\ldots \sum_{i=0}^{k} \eta_i \Delta lLEI11_{t=1}$$

$$+ECT_{t-1} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(eq.7)}$$

$$\Delta lY_t = a_0 + \sum_{i=1}^{k} \beta_i \Delta lY_{t-1} + \sum_{i=0}^{k} \delta_i \Delta lCOI1_{t-i} + \sum_{i=0}^{k} \sigma_i \Delta lCOI2_{t-i} \ldots\ldots \sum_{i=0}^{k} \eta_i \Delta lCOI5_{t=1}$$

$$+ECT_{t-1} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(eq.8)}$$

$$\Delta lY_t = a_0 + \sum_{i=1}^{k} \beta_i \Delta lY_{t-1} + \sum_{i=0}^{k} \delta_i \Delta lLAI1_{t-i} + \sum_{i=0}^{k} \sigma_i \Delta lLAI2_{t-i} \ldots\ldots \sum_{i=0}^{k} \eta_i \Delta lLAI7_{t=1}$$

$$+ECT_{t-1} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(eq.9)}$$

Such that: ECT represents the error correction term and captures equilibrium adjustments made from short-run towards the long-run; ΔlY_t represents each capital market (ALSI, ALBI, ALCI and REER) in their natural log form individually expressed repeatedly as a separate equation.

5.3.5.2 Diagnostic testing

Interpretation of econometric estimations follows the verification of whether the performance of utilised models passes tests for heteroscedasticity, serial correlation, normality and parameter stability testing with the latter inscribed on the basis of the recurve estimates and function form (Takaendesa, 2006:100). In doing so, the Jarque Bera test is estimated in order to verify whether residuals are normally distributed. Upon ensuring that the time-series were free from auto-correlation, the Breusch-Godfrey's Lagranges Multiplier (LM) test was used in the ARDL model to confirm that error terms were uncorrelated during the course of the period. Moreover, the test for homoscedasticity ensued the Breusch Pagan Godfrey heteroscedasticity test to ascertain whether residuals possessed common variance. The cumulative sum of recursive residuals (CUSUM) was also employed to confirm the stability of recursive estimates of residuals. For the cross-correlation test, the model with the least Akaike information criterion (AIC) value was selected based on the automatic (auto.arima) function provided in Rstudio.

5.3.5 The Autoregressive Conditional Heteroscedasticity and the Generalized Autoregressive Conditional Heteroscedasticity models

The first model of Heteroscedasticity testing, the autoregressive conditional Heteroscedasticity (ARCH) model introduced by Engle (1982), as the initial stationary non-linear model to be proposed (Fryzlewicz, 2007:4) preceded the generalised autoregressive conditional Heteroscedasticity (GARCH) model proposed by Bollerslev (1986) and Taylor (1986). Both the ARCH and GARCH models have been key in the analysis of volatility among variables ranging from economic to financial time-series. Without the prerequisites of using higher-order models, the ARCH model has been salient for capturing Heteroscedasticity in time-series variables and presumes that the variances of the preceding error term determines the variance of the error term (Andersson & Haglund, 2015:8). Following Fryzlewicz (2007), Andersson and Haglund (2015:8), the ARCH model consisting of order q is thus modelled based on the assumption that:

$$y_t^2 = b_0 + \sum_{k=1}^{q} b_k \, \emptyset_{t-k}^2 \quad \ldots\ldots (eq.10)$$

Such that; q – 1, $b_0 > 0$, $b_k \geq 0$, …, $b_q > 0$, and $k = 1$. While y_t^2 , b_t , $\emptyset_t$ are variations of residuals with time t. Moreover, the GARCH model's conditional variance is also considered to be a linear function containing its own lag (Teräsvirta, 2006:4). GARCH (p,q) is characterised by the conditional variance's p lags and expressed as:

$$y_t^2 = b_0 + \sum_{k=1}^{q} b_k \, \emptyset_{t-k}^2 + \sum_{k=1}^{p} \eta_k \, y_{t-k}^2 \quad \ldots\ldots (eq.11)$$

Where; y_t^2 captures the residuals' variance given time t, b_k is the ARCH parameter, $\emptyset_{t-k}^2$ is the square of residuals at time $t-k$, η_k is the parameter of the GARCH, y_{t-k}^2 captures the variance of residuals given time $t-k$, and b_0 is the constant. The GARCH (p,q) is linked between the variance of residuals provided time t and the preceding time's variance of residuals.

5.4 SYNOPSIS

The preceding analysis provides a critical mapping framework for analysing the interrelationship and co-movement between the dynamics of South Africa's individual component series of the composite BCIs and stock, bond, commodity and exchange rate market can be tested. Chapter 6 proceeds with the achievement of empirical objectives specific to the

former declaration by using varying econometric tools and methods. Such methods include the cross-correlations test, Granger causality, variance decomposition, GARCH processes and the ARDL model, including the chart analyses of the identified composite indices or indicators of each capital market. Established findings in the following chapter will be discussed in conjunction with established literature, theory and insights gleaned from the previous chapters.

CHAPTER 6: RESULTS AND DISCUSSION OF THE FINANCIAL MARKET AND BUSINESS CYCLE INDICATORS

6.1 INTRODUCTION

The preceding chapter sought to provide the methodological frameworks and background on which the set empirical objectives detailed in Chapter 1 were accomplished. Literature provided in Chapter 2 and Chapter 4 also made insightful contributions in acknowledging the theoretical and empirical implications surrounding the economic and market forces in question. Literature amassed by Dritsaki (2005), Tripathy (2011), Yuan (2011), Mirchandani (2012), Smolík *et al.* (2015), Jena (2016), Nkwede (2017), and Francová (2018), suggest that economic fundamentals are key determinants of various capital market segments for among developing and emerging nations. Therefore, the plausibility of establishing existing predictive and explanatory power of economic fundamentals, specifically for business cycle components, may not be farfetched.

Such a phenomenon requires explanations for existing causal relationships between market and economic forces as exemplified, among others, by Ikoku (2010) and Raza and Afshan (2017), who respectively project bidirectional causality between GDP and stock prices, and GDP with the exchange rate. Also, Bangara and Dunne (2018), as well as Schaling *et al*. (2014), respectively make a case for unidirectional causal relationships, running from tobacco prices to respective macroeconomic factors, and from commodity prices to the nominal exchange rate. In light of the volatile nature of market series, Frankel and Rose (2010), Karali and Power (2013), Nieto *et al*. (2015), and Naidu *et al*. (2016), *inter alia*, also highlight that volatility of capital market segments can resonate with the imposed volatility of macroeconomic variables or fundamentals.

The current chapter superimposes estimations and discussions of established findings structured on the various models provided in the preceding chapter, in pursuit of set empirical objectives. Forthcoming analyses of the chapter consist of seven main sections. The chapter first introduces descriptive representations of the characteristics of the considered time-series. Findings on the concordance between capital markets and business cycle indicators (BCIs) are subsequently provided. Specifically, this involves identifying South Africa's official BCIs' potential attribute in serving as either component series of leading, lagging and coincident indicators of the stock market, bond market, commodity market and the exchange rate market. Various tests were concurrently utilised, these included cross-correlation tests, Granger

causality tests and variance decomposition. Having identified respective leading series of each capital market, the chapter introduces estimates of the GARCH (1,1) model for these series to contrast volatility movements in their conditional variances relative to that of the capital markets. Atoi (2014) and Masinga (2015) show that the univariate GARCH (1,1) tends to dominate other model in both in-sample and out-of-sample volatility modelling. Long-and short-run estimates between the capital markets and BCIs are provided, followed by the performance of the constructed indexes relative capital markets. Finally, findings, as per set objectives provided in Section 1.3 of Chapter 1, are discussed relative to existing theory and literature.

6.2 DESCRIPTIVE CHARACTERISTICS OF CAPITAL MARKETS AND BUSINESS CYCLE INDICATORS

Table 6.1 details the transformed series of the capital market variables and BCIs converted to their natural logarithmic form. Variables are coded as represented for simplicity of demonstration and will thus be subsequently referred to as shown in the following table for the majority of the current chapter.

Table 6.1: Representation of variables and transformed time series to logged series

Variable	Log Series	Representation
All share index	LALSI	Log of the All-Share Index
All-Bond Index	LALBI	Log of the All-Bond Index
All-Commodity Index	LALCI	Log of the All-Commodity Index
Real effective exchange rate	LREER	Log of the Real Effective Exchange Rate
Job advertisement space in the *Sunday Times* newspaper: Percentage change over twelve months	LLEI1	Log of Leading Indicator 1
Number of residential building plans passed for flats, townhouses & houses larger than 80m'	LLEI2	Log of Leading Indicator 2
Interest rate spread: 1-year government bonds less 91-dat Treasury bills	LLEI3	Log of Leading Indicator 3
Real M1 money supply (deflated with CPI) * six-month smoothed growth rate	LLEI4	Log of Leading Indicator 4
Index of commodity prices (in US dollar) for a basket of South African-product export commodities	LLEI5	Log of Leading Indicator 5
A composite leading indicator of South Africa's major trading partner countries: percentage changes over twelve months	LLEI6	Log of Leading Indicator 6

Variable	Log Series	Representation
Gross operating surplus as a percentage of gross domestic product	LLEI7	Log of Leading Indicator 7
RMB/BER Business Confidence Index	LLEI8	Log of Leading Indicator 8
The new balance of manufacturers observing an increase in the average number of hrs. worked per factory worker (half weight)	LLEI9	Log of Leading Indicator 9
The net balance of manufacturers observing an increase in the volume of domestic order received (half weight)	LLEI10	Log of Leading Indicator 10
Number of new passengers	LLEI11	Log of Leading Indicator 11
Gross value added at constant prices, excluding agriculture, forestry & fishing	LCOI1	Log of Coincident Indicator 1
Total formal non-agricultural employment	LCOI2	Log of Coincident Indicator 2
Value of retail & new vehicle sales at constant prices	LCOI3	Log of Coincident Indicator 3
Industrial production index	LCOI4	Log of Coincident Indicator 4
The utilisation of production capacity in manufacturing	LCOI5	Log of Coincident Indicator 5
Cement sales (in tons)	LLAI1	Log of Lagging Indicator 1
Value of non-residential buildings completed at constant prices	LLAI2	Log of Lagging Indicator 2
The ratio of gross fixed capital formation in machinery & equipment to final consumption expenditure on goods by households	LLAI3	Log of Lagging Indicator 3
The ratio of inventories to sales in manufacturing & trade	LLAI4	Log of Lagging Indicator 4
Nominal labour cost per unit of production in the manufacturing sector: percentage change over twelve months	LLAI5	Log of Lagging Indicator 5
Predominant prime overdraft rate of banks	LLAI6	Log of Lagging Indicator 6
The ratio of consumer instalment sale credit to the disposable income of households	LLAI7	Log of Lagging Indicator 7

Source: Author compilation (description of variables as obtained from the SARB (2018)).

To obtain a meaningful preliminary understanding of distributive properties of the study's observations, Table 6.2 presents the descriptive sequences of the various capital markets and BCIs as of the period 2003/06 to 2017/11. As demonstrated in Table 6.2, the mean or average price movements in the capital market and business cycle indicator series were all positive for the period. This implies that the trend and price movements in the collective patterns of the series have mostly been in tandem with upward pressure, echoing an average increase in trends

of the overall series. Among the capital market variables, patterns in the All-Share Index (ALSI) are depicted as having witnessed the highest price margins relative to other capital markets variables. This was followed by the All-Bond Index (ALBI), but yet to a relatively marginal extent. Information on distributional properties purport relative volatility in some series and, as a result, this calls for subsequent official volatility testing to further the understanding of the nature of the dataset.

Table 6.2: Distributional characteristics of capital markets and business cycle indicators

	Mean	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
ALSI	10.274	10.998	9.030	0.518	-0.657	2.548
ALBI	5.113	5.214	4.983	0.049	-0.025	2.475
ALCI	4.413	5.015	3.690	0.269	-0.342	2.994
REER	4.487	4.655	4.225	0.097	-0.282	2.189
LEI1	3.957	4.554	0.000	0.587	-4.185	23.844
LEI2	3.788	4.615	-0.916	0.721	-3.362	19.656
LEI3	4.162	4.820	0.000	0.552	-3.445	22.469
LEI4	3.886	4.466	3.136	0.348	0.194	2.134
LEI5	8.129	8.797	7.451	0.349	0.159	2.038
LEI6	3.580	4.463	-0.223	0.683	-2.172	10.009
LEI7	3.771	3.839	3.682	0.047	-0.549	1.948
LEI8	1.632	2.002	0.095	0.372	-1.834	6.046
LEI9	2.758	3.775	-0.357	0.585	-2.339	10.709
LEI10	4.416	5.015	3.713	0.264	-0.274	2.949
LEI11	2.568	3.266	-0.511	0.558	-3.636	17.502
COI1	14.698	14.841	14.451	0.111	-0.659	2.403
COI2	16.053	16.095	15.928	0.046	-1.328	3.803
COI3	4.448	4.676	4.059	0.150	-0.799	2.863
COI4	4.600	4.679	4.507	0.037	-0.086	2.831
COI5	4.411	4.456	4.351	0.028	0.101	2.036
LAI1	15.376	15.596	15.219	0.082	0.570	2.554
LAI2	4.566	5.484	3.497	0.438	-0.257	2.590

	Mean	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
LAI3	2.897	3.234	2.682	0.116	0.225	3.297
LAI4	3.422	3.531	3.348	0.051	0.529	1.991
LAI5	1.9349	3.360	-0.693	0.567	-0.399	6.156
LAI6	2.359	2.781	2.140	0.171	0.757	2.748
LAI7	7.632	7.761	7.361	0.089	-0.847	3.713

Source: Author compilation

Moreover, the series ALSI, ALCI, LEI1, LEI2, LEI3, LEI4, LEI5, LEI6, LEI8, LEI9, LEI10, LEI11, LAI2 and LAI5 are suggested to have relatively had the highest standard deviation from average movements, implying a higher level of variation in terms of risk. Nevertheless, the remainder of the series exhibits relatively moderate deviations from the trend in comparison to the former series. Subsequently, all capital markets recorded negative skewness, including most business cycle indicator series, with the exception of the series LEI4, LEI5, COI5, LAI1, LAI3, LAI4 and LAI6. Ivanovski, Stojanovski and Narasanov (2015:211) suggest that a negatively (positively) skewed distribution purports a higher prospect of obtaining increased negative (positive) price flows than large positive (negative) price flows. Henceforth, negatively skewed prices imply that prices will be less than expected. Notwithstanding this, all the series displayed positive kurtosis which implies a relatively peaked distribution (Čisar & Čisar, 2010:96).

6.3 ANALYSIS OF BUSINESS CYCLE INDICATORS' EXPLANATORY POWER

In order to obtain more meaningful estimations, the detrended (cyclical) component of each series was utilised. The detrending process was achieved by means of Kydland and Prescott's (1990) Hodrick-Prescott (HP) filter, where the values "14400", the default for monthly time series (Pollock, 2018:20), were specified as smoothing parameter values to extract the cyclical component. The time series dataset was additionally cleaned using the "tsclean" function embedded in the Rstudio statistical program to clean or remove any outliers within each series. The cross-correlations test, in line with established research methods by Kydland and Prescott (1990), Bergman, Bordo and Jonung (1998), Gavin and Kydland (2000)), and Burger (2010), was used as a gauging mechanism of synchronisation or co-movement between time series.

In the case of existing cross-correlations between two time-series, the cross-correlations test establishes both the co-movement as well as the negative or positive correlation for a certain

lag. Co-movement indicates whether an input variable contains properties that lead, lag or coincides with changes in the output series gap (Carmona, Congregado and Golpe, 2012:3; Dajcman, 2013:29). In this case, the input series are the BCIs (independent variables), and the capital markets as output series (dependent variables). Cross-correlations tests were employed by scrutinising and screening 23 BCIs as provided by the South African Reserve Bank. Tests for identifying the lead, lag and coinciding properties of business cycle series against capital market series were conducted without considering the BCIs' former classification as either leading, lagging and coincident series of the overall business cycle.

In addition to the correlations test, the Granger causality test was employed, following Bergman *et al*. (1998), Burger (2010), and Carmona *et al*. (2012). The Granger causality test provides a more extensive analysis of the lead, lag and coinciding relationship (Damos, 2016:2). According to Burger (2010:30), in the case of existing high cross-correlations between the input and output series, and results of Granger causality provide statistically significant findings. This confirms that changes in the input series lead or lag the gap in the output series. In contrast, if high cross-correlations are established while Granger causality results do not yield statistically significant findings, this serves as evidence that changes in the input series are contemporaneous or coincide with changes in the output series gap.

6.3.1 Stationarity tests and ARIMA model-based prewhitening

The cross-correlations test requires that variables are stationary (Podobnik & Stanley, 2008:1). Mahan *et al*. (2015:97) cautions that time series may be characterised by auto-correlation, implying that their values may be influenced by their historical values.

Table 6.3: ADF unit root results for capital markets and business cycle indicators

Variables	Level				First Difference		Order of Integration
	With intercept & without trend		With intercept & trend		Without trend		
	t-stat	P-value	t-stat	P-value	t-stat	P-value	
LALSI	-3.428	0.011*	-3.417	0.053	-14.864	0.000	I(0)
LALBI	-4.875	0.000**	-4.860	0.001	-14.46	0.000	I(0)
LALCI	-4.150	0.001**	-4.138	0.007	-6.963	0.000	I(0)
LREER	-4.972	0.000**	-4.958	0.000	-11.349	0.000	I(0)
LLEI1	-4.291	0.001**	-4.278	0.004	-10.527	0.000	I(0)
LLEI2	-3.018	0.035*	-3.008	0.133	-14.009	0.000	I(0)

Variables	Level				First Difference		Order of Integration
	With intercept & without trend		With intercept & trend		Without trend		
	t-stat	P-value	t-stat	P-value	t-stat	P-value	
LLEI3	-4.392	0.000**	-4.378	0.003	-13.432	0.000	I(0)
LLEI4	-3.962	0.002**	-3.951	0.012	-4.870	0.000	I(0)
LLEI5	-11.607	0.000**	-11.571	0.000	-9.816	0.000	I(0)
LLEI6	-3.657	0.006**	-3.643	0.029	-6.874	0.000	I(0)
LLEI7	-3.873	0.003**	-3.837	0.017	-4.742	0.000	I(0)
LLEI8	-4.802	0.000**	-4.804	0.001	-10.655	0.000	I(0)
LLEI9	-6.873	0.000**	-6.861	0.000	-11.812	0.000	I(0)
LLEI10	-4.104	0.001**	-4.093	0.008	-7.112	0.000	I(0)
LLEI11	-6.678	0.000**	-6.658	0.000	-6.423	0.000	I(0)
LCOI1	-3.821	0.003**	-3.808	0.018	-4.502	0.000	I(0)
LCOI2	-3.985	0.002**	-3.976	0.011	-3.879	0.003	I(0)
LCOI3	-2.740	0.029*	-2.723	0.229	-17.396	0.000	I(0)
LCOI4	-5.695	0.000**	-5.678	0.000	-17.387	0.000	I(0)
LCOI5	-4.776	0.000**	-4.766	0.001	-4.668	0.000	I(0)
LLAI1	-4.690	0.000**	-4.675	0.001	-11.137	0.000	I(0)
LLAI2	-12.182	0.000**	-12.144	0.000	-11.315	0.000	I(0)
LLAI3	-5.100	0.000**	-5.083	0.000	-4.481	0.000	I(0)
LLAI4	-6.521	0.000**	-6.498	0.000	-18.179	0.000	I(0)
LLAI5	-4.514	0.000**	-4.495	0.002	-8.540	0.000	I(0)
LLAI6	-4.514	0.000**	-4.530	0.002	-7.260	0.000	I(0)
LLAI7	-3.09	0.029 *	-3.081	0.114	-11.053	0.000	I(0)

Source: Author compilation (***Note:*** *** and * indicates significance levels at 0.01 and 0.05, respectively*).

Time series can also contain non-stationarities which can persist in the form of drifts or trends over time. In either instance where series contain auto-correlation or non-stationarity, this can lead to spurious estimations, such as exaggerated correlation where there is none.

To ensure that all series are free from properties of non-stationarity, Carmona *et al*. (2012:3) note that variable transformations may be conducted through detrending methods. The study transformed and utilised log-based time series with detrended cycles extracted through the HP

filter. Further stationarity tests are conducted using the Augmented Dickey-Fuller (ADF) test, as showcased in Table 6.3, to ensure that the variables are indeed stationary. The ADF test results in Table 6.3 suggest that the p-values established for all individual series are indeed below 0.01 and below 0.05 for some. This indicates that the null hypothesis marked H_0 of the presence of a unit root is clearly rejected. Henceforth, a conclusion can be made that all series are stationary at "level" as no unit root is present for all variables. Thus, no further differencing was required. Table 6.4 reports the automatically selected ARIMA order processes using the auto.arima function in Rstudio as a measure to prewhitened the residuals.

Table 6.4: Selection of ARIMA model for prewhitening of residuals

Time series	ARIMA Order			AIC
	p	***d***	***q***	
LLEI1	1	0	2	417.42
LLEI2	1	0	0	49.78
LLEI3	1	0	2	430.2
LLEI4	5	0	3	687.5
LLEI5	0	0	0	117.39
LLEI6	2	0	5	132.74
LLEI7	2	0	2	1617.8
LLEI8	2	0	1	486.89
LLEI9	1	0	0	38.16
LLEI10	2	0	0	698.85
LLEI11	2	0	1	638.27
LCOI1	3	0	2	1891
LCOI2	4	0	2	1950.81
LCOI3	1	0	1	981.24
LCOI4	1	0	1	925.12
LCOI5	5	0	0	1592.11
LLAI1	1	0	1	729.07
LLAI2	0	0	0	55.85
LLAI3	4	0	1	1109.71
LLAI4	3	0	1	1021.83
LLAI5	2	0	2	289.57
LLAI6	2	0	1	1014.96

LLAI7	2	0	2	1199

Source: Author compilation

6.3.2 Cross-correlations analysis

This section sought to analyse the first empirical objective focused on scrutinising the explanatory power of BCIs in explaining the performance and behaviour of capital market segments. This entails scrutinising whether the component series of BCIs exhibit the lead, lag or coinciding properties in explaining the behaviour of the LALSI, LALBI, LALCI and LREER. To achieve this, cross-correlations and Granger causality tests are concurrently utilised. Consequently, prewhitening, as recommended by Probst *et al*. (2012:673) is used by fitting ARIMA modelling to the input series to ensure that the time series dataset is white noise process, and applying the modeled series to the output series as demonstrated by both Probst *et al*. (2012:673) and Mahan *et al*. (2015:97). The prewhitened series were used to analyse the responsiveness of capital market series to the BCIs. By definition, cross-correlations with time t are leads (time t-20 to t-1 (negatives)), lags (time t+1 to t+20 (positives)) and contemporaneous (time t=0) values of the input series against the output series (Carmona *et al*., 2012:3). To identify the lead, lag and contemporaneous properties, correlation coefficients with the highest lags which are statistically significant at 0.05 significance level are selected.

Table 6.5 presents the results of the cross-correlations test between business cycle input series and the capital market output series. For the All-Share Index, results indicate that there is a leading correlation between the gap in the LALSI and the gaps in the series LLEI3, LLEI8, LLEI9, LLAI4, LLAI6 and LLAI7. Cross-correlations between LALSI and the series LLEI7 appears to be absent over the period. The gaps in the series LLEI1, LLEI2, LLEI4, LLEI5, LLEI6, LLEI10, LLEI11, LCOI1, LCOI2, LCOI3, LCOI4, LCOI5, LLAI1, LLAI2, LLAI3 and LLAI5 appears to lag the gap in the LALSI.

When it comes to the All-Bond Index, the gaps in the series LLEI4, LLEI5, LLEI10, LCOI1 and LLAI7 is suggested to lead the gap in the LALBI. Whereas the gaps in LLEI1, LLEI2, LLEI6, LLEI9, LLEI11, LCOI5, LLAI1, LLAI2, LLAI3 and LLAI4 appear to lag behind the gap in the ALBI. The input series LLEI8, LCOI3 and LCOI4 are suggested to be contemporaneous or to coincide with the series LALBI. Meanwhile, no cross-correlation was found between the LALBI and the series LLEI3, LLEI7, LCOI2, LLAI5 and LLAI6.

Further cross-correlations results between the All-Commodity Index and the capital markets suggests that LLEI3, LLEI8, LLEI9, LLEI11, LLAI1 and LLAI7 tend to lead the gap in the

LALCI. Moreover, the gaps in the series LLEI1, LLEI2, LLEI4, LLEI5, LCOI1, LCOI2, LCOI3, LCOI4, LCOI5, LLAI1, LLAI3 and LLAI4 appear to lag behind the gap in the LALCI. Changes in both input series LLEI10 and LLAI6 are indicated to be contemporaneous to changes in the LALCI. No cross-correlation was found between the ALCI and the input series LLEI6, LLAI2 and LLAI5.

Lastly, cross-correlation findings between the real effective exchange rate and the BCIs suggest that the input series LLEI5, LLEI6, LLEI7, LLEI11, LCOI4, LLAI5, LLAI6 and LLAI7, appear to lead the gap in the LREER. Changes in the input series LLEI1, LLEI2, LLEI3, LLEI4, LLEI9, LLEI10, LCOI1, LCOI2, LCOI5, LLAI2 and LLAI3, are suggested to lag behind the gap in the LREER. The series LLEI8, LCOI3, LLAI1 and LLAI4 appeared to be contemporaneous to the LREER. All input variables were suggested to be correlated with the LREER as either having leading, lagging and coinciding properties.

Table 6.5: Cross-correlations between capital markets and business cycle indicators

	LALSI		**LALBI**		**LALCI**		**LREER**	
	Max lag	**Coefficient**	**Max lag**	**Coefficient**	**Max lag**	**Coefficient**	**Max lag**	**Coefficient**
LLEI1	3	0.183	1	-0.144	17	0.177	3	0.200
LLEI2	5	0.221	16	0.196	17	-0.299	9	0.237
LLEI3	-1	0.158	-	-	-9	0.172	5	0.227
LLEI4	19	0.191	-19	0.169	14	-0.200	16	0.244
LLEI5	5	0.286	-5	0.215	1	0.268	-8	-0.227
LLEI6	13	-0.185	4	0.158	-	-	-6	0.216
LLEI7	-	-	-	-	-1	0.188	-4	0.162
LLEI8	-18	-0.164	0	-0.280	-17	0.154	0	-0.163
LLEI9	-3	0.269	9	0.156	-8	0.219	3	0.207
LLEI10	1	0.286	-1	-0.166	0	0.955	4	0.217
LLEI11	10	0.182	13	-0.267	-12	0.189	-4	0.190
LCOI1	12	-0.227	-15	-0.165	13	0.239	10	0.164
LCOI2	2	-0.174	-	-	10	0.194	1	0.182
LCOI3	7	0.205	0	-0.170	14	-0.229	0	-0.240
LCOI4	2	0.263	0	-0.219	2	0.335	-6	-0.200
LCOI5	4	0.210	9	0.204	4	0.244	4	0.202
LLAI1	2	0.195	12	0.249	-1	0.221	0	-0.225
LLAI2	13	0.157	3	-0.161	-	-	5	-0.173

	LALSI		LALBI		LALCI		LREER	
	Max lag	Coefficient	Max lag	Coefficient	Max lag	Coefficient	Max lag	Coefficient
LLAI3	13	0.189	9	0.172	3	0.401	4	0.255
LLAI4	-11	0.263	5	0.219	2	-0.217	0	0.260
LLAI5	8	0.177	-	-	-	-	-15	0.170
LLAI6	-3	-0.249	-	-	0	-0.171	-17	0.166
LLAI7	-9	-0.172	-16	0.169	-9	-0.209	-17	0.347

Source: Author compilation

Prior to concluding the lead, lag and coinciding business cycle series of capital market segments using Granger causality in relation to the first empirical objective, Table 6.6 summarises the cyclical properties of the BCIs based on suggested cross-correlation findings from Table 6.5. This process oversees the fulfilment of the second objective which aims to establish the cyclicality of BCIs as either pro-cyclical, counter-cyclical or acyclical to capital market segments. Thus, Table 6.6 assigns the input variables as either pro-or countercyclical variables of the capital markets, following Forni, Hallin, Lippi and Reichlin (2000). Correlation with a positive sign suggests that the cycle in the input series are pro-cyclical to the output variable, while a negative sign is interpreted as being counter-cyclical to time-series patterns of the capital market variables (Forni *et al*., 2000:8). On the other hand, acyclical patterns were identified based on cross-correlations with no definitive cross-correlating patterns between the component or input series and the reference or output series (Napoletano, Roventini & Sapio, 2006).

Table 6.6: Cyclicality properties of business cycle indicators towards capital markets

Series	LALSI	LALBI	LALCI	LREER
LLEI1	Pro-cyclical	Counter-cyclical	Pro-cyclical	Pro-cyclical
LLEI2	Pro-cyclical	Pro-cyclical	Counter-cyclical	Pro-cyclical
LLEI3	Pro-cyclical	Acyclical	Pro-cyclical	Pro-cyclical
LLEI4	Pro-cyclical	Pro-cyclical	Counter-cyclical	Pro-cyclical
LLEI5	Pro-cyclical	Pro-cyclical	Pro-cyclical	Counter-cyclical
LLEI6	Counter-cyclical	Pro-cyclical	Acyclical	Pro-cyclical
LLEI7	Acyclical	Acyclical	Pro-cyclical	Pro-cyclical
LLEI8	Counter-cyclical	Counter-cyclical	Pro-cyclical	Counter-cyclical
LLEI9	Pro-cyclical	Pro-cyclical	Pro-cyclical	Pro-cyclical
LLEI10	Pro-cyclical	Counter-cyclical	Pro-cyclical	Pro-cyclical

Series	LALSI	LALBI	LALCI	LREER
LLEI11	Pro-cyclical	Counter-cyclical	Pro-cyclical	Pro-cyclical
LCOI1	Counter-cyclical	Counter-cyclical	Pro-cyclical	Pro-cyclical
LCOI2	Counter-cyclical	Acyclical	Pro-cyclical	Pro-cyclical
LCOI3	Pro-cyclical	Counter-cyclical	Counter-cyclical	Counter-cyclical
LCOI4	Pro-cyclical	Counter-cyclical	Pro-cyclical	Counter-cyclical
LCOI5	Pro-cyclical	Pro-cyclical	Pro-cyclical	Pro-cyclical
LLAI1	Pro-cyclical	Pro-cyclical	Pro-cyclical	Counter-cyclical
LLAI2	Pro-cyclical	Counter-cyclical	Acyclical	Counter-cyclical
LLAI3	Pro-cyclical	Pro-cyclical	Pro-cyclical	Pro-cyclical
LLAI4	Pro-cyclical	Pro-cyclical	Counter-cyclical	Pro-cyclical
LLAI5	Pro-cyclical	Acyclical	Acyclical	Pro-cyclical
LLAI6	Counter-cyclical	Acyclical	Counter-cyclical	Pro-cyclical
LLAI7	Counter-cyclical	Pro-cyclical	Counter-cyclical	Pro-cyclical

Source: Author compilation

6.3.3 Causal analysis: Granger causality testing

In continuation of the fulfilment of the first empirical objective, the study proceeded with Granger causality testing to conclude on the lead, lag or coinciding properties of BCIs relative to the suggested cross-correlation lags. This was to confirm the strength and statistical significance of the formerly established correlations between capital markets and BCIs. The Granger causality test presents a rigorous standard of causation on the flow of information than the mere estimation of lead-lag relationships observed in cross-correlations (Damos, 2016:5).

Findings of the Granger causality tests are reported in Table 6.7. Results indicate that amongst the suggested leading indicators of the cross-correlations test, only LLEI3, LLEI8, LLEI9, LLAI4 and LLAI6 are statistically significant leading indicators of the All-Share Index, with unidirectional causal relationships at lags 1, 18, 3, 11 and 3, respectively. This means that these indicators lead the All-Share Index by 1, 18, 3, 11 and 3 months, respectively. Granger causality tests also confirmed that the series LLEI1, LLEI2, LLEI5, LLEI6, LLEI10, LLEI11, LCOI1, LCOI2, LCOI3, LCOI4, LCOI5, LLAI1 and LLAI3 are lagging indicators of the All Share Index. Meanwhile, the suggested lagging series LLEI1, LLEI6, LCOI1, LCOI3 and LLAI3 also exhibit bidirectional causal relationships with the All-Share Index at both 0.05 and 0.1

significance levels. Lastly, the series LLEI4, LLAI2, LLAI5 and LLAI7 were suggested to be coincident indicators of the All Share Index.

Table 6.7: Granger causality results

Series	ALSI (y)			ALBI (y)			ALCI (y)			REER (y)		
	lag	yx	xy	lag	yx	xy	lag	yx	xy	lag	yx	xy
LLEI1	3	0.027**	0.035**	1	0.034**	0.059*	17	0.113	0.001***	3	0.169	0.061*
LLEI2	5	0.589	0.021**	16	0.893	0.079*	17	0.453	0.003***	9	0.561	0.007***
LLEI3	-1	0.037**	0.577	-	-	-	-9	0.078*	0.374	5	0.381	0.035**
LLEI4	19	0.499	0.190	-19	0.473	0.434	14	0.285	0.134	16	0.046**	0.038**
LLEI5	5	0.561	0.005***	-5	0.036**	0.155	1	0.543	0.001***	-8	0.164	0.946
LLEI6	13	0.091*	0.095*	4	0.520	0.195	-	-	-	-6	0.017**	0.045**
LLEI7	-	-	-	-	-	-	-1	0.027**	0.343	-4	0.294	0.126
LLEI8	-18	0.073**	0.159	0	0.000***	0.000***	-17	0.137	0.051*	0	0.000***	0.000***
LLEI9	-3	0.001***	0.712	9	0.844	0.043**	-8	0.091*	0.166	3	0.431	0.021**
LLEI10	1	0.458	0.000***	-1	0.168	0.248	0	0.000***	0.000***	4	0.627	0.086*
LLEI11	10	0.004***	0.134	13	0.047**	0.009***	-12	0.013**	0.221	-4	0.124	0.251
LCOI1	12	0.000***	0.001***	-15	0.348	0.496	13	0.055*	0.000***	10	0.109	0.447
LCOI2	2	0.748	0.048**	-	-	-	10	0.218	0.001***	1	0.022**	0.016**
LCOI3	7	0.059*	0.037**	0	0.000***	0.000***	14	0.219	0.016**	0	0.000***	0.000***
LCOI4	2	0.242	0.000***	0	0.000***	0.000***	2	0.257	1.47	-6	0.257	0.091*
LCOI5	4	0.128	0.003***	9	0.553	0.339	4	0.089*	0.011	4	0.465	0.047**
LLAI1	2	0.798	0.032**	12	0.045**	0.184	-1	0.009***	0.003***	0	0.000***	0.000***
LLAI2	13	0.881	0.359	3	0.692	0.214	-	-	-	5	0.780	0.259
LLAI3	13	0.075*	0.000***	9	0.932	0.025**	3	0.482	5.843	4	0.086*	0.006***
LLAI4	-11	0.016**	0.810	5	0.459	0.008***	2	0.552	0.011**	0	0.000***	0.000***
LLAI5	8	0.774	0.252	-	-	-	-	-	-	-15	0.220	0.033**
LLAI6	-3	0.016**	0.665	-	-	-	0	0.000***	0.000***	-17	0.416	0.103
LLAI7	-9	0.235	0.769	-16	0.737	0.069*	-9	0.053*	0.771	-17	0.001***	0.991

Source: Author compilation (***Note:*** ****,** and * indicates significance levels at 0.01, 0.05 and 0.1, respectively*).

For the All-Bond Index, Granger causality results at the respective lags confirmed that only the input series LLEI5 at lag 5 was a statistically significant leading indicator, implying that this indicator leads the All-Bond Index by five months. Amongst the previously suggested lagging

indicators of the All-Bond Index, only LLEI1, LLEI2, LLEI9, LLEI11, LLAI1, LLAI3, LLAI4 and LLAI7 turned out to be statistically significant lagging indicators. Not only are the series LEI1 and LLEI11 significant lagging indicators, but they also exhibit bidirectional causal relationships with the All-Bond Index at 0.05 and 0.1 significance levels. Granger causality tests further revealed that the input series LLEI4, LLEI6, LLEI10, LCOI1, LCOI5 and LLAI2, together with the already established series LLEI8, LCOI3 and LCOI4, were coinciding or contemporaneous indicators of the All-Bond Index.

Granger causality results of the All-Commodity Index confirmed that the input series LLEI3, LLEI7, LLEI9, LLEI11, LLAI1 and LLAI7 were leading series of the All-Commodity Index. With a bidirectional relationship between the All-Commodity Index and LLAI1. The series LLEI1, LLEI2, LLEI5, LLEI8, LCOI1, LCOI2, LCOI3, LCOI5 and LLAI4 were confirmed as having lagging properties with the All-Commodity Index, with bidirectional causal relationships from the series LCOI1 and LCOI5. The series LLEI4, LCOI4, LLAI3 was identified as coincident indicators of the All Commodity Market, together with the already established coincident series LLEI10 and LLAI6.

Table 6.8: Deduced findings of Granger causality and cross-correlations tests

INDICATORS	LALSI	LALBI	LALCI	LREER
Leading	LLEI3	LLEI5	LLEI3	LLEI6
	LLEI8		LLEI7	LLAI7
	LLEI9		LLEI9	
	LLAI4		LLEI11	
	LLAI6		LLAI1	
			LLAI7	
Coinciding	LLEI4	LLEI4	LLEI4	LLEI5
	LLAI2	LLEI6	LLEI10	LLEI7
	LLAI5	LLEI8	LCOI4	LLEI8
	LLAI7	LLEI10	LLAI3	LLEI11
		LCOI1	LLAI6	LCOI1
		LCOI3		LCOI3
		LCOI4		LLAI1
		LCOI5		LLAI2
		LLAI2		LLAI4
		LLEI8		LLAI6

INDICATORS	LALSI	LALBI	LALCI	LREER
Lagging	LLEI1	LLEI1	LLEI1	LLEI1
	LLEI2	LLEI2	LLEI2	LLEI2
	LLEI5	LLEI9	LLEI5	LLEI3
	LLEI6	LEI11	LLEI8	LLEI4
	LLEI10	LLAI1	LCOI1	LLEI9
	LLEI11	LLAI3	LCOI2	LLEI10
	LCOI1	LLAI4	LCOI3	LCOI2
	LCOI2	LLAI7	LCOI5	LCOI4
	LCOI3		LLAI4	LCOI5
	LCOI4			LLAI3
	LCOI5			LLAI5
	LLAI1			
	LLAI3			

Source: Author compilation

Moreover, only the input series LLEI6 and LLAI7 were confirmed as leading indicators of the real effective exchange rate. While the series LLEI1, LLEI2, LLEI3, LLEI4, LLEI9, LLEI10, LCOI2, LCOI4. LCOI5. LLAI3 and LLAI5 were also confirmed as the lagging indicators of the real effective exchange rate, with bidirectional relationships with the series LLEI4, LCOI2 and LLAI3. The series LLEI5, LLEI7, LLEI11, LCOI1, LLAI2, and LLAI6, was confirmed to be coinciding indicators of the real effective exchange rate, together with the pre-established coinciding series LLEI8, LCOI3, LLAI1 and LLAI4.

6.3.3.1 Detailed classification of business cycle component series as the leading, lagging and coincident indicators of the capital markets

On aggregate, twenty-three component series of South Africa's official business cycle composite series were chosen in the study. In terms of the leading series of the various capital markets, Table 6.9 shows that five business cycle series were identified as leading indicators of the cycle in the All Share Index. This means that changes in the nine business cycle series lead changes in the All Share Index. Only one series was observed to be a leading indicator of the All-Bond Index. Six business cycles series, the most compared to other markets, were revealed to be leading indicators of the All-Commodity Index, with two leading series of the real effective exchange rate. Likewise, changes in cycles of the identified leading series

respective to the All-Bond Index, All-Commodity Index and the real effective exchange rate, are said to precede changes in these capital markets.

Table 6.9: Observed capital market's leading business cycle series

	ALSI	ALBI	ALCI	REER
Identified leading series of each capital market	• Interest rate spread: 1-year government bonds less 91-dat Treasury bills • RMB/BER Business Confidence Index • A new balance of manufacturers observing an increase in the average number of hours worked per factory worker (half weight) • Predominant prime overdraft rate of banks • The ratio of inventories to sales in manufacturing and trade	• Index of commodity prices (in US dollar) for a basket of South African-product export commodities	• The ratio of consumer instalment sale credit to the disposable income of households • Gross operating surplus as a percentage of gross domestic product • The new balance of manufacturers observing an increase in the average number of hours worked per factory worker (half weight) • Number of new passengers • Interest rate spread: 1-year government bonds less 91-dat Treasury bills • Cement sales (in tons)	• The ratio of consumer instalment sale credit to the disposable income of households • The composite leading indicator of South Africa's major trading partner countries: percentage changes over twelve months

Source: Author compilation (description of variables as obtained from the SARB (2018)).

In terms of the coincident indicators of the capital markets, Table 6.9 reveals that about four business cycle series had contemporaneous cycles, with the All-Share Index. About ten series were observed as coincident indicators of the All-Bond Index, whereas the All-Commodity Index constituted about five coincident indicators.

Table 6.10: Observed capital market's coincident business cycle series

	ALSI	ALBI	ALCI	REER
Identified coincident series of each capital market	• Real M1 money supply (deflated with CPI) * six-month smoothed growth rate • Nominal labour cost per unit of production in the manufacturing sector: percentage change over twelve months • Value of non-residential buildings completed at constant prices • The ratio of consumer instalment sale credit to the disposable income of households	• Real M1 money supply (deflated with CPI) * six-month smoothed growth rate • The composite leading indicator of South Africa's major trading partner countries: percentage changes over twelve months • Value of retail and new vehicle sales at constant prices • The net balance of manufacturers observing an increase in the volume of domestic order received (half weight) • Gross value added at constant prices, excluding agriculture, forestry and fishing • RMB/BER Business Confidence Index • Industrial production index • The utilisation of production capacity in manufacturing • Value of non-residential buildings completed at constant prices • RMB/BER Business Confidence Index	• Real M1 money supply (deflated with CPI) * six-month smoothed growth rate • The net balance of manufacturers observing an increase in the volume of domestic order received (half weight) • Industrial production index • The ratio of gross fixed capital formation in machinery and equipment to final consumption expenditure on goods by households • Predominant prime overdraft rate of banks	• Gross operating surplus as a percentage of gross domestic product • Index of commodity prices (in US dollar) for a basket of South African-product export commodities • Value of retail and new vehicle sales at constant prices • Number of new passengers • Gross value added at constant prices, excluding agriculture, forestry and fishing • RMB/BER Business Confidence Index • Cement sales (in tons) • Value of non-residential buildings completed at constant prices • The ratio of inventories to sales in manufacturing and trade • Predominant prime overdraft rate of banks

Source: Author compilation (description of variables as obtained from the SARB (2018)).

Similar to the All-Bond Index, ten business cycle series were identified as a coincident indicator of the real effective exchange rate. These findings insinuate that cyclical variations of the recognised coincident indicators are contemporaneous or at least occurs *a*t the same time as those of the underlying capital markets.

Lastly, Table 6.11 presents a summary of the lagging series business cycle series of the various capital markets. Accordingly, most of the business cycle series turned out to be lagging series of the All-Share index. This means that changes in the All-Share Index precede changes of about thirteen business cycle series. For the All-Bond Index, eight series business cycle series were revealed to lag being cycles in the former. This was the also the case for about nine business cycle series which were revealed to lag behind movements in cycles of the All-Commodity Index. Lastly, changes in the real effective exchange rate were revealed to precede about eleven business cycle series, which ultimately served lagging indicators of the former.

Table 6.11: Observed capital market's lagging business cycle series

	ALSI	**ALBI**	**ALCI**	**REER**
Identified lagging series of each capital market	• Job advertisement space in the Sunday Times newspaper: Percentage change over twelve months • Number of residential building plans passed for flats, townhouses and houses larger than 80m' • Index of commodity prices (in US dollar) for a basket of South African-product export commodities • A composite leading indicator of South Africa's major trading partner countries: percentage changes over twelve months	• Job advertisement space in the Sunday Times newspaper: Percentage change over twelve months • Number of residential building plans passed for flats, townhouses and houses larger than 80m' • A new balance of manufacturers observing an increase in the average number of hours worked per factory worker (half weight) • Number of new passengers	• Job advertisement space in the Sunday Times newspaper: Percentage change over twelve months • Number of residential building plans passed for flats, townhouses and houses larger than 80m' • Index of commodity prices (in US dollar) for a basket of South African-product export commodities • RMB/BER Business Confidence Index	• Job advertisement space in the Sunday Times newspaper: Percentage change over twelve months • Number of residential building plans passed for flats, townhouses and houses larger than 80m' • Interest rate spread: 1-year government bonds less 91-dat Treasury bills • Real M1 money supply (deflated with CPI) * six-month smoothed growth rate • The new balance of manufacturers observing an increase in the average number of

	ALSI	ALBI	ALCI	REER
	• The net balance of manufacturers observing an increase in the volume of domestic order received (half weight) • Number of new passengers • Gross value added at constant prices, excluding agriculture, forestry and fishing • Total formal non-agricultural employment • Value of retail and new vehicle sales at constant prices • The ratio of gross fixed capital formation in machinery and equipment to final consumption expenditure on goods by households • The utilisation of production capacity in manufacturing • Cement sales (in tons) • Industrial production index	• Cement sales (in tons) • The ratio of gross fixed capital formation in machinery and equipment to final consumption expenditure on goods by households • The ratio of inventories to sales in manufacturing and trade • The ratio of consumer instalment sale credit to the disposable income of households	• Gross value added at constant prices, excluding agriculture, forestry and fishing • Total formal non-agricultural employment • Value of retail and new vehicle sales at constant prices • The utilisation of production capacity in manufacturing • The ratio of inventories to sales in manufacturing and trade	hours worked per factory worker (half weight) • The net balance of manufacturers observing an increase in the volume of domestic order received (half weight) • Total formal non-agricultural employment • Industrial production index • The utilisation of production capacity in manufacturing • The ratio of gross fixed capital formation in machinery and equipment to final consumption expenditure on goods by households • Nominal labour cost per unit of production in the manufacturing sector: percentage change over twelve months

Source: Author compilation (description of variables as obtained from the SARB (2018)).

6.3.4 Analysis of variance decomposition

Following Ramos (2003) and Burger (2010), the study proceeded with the analysis of variance decomposition as an extension of the Granger causality test in order to acquire further insights on the sole contribution of each identified leading input series towards the respective capital

market series. The variance decomposition test, also known as the forecast variance decomposition, describes the dynamic behaviour of an endogenous series in terms of the component shocks. It gauges and apportions a variable's proportion of forecast error variance explained by its own shocks, and those of other variables (Olusegun, 2008:125; Asmah, 2013:296). Ramos (2003:105) underscores that a variance decomposition is an alternative approach to analysing Granger causality. A variable whose forecast error is significantly explained by its own innovations is therefore considered as exogenous in regards to Granger causality. To confirm the findings provided by the Granger causality test, Tables 6.12 and 6.13 present results of the variance decomposition.

Results in Table 6.12 show that from the 1st to the 10th period the shocks in the All-Share Index are mostly explained by the series LLEI9, which is shown to have the most stable and largest contribution of about 20.3 per cent as of the 20th period. The series LLAI4, despite having experienced a diminishing share of contribution in the shocks of the All-Share Index in the 3rd period, contributed about 18.6 per cent of variations in the All-Share Index during the 10th period, second largest to the series LLEI9.

Table 6.12: Variance decomposition results of the ALSI and the ALBI

Period	LALSI					LALBI
	LLEI3	LLEI8	LLEI9	LLAI4	LLAI6	LLAI5
1	0.000	0.000	0.000	0.000	0.000	0.000
2	1.170	1.529	3.151	4.02E-1	0.385	0.536
3	3.224	6.314	6.174	0.031	0.513	0.441
4	5.625	13.999	17.099	0.886	2.696	0.804
5	8.039	14.112	19.324	1.171	3.235	2.257
6	10.295	14.562	20.016	5.511	5.523	4.786
7	12.321	15.246	20.262	9.972	7.953	8.018
8	14.104	15.480	20.357	12.933	9.932	11.490
9	15.656	15.279	20.267	17.216	10.430	14.871
10	17.002	15.195	20.292	18.621	10.768	17.905

Source: Author compilation

Correspondingly, the series LLEI3, LLEI8 and LLAI6 respectively contributed about, 17.0 per cent, 15.2 per cent and 10.8 per cent during the 10th period to variations in the All-Share Index. With the lowest contribution in the variation of the All-Share Index stemming from the series LLAI6. Moreover, the series LLAI, the only identified business cycle leading indicator of the

All-Bond Index, was shown to have contributed about 17.9 per cent in the variation of shocks observed in the latter series.

Furthermore, Table 6.13 shows explanations of the variations in the All-Commodity Index and the All-Bond Index. In terms of the All-Commodity Index, the series LEI9 is depicted to have had the highest contribution of variations in the former index of about 27.1 per cent during the 10th period. Second, to the LEI9 series, the series LLAI7 and LLAI1 constituted about 11.1 per cent and 10.7 per cent of the contribution in the variations of shocks pertaining to the All-Commodity Index. The series LLEI11 is suggested to have contributed about 7.9 per cent of shocks in the All-Commodity Index during the 10th period. Whereas, the series LLEI3 is shown to have had the least contribution of about 0.32 per cent, followed by the series LLEI7 with 4.7 per cent.

Table 6.13: Variance decomposition results of the ALCI and the REER

Period	LALCI						LREER	
	LLEI3	LLEI7	LLEI9	LLEI11	LLAI1	LLAI7	LLEI6	LLAI7
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.045	1.347	0.157	1.708	1.888	0.305	1.216	0.586
3	0.114	3.631	0.665	3.237	2.142	1.661	5.906	1.309
4	0.180	4.499	1.356	3.732	2.865	3.601	9.092	2.551
5	0.232	4.089	3.444	4.485	4.029	4.683	13.251	3.838
6	0.269	3.453	5.298	4.854	5.624	6.747	18.539	6.045
7	0.294	3.337	9.069	5.856	7.162	9.039	19.499	7.253
8	0.309	3.779	13.413	6.638	8.529	10.569	20.399	9.439
9	0.319	4.297	19.749	7.246	9.705	11.028	20.582	11.613
10	0.324	4.714	27.136	7.911	10.737	11.058	20.763	11.758

Source: Author compilation

When it comes to explaining the variations in the real effective exchange rate index, the series LLEI6 and LLAI7 as the two identified leading indicators of the former index, constituted about 20.8 per cent and 11.8 per cent during the 10th period. With highest contribution coming from the series LLEI6, and the series LLAI7 having been suggested to have had the least contribution.

6.4 GARCH ANALYSIS OF BUSINESS CYCLE INDICATORS' VOLATILITY RELATIVE TO CAPITAL MARKETS

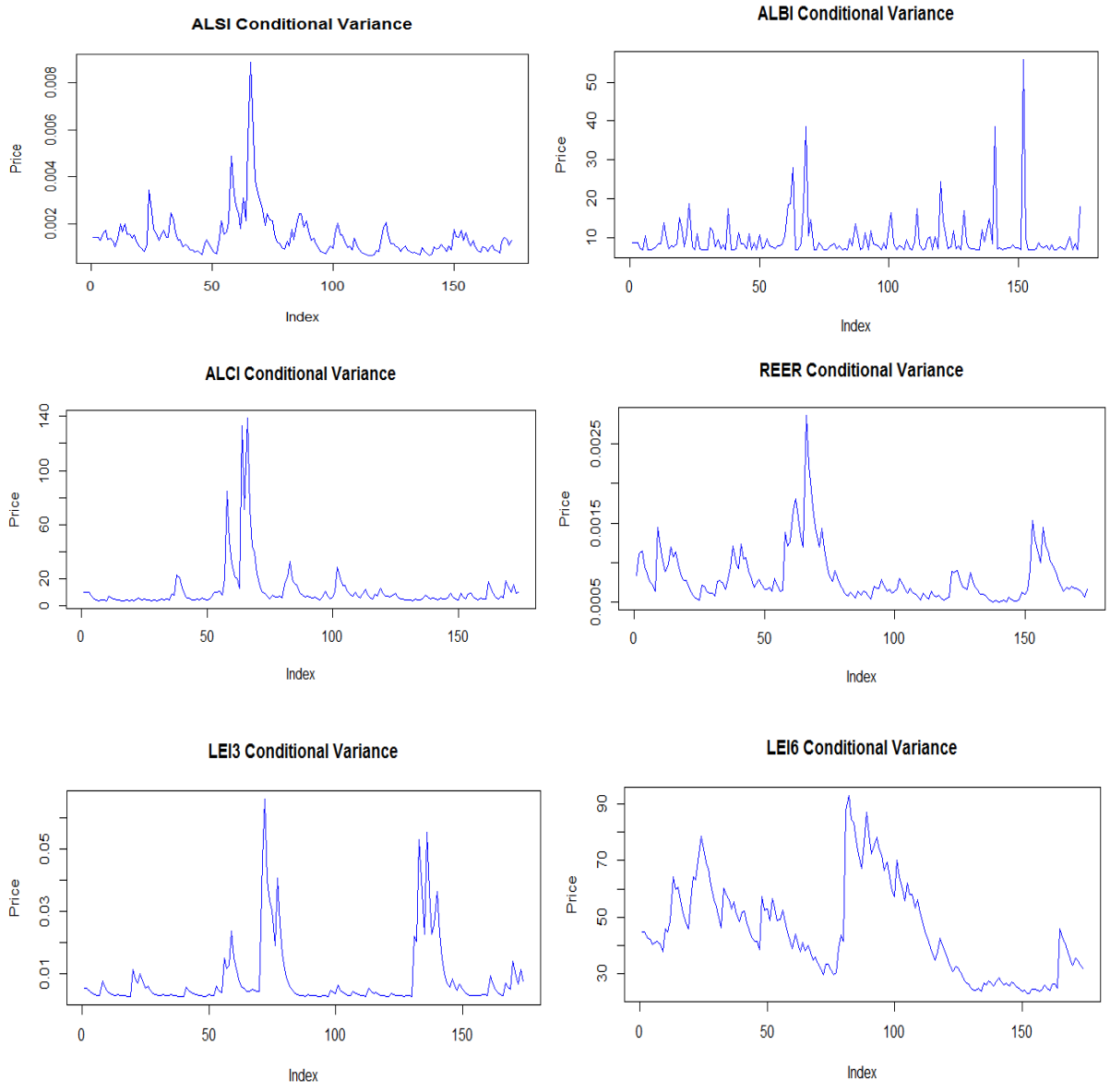
This section focusses on achieving the third empirical objective of modelling the volatility of the stock, bond, commodity and exchange rate markets on South Africa's BCIs. Principally, this objective underscores the relative price volatility of South Africa's capital markets and BCIs using the GARCH model. Before establishing estimations of equation 10, the Lagrange Multiplier (LM) test examines the ARCH effects and autocorrelations of the data set to confirm the fitness of utilizing the GARCH model. The LM test is of the null hypothesis of no significant ARCH effects. Table 6.14 provides results of the LM test. Based on the findings, the null hypothesis of no significant ARCH effects is rejected for all series, with all p-values below 0.05 significance level. These findings indicate that the series contains significant ARCH effects in both the leading- and capital market series. This concurs with estimations of the GARCH model. Correspondingly, no serial correlation was found, therefore a continued interpretation of the estimates of equation 11 can be made.

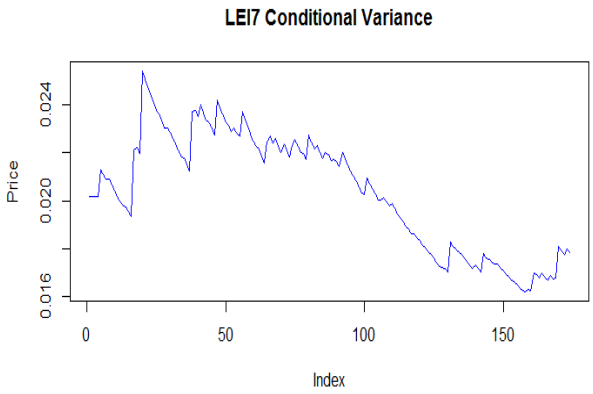
Table 6.14: Lagrange multiplier test for ARCH effects

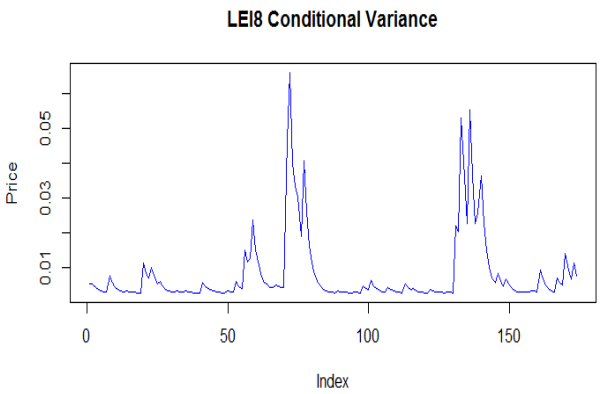
	chi-square	p-values	Decision
LALSI	119.800	p-v < 2.2e-16	ARCH effects are significant
LALBI	28.484	p-v < 2.2e-16	ARCH effects are significant
LALCI	148.920	p-v < 2.2e-16	ARCH effects are significant
LREER	75.476	p-v < 2.2e-16	ARCH effects are significant
LLEI3	130.390	p-v < 2.2e-16	ARCH effects are significant
LLEI6	97.994	p-v < 2.2e-16	ARCH effects are significant
LLEI7	84.898	p-v < 2.2e-16	ARCH effects are significant
LLEI8	136.800	p-v < 2.2e-16	ARCH effects are significant
LLEI9	71.993	p-v < 2.2e-16	ARCH effects are significant
LLEI11	151.370	p-v < 2.2e-16	ARCH effects are significant
LLAI1	14.683	0.0001272	ARCH effects are significant
LLAI4	17.710	p-v = 2.573e-05	ARCH effects are significant
LLAI5	127.010	p-v < 2.2e-16	ARCH effects are significant
LLAI6	153.880	p-v < 2.2e-16	ARCH effects are significant
LLAI7	101.260	p-v < 2.2e-16	ARCH effects are significant

Source: Author compilation

Based on the use of GARCH graphs, an explanatory conditional variances analysis is presented in the presence of volatility in Figure 6.1. The graphs in Figure 6.1 demonstrate significant volatility in the conditional variance of the leading indicators and the capital markets. There are, at least, similar conditional variances during the period moving in relatable directions of the two categories of series. Most series in commonality exhibit high volatility ranging between the years 2004, 2008, 2009, 2015 and 2016, proving increased volatility. Increased levels of volatility can in part be associated with the 2008-09 financial crises. Also, during the 2015/16 period, temporal shifts in potential growth were incurred due to the drought at that time (Botha, Ruch & Steinbach, 2018:1). Having acquired an understanding of volatility commonalities within the series, more extensive formal estimations were required to ratify the commonality in volatility between the leading indicators and capital market series.




LEI7 Conditional Variance
Price
0.016
0.020
0.024
0
50
100
150
Index


LEI8 Conditional Variance
Price
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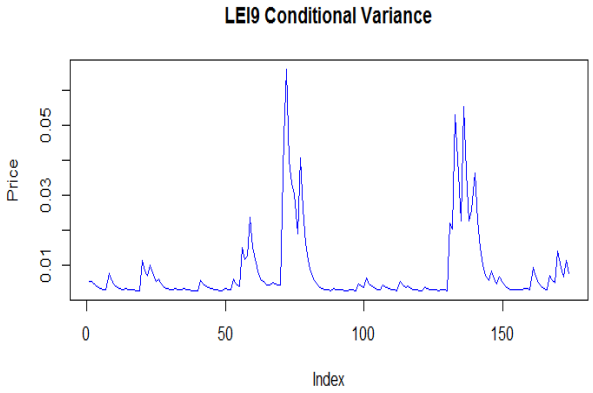
0.03
0.05
0
50
100
150
Index


LEI9 Conditional Variance
Price
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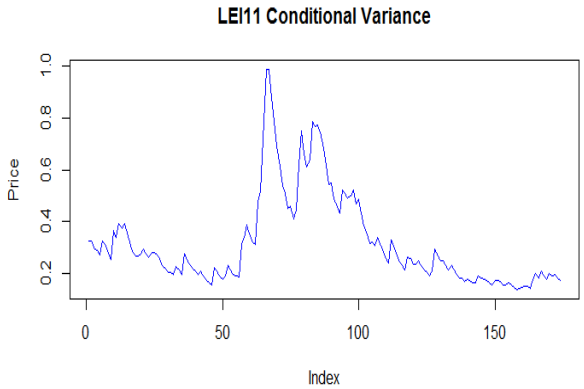
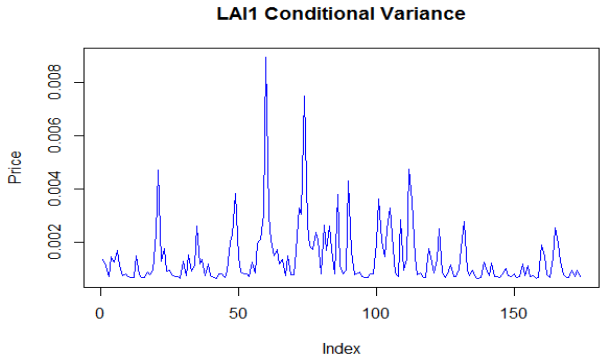
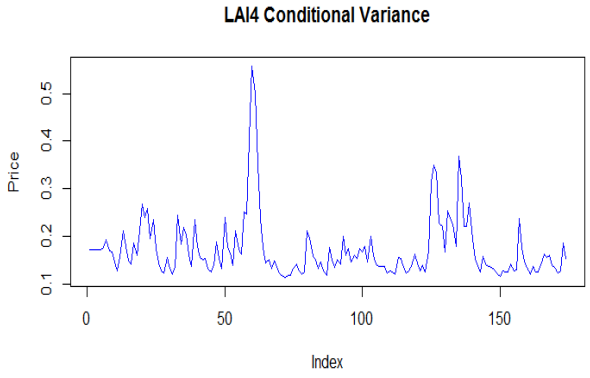
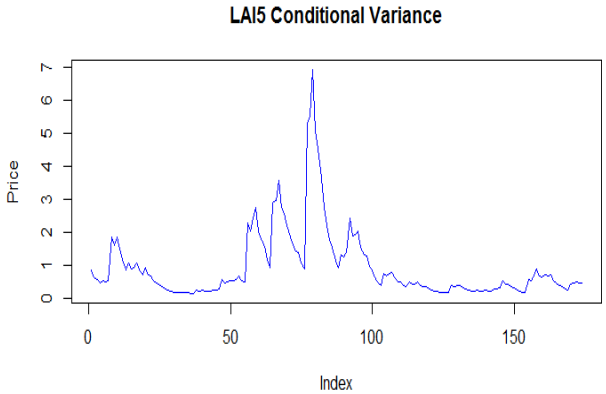
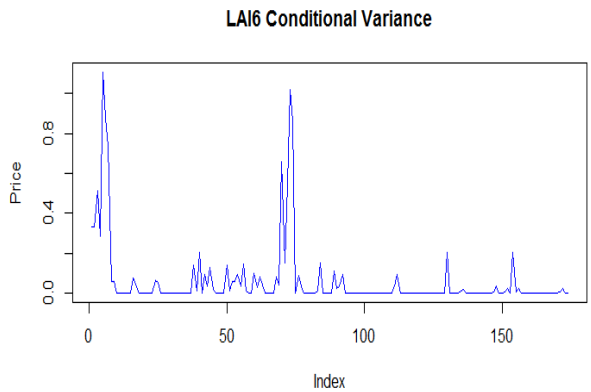
0.03
0.05
0
50
100
150
Index


LEI11 Conditional Variance
Price
0.2
0.4
0.6
0.8
1.0
0
50
100
150
Index


LAI1 Conditional Variance
Price
0.002
0.004
0.006
0.008
0
50
100
150
Index


LAI4 Conditional Variance
Price
0.1
0.2
0.3
0.4
0.5
0
50
100
150
Index


LAI5 Conditional Variance
Price
0
1
2
3
4
5
6
7
0
50
100
150
Index


LAI6 Conditional Variance
Price
0.0
0.4
0.8
0
50
100
150
Index

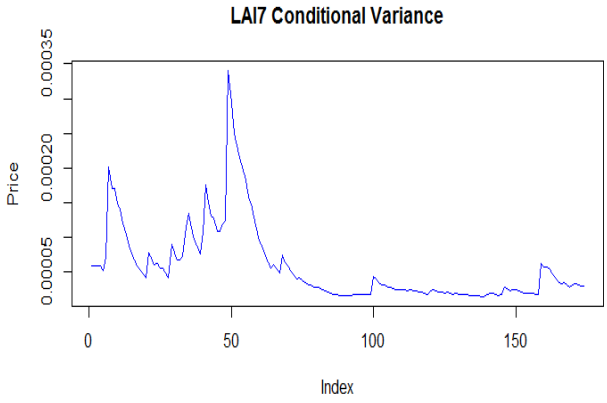


Figure 6.1: Conditional variances of capital markets and suggested leading indicators

Source: Author compilation

Table 6.15 exhibits results of the GARCH (1,1) model in consideration of volatility from capital markets and their identified leading business cycle series based on equation 10.

Table 6.15: GARCH (1,1) findings

Variance Equation	Coefficient	Std. Error	z-Statistic	Prob.
LALSI				
RESID(-1)^2 (alpha)	0.2409	0.1082	2.2267	0.0259**
GARCH(-1) (beta)	0.6159	0.1632	3.7729	0.0002***
LALBI				
RESID(-1)^2 (alpha)	0.3193	0.0143	2.2393e+01	0.0000***
GARCH(-1) (beta)	0.0004	0.3311	1.1290e-03	0.9991
LALCI				
RESID(-1)^2 (alpha)	0.3906	0.1947	2.0065	0.0448**
GARCH(-1) (beta)	0.5066	0.1755	2.8874	0.0039***
LREER				
RESID(-1)^2 (alpha)	0.1221	0.0606	2.0162	0.0438**
GARCH(-1) (beta)	0.7357	0.0698	10.5341	0.0000***
LLEI3				
RESID(-1)^2 (alpha)	0.4114	0.1786	2.3032	0.0213**
GARCH(-1) (beta)	0.5876	0.1188	4.9471	0.0000***
LLEI6				
RESID(-1)^2 (alpha)	0.1320	0.0569	2.3216	0.0203**
GARCH(-1) (beta)	0.8016	0.0833	9.6197	0.0000***
LLEI7				

Variance Equation	Coefficient	Std. Error	z-Statistic	Prob.
RESID(-1)^2 (alpha)	0.0115	0.0009	11.7526	0.0000***
GARCH(-1) (beta)	0.9737	0.0361	26.997	0.0000***
LLEI8				
RESID(-1)^2 (alpha)	0.4114	0.1786	2.3032	0.0213**
GARCH(-1) (beta)	0.5876	0.1188	4.9471	0.0000***
LLEI9				
RESID(-1)^2 (alpha)	0.2615	0.1153	2.2691	0.0233**
GARCH(-1) (beta)	0.6013	0.1383	4.3491	0.0000***
LLEI11				
RESID(-1)^2 (alpha)	0.0976	0.0404	2.4161	0.0157**
GARCH(-1) (beta)	0.8646	0.0556	15.5492	0.0000***
LLAI1				
RESID(-1)^2 (alpha)	0.5016	0.1663	3.0161	0.0026***
GARCH(-1) (beta)	0.1188	0.2666	0.4456	0.6559
LLAI4				
RESID(-1)^2 (alpha)	0.1822	0.1033	1.7634	0.0778*
GARCH(-1) (beta)	0.5213	0.2519	2.0696	0.0385**
LLAI5				
RESID(-1)^2 (alpha)	0.2660	0.1318	2.0179	0.0436**
GARCH(-1) (beta)	0.7248	0.1007	7.2003	0.0000***
LLAI6				
RESID(-1)^2 (alpha)	0.9613	0.1967	4.8883	0.0000***
GARCH(-1) (beta)	0.0025	0.0007	3.3304	0.0009***
LLAI7				
RESID(-1)^2 (alpha)	0.1294	0.0696	1.8587	0.0630*
GARCH(-1) (beta)	0.8369	0.0518	16.1714	0.0000***

Source: Author compilation (***Note:*** ****,** and * indicates significance levels at 0.01, 0.05 and 0.1, respectively*).

Results show that ARCH (RESID(-1)^2) and GARCH coefficients are significant for all the series at 0.05, and 0.1 significance levels for some. This implies that volatility of these time-series is influenced by inherent shocks within themselves; particularly, their historical information and volatility. These are interesting findings of commonality among the series. In contrast to these findings, the GARCH coefficients of the series LALBI and LLAI1 are not

significant at either significance levels, but notwithstanding, there are significant ARCH (RESID(-1)^2) coefficients. These findings are contrary to the general overview of the behavioural finance theory which assumes that past information holds no significant role in influencing future movements in the time-series as elaborated upon in Section 2.5 of Chapter 2.

6.5 LONG-RUN AND SHORT-RUN INTERACTIONS BETWEEN CAPITAL MARKETS AND BUSINESS CYCLE INDICATORS

The current section seeks to achieve the fourth objective, which was set to examine the interactions or linkages between the capital markets and BCIs in order to highlight the short- and long-run dynamics between the two categories to ratify the significance of the formerly projected relationships. In light of the study's established empirical objectives, analysis of the long-run and short-run cointegration, including the forthcoming econometric analyses, are only tested for the identified leading variables for each capital market segment (the stock, bond, commodity and exchange rate market). The long-run and short-run relationships are examined using the Autoregressive Distributed Lag (ARDL) model. These tests are subsequent to the acquired findings of the presence of cross-correlations, causality, and similar volatility among the studies sample series. Preliminary stationarity and unit root estimations provided in Table 6.3 through the ADF test showcased that the series stationary are stationary and none of the series is of order I(2) or second difference, thus readily equipped to be tested for cointegration.

6.5.1 Lag length and model specification

The selection of optimal lags is crucial for establishing non-parsimonious estimations. A model with optimally selected lags is projected as one producing the lowest information criterion value. Although, larger lags can solely be expected for models carrying a minimised value of log-likelihood which outweighs the value of the penalty term (Javed & Mantalos, 2013:1921).

The selected lags for the capital markets were based on the automatic consensus between the Akaike information criterion (AIC), Hannan–Quinn information criterion (HQC), Schwarz information criterion (SIC/or SBIC). The lags for the capital markets and the various BCIs were chosen with respect to establishing long-run and short-run estimations free from diagnostic errors such as heteroscedasticity, serial-correlation and normality errors. Pesaran *et al*. (1999) demonstrate that the choice of correct lags within the ARDL model fixes the glitches of serial correlation and endogeneity issues. To establish any possible long-run and short-run cointegration between the capital markets and BCIs, the following models presented in Table

6.16 were specified for the analysis while accounting diagnostic errors which may produce spurious findings if present. R-Squared estimations in each of the models confirm that extreme variability in the capital markets can be explained by BCIs as per specified models.

Table 6.16: Model selection

	Variable	*Selected Model*	*Trend Specification*	*R-Squared*
Capital markets vs. leading business cycle series	ALSI (eq.1)	(1,1,5,2,2,4,1,1,3,3,1,4)	Rest. constant	0.5393
	ALBI (eq.2)	(1,6,1,2,4,5,1,4,1,3,7,3)	Rest. constant	0.5407
	ALCI (eq.3)	(2,2,1,3,1,1,1,3,1,4,1)	Rest. constant	0.5300
	REER (eq.4)	(3,1,5,2,2,3,1,3,1,1,1,1)	Rest. constant	0.5368
Capital markets vs. lagging business cycle series	ALSI (eq.5)	(1,5,4,2,5,2,4,1)	Rest. constant	0.3100
	ALBI (eq.6)	(1,1,1,1,1,2,2,1)	Rest. constant	0.2434
	ALCI (eq.7)	(2,1,5,2,5,6,1,7)	Rest. constant	0.5977
	REER (eq.8)	(4,2,1,3,3,6,4,2)	Rest. constant	0.3908
Capital markets vs. coincident business cycle series	ALSI (eq.9)	(1, 5,4,1,2,2)	Rest. constant	0.2917
	ALBI (eq.10)	(1,2,2,1,1,3)	Rest. constant	0.2696
	ALCI (eq.11)	(2,5,1,4,4,3)	Rest. constant	0.5257
	REER (eq.12)	(3, 6,5,1,6,6)	Rest. constant	0.3388

Source: Author compilation

As a prerequisite, residual diagnostics establish whether stochastic properties are met by the specified models in avoidance of common econometric glitches which violate assumptions of the classical linear model (Takaendesa, 2006:100). Post-estimation diagnostics were accounted for within the specified models to accompany tests for heteroscedasticity, autocorrelation and parameter stability as provided in Table 6.17. Based on the diagnostic findings, it can be noted that the specified models passed all tests for heteroscedasticity and serial correlation. With p-values above the 0.05 significance level, the null hypothesis of heteroscedasticity and serial-correlation in each underlying model can be rejected.

Based on p-values above the 0.05 significance level benchmark, residual diagnostic testing of normality using the Jarque Bera test ensued that the models $LALCI_t$ (eq.7), $LALSI_t$ (Eq.9), $LALBI_t$ (eq.10) and $LALCI_t$ (eq.11) were the only ones to pass the test for normality of distributions. Nevertheless, the remainder of the models failed the normality test. Frain (2007:3-15) demonstrates that large samples of time-series data are not innately characterised by an "α-stable" distribution, thus, it is naturally anticipated that the null hypothesis assumption of normally distributed residuals can be rejected. As per various scholars (such as Ruxanda & Botezatu, 2008:59; Kundu, Mishra & Khare, 2011:2-3), this also conveys that some regressions may be bound to being non-constant over time, whereas normality testing is highly sensitive in large sample sizes. Henceforth, the distributive normality of residuals in the latter test can be more frequently rejected than it should be (Chen & Kuan, 2003:7-8).

A failed normality test calls for estimating further parameter stability tests to confirm the results projected by the Jarque Bera test and to avoid volatility misspecifications within time-series (Pesaran & Pesaran, 1997; Zanini, Irwin & Schnitkey, 2000). Table 6.17 also presents the Cumulative sum of Recursive Residuals (CUSUM) test as following Lee and Strazicich (2004:132) to clarify stability concerns. The CUSUM test plots indicated in Figure 6.6 of the appendix show that all plots remained within/and or retained to the 0.05 significance level upper and lower bound, declaring that the parameters of the set models are stable and robust. Thus, interpretations of estimations of the ARDL cointegration tests can be made.

Table 6.17: Residual diagnostic testing

Estimations	Breusch-Pagan Test	Breusch-Godfrey LM Test	Jarque Bera Normality Test	CUSUM Stability Test
	H0= No heteroscedasticity	H0= No serial correlation		
$LALSI_t$ *(Eq.1)*	0.6458	0.1383	0.0152**	Stable
$LALBI_t$ *(Eq.2)*	0.7238	0.3428	0.0034***	Stable
$LALCI_t$ *(Eq.3)*	0.3115	0.6826	0.0000***	Stable
$LREER_t$ *(Eq.4)*	0.1229	0.3715	3.0e-07***	Stable
$LALSI_t$ *(Eq.5)*	0.4225	0.2998	0.0053***	Stable
$LALBI_t$ *(Eq.6)*	0.5398	0.4068	9.9e-0***	Stable
$LALCI_t$ *(Eq.7)*	0.1754	0.3134	0.0633*	Stable
$LREER_t$ *(Eq.8)*	0.1353	0.5475	0.0278**	Stable
$LALSI_t$ *(Eq.9)*	0.6620	0.6731	0.8231	Stable
$LALBI_t$ *(Eq.10)*	0.7508	0.4991	0.0760*	Stable
$LALCI_t$ *(Eq.11)*	0.1754	0.3134	0.6173	Stable
$LREER_t$ *(Eq.12)*	0.1697	0.2690	0.0060***	Stable

Source: Author compilation (***Note:*** ****,** and * indicates significance levels at 0.01, 0.05 and 0.1, respectively*).

6.5.2 Results of the ARDL Bounds Test to Cointegration: Long-run

Estimating Pesaran *et al.*'s (2001) ARDL approach involves establishing the long-run cointegration with the bounds test, then estimating error correction adjustments as well as long-run and short-run coefficients of the established relationships. Table 6.18 shows the findings of the ARDL's bounds test to cointegration for long-run estimations as per lower and upper bound values with corresponding F-statistic values. The estimated F-statistic values for all models (from model 1, model 2, ... to model 12), exceeds the estimated lower and upper bounds critical values. Thus, this permits the rejection of the null hypothesis of no cointegration for all models at 5 per cent, and 1 per cent for some. Based on such evidence, deductions can be made of existing long-run co-movement between capital markets and the business cycle component series.

Table 6.18: Bounds test and F-statistic results

Estimated models	Business cycle series	F-Stat	I(0) Bound	I(1) Bound	Outcome
$\boldsymbol{LALSI_t}$ *(model 1)*	LLEI	5.018	2.501	4.018***	Cointegration
$\boldsymbol{LALBI_t}$ *(model 2)*	LLEI	5.439	2.523	4.006***	Cointegration
$\boldsymbol{LALCI_t}$ *(model 3)*	LLEI	3.542	2.068	3.368**	Cointegration
$\boldsymbol{LREER_t}$ *(model 4)*	LLEI	7.758	2.531	3.995***	Cointegration
$\boldsymbol{LALSI_t}$ *(model 5)*	LLAI	4.696	2.658	3.959**	Cointegration
$\boldsymbol{LALBI_t}$ *(model 6)*	LLAI	4.911	3.024	4.432***	Cointegration
$\boldsymbol{LALCI_t}$ *(model 7)*	LLAI	6.138	3.44	4.898***	Cointegration
$\boldsymbol{LREER_t}$ *(model 8)*	LLAI	4.017	2.298	3.616**	Cointegration
$\boldsymbol{LALSI_t}$ *(model 9)*	LCOI	5.092	3.458	4.887***	Cointegration
$\boldsymbol{LALBI_t}$ *(model 10)*	LCOI	5.254	3.479	4.871***	Cointegration
$\boldsymbol{LALCI_t}$ *(model 11)*	LCOI	6.138	2.615	3.887**	Cointegration
$\boldsymbol{LREER_t}$*(model 12)*	LCOI	4.224	2.583	3.897**	Cointegration

Source: Author compilation (***Note:*** ****,** and * indicates significance levels at 0.01, 0.05 and 0.1, respectively*).

6.5.3 Results of the Error Correction Model, Long-and Short-run Coefficients of Identified Leading Series of the Capital Markets

Having established long-run cointegration, the error correction model (ECM) is estimated to capture the adjustment dynamics of disequilibrium towards long-run equilibrium. With existing long-run relationships, there is a corresponding representation of the error correction measured by the error correction term (ECT). This means that variations in the dependent variables are a function of the disequilibrium level of the insisted cointegrating relationships and variations in the explanatory variable(s) (Sarkar, 2011:39). As a prerequisite, a significant p-value and a negative adjustment coefficient of the ECT are required pre-conditions for explaining short-run adjustments towards long-run equilibrium (Chipeta, Meyer & Muzindutsi, 2017:29). Upon presenting findings of the ECM in each overall models, this section also provides and discusses the results of the long-run and short-run coefficients only for identified and significant leading indicators of each respective capital market.

Based on Table 6.19 of the overall model of the LALSI and the leading BCIs (model 1), ECM results have a statistically significant p-value of 0.000 at 0.01 significance level, with a negative ECT (-0.29199). These results show a clear adjustment of disequilibrium towards long-run

equilibrium for the LASI and the leading business cycle series. Deductions can thus be made that disequilibrium between the cointegrated LALSI and leading BCIs is corrected at an error correction speed of 29.2 per cent per month. Also, in regards to model 2, which measures the adjustment period of the LALSI and overall series of the business cycle lagging indicators, there is a significant adjustment of errors between the overall model of LALSI and the lagging BCIs. Based on the coefficient of -0.2729, it can be deduced that approximately 27.3 per cent of disequilibrium in the model is corrected in each month.

Table 6.19: Long- and short-run results of identified leading indicators of the ALSI

	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
M*odel* 1: LLEI						
Adj- LLALSI	-0.292	0.056	-5.220	0.000***	-0.403	-0.181
LR						
LLEI3	-0.212	0.0883	-2.410	0.018**	-0.387	-0.038
LLEI8	-0.206	0.0939	-2.200	0.030**	-0.392	-0.021
LLEI9	0.061	0.0508	1.210	0.229	-0.039	0.162
SR						
LLEI3(-2)	0.069	0.0236	2.940	0.004***	0.023	0.116
LLEI8(-2)	0.138	0.0409	3.370	0.001***	0.057	0.219
LLEI9(-3)	-0.038	0.0098	-3.830	0.000***	-0.057	-0.018
M*odel* 2: LLAI						
Adj - LLALSI	-0.273	0.0532	-5.130	0.000***	-0.378	-0.168
LR						
LLAI4	3.533	1.2638	2.800	0.006***	1.033	6.032
LLAI6	-0.122	0.3211	-0.380	0.706	-0.756	0.514
SR						
LLAI4(-5)	-0.765	0.2782	-2.750	0.007***	-1.316	-0.215
LLAI6(-5)	-0.626	0.2455	-2.550	0.012**	-1.111	-0.140

Source: Author compilation (***Note:*** ****,** and * indicates significance levels at 0.01, 0.05 and 0.1, respectively*).

Results of the long-run coefficients in Table 6.19 show significant long-run relationships between the LALSI and the series LLEI3, LLEI8 and LLAI4. Thus, in the long-run, a one per cent increase in the series LLEI3 and LLEI8 will respectively lead to a decrease in the log of

the All-Share Index by 0.2124 per cent and 0.2063 per cent. Conversely, a one per cent increase in the series LLAI4 induces an increase in the log of the All-Share Index by 3.5325 per cent in the long-run. However, long-run findings for the LALSI and the series LLEI9 and LLAI6 were not significant.

Moreover, short-run estimations of the LALSI and all identified explanatory leading series were suggested to be significant. Positive short-run relationships were identified between the LALSI with the series LLEI3 and LLEI8, and negative with the series LEI9, LLAI4 and LLAI6. Therefore, a one per cent increase in the series LLEI3 and LLEI8 leads to an increase in the log of the All-Share Index by 0.0695 per cent and 0.1381 per cent, respectively. In contrast, a one per cent increase in the series LLEI9, LLAI4 and LLAI6 will respectively lead to a decrease in the log of the All-Share Index by 0.0375 per cent, 0.7653 per cent and 0.6257 per cent.

Furthermore, Table 6.20 presents results of the recognised significant leading indicators of the LALBI as well as the error correction adjustment estimations of the overall model for model 4 of the LALBI and business cycle leading series. Based on the findings, there is a significant adjustment ECT with a p-value below 0.01 and a negative coefficient (-0.4562). Meaning that approximately 45.6 per cent of the models' disequilibrium is corrected each month towards reaching long-run equilibrium.

Table 6.20: Long- and short-run results of identified leading indicators of the ALBI

	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
M*odel* 4: LLEI						
Adj- LLALBI	-0.456	0.065	-7.060	0.000***	-0.584	-0.328
LR						
LLEI5	0.094	0.047	1.980	0.049**	0.000	0.187
SR						
LLEI5(-5)	-0.025	0.008	-3.160	0.002***	-0.041	-0.009

Source: Author compilation (***Note:*** ****,** and * indicates significance levels at 0.01, 0.05 and 0.1, respectively*).

The only variable recognised to be a significant leading series for the LALBI was the series LLEI5. Results suggested that there are existing long-run and short-run relationships between the series LALBI and LLEI5. Therefore, in the long-run, a one per cent increase in the series LLEI5 leads to an increase in the log of the All-Bond Index by 0.0936 per cent, whereas, a one per cent increase in LLEI5 induces a decrease in the log of the All-Bond Index by 0.0250 per cent.

Table 6.21 shows results of the formerly established significant leading indicators of the LALCI and the error correction adjustment estimations of the overall models of Model 5 and Model 6 of the LALCI and the overall business cycle leading and lagging indicators. When it comes to the LALCI and the overall business cycle leading series, there is evidence of short-run adjustment towards long-run equilibrium based on the statistically significant p-value (0.0040) and the negative coefficient of the ECT (-0.1001). Thus, approximately 10.0 per cent of errors of disequilibrium in Model 5 is corrected in each month. Likewise, the significant p-value of 0.01 and negative ECT coefficient of -0.0884 implies that about 8.8 per cent of the disequilibrium is corrected each month towards reaching long-run equilibrium.

Table 6.21: Long- and short-run results of identified leading indicators of the ALCI

	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
***Model* 5: LLEI**						
Adj- LLALCI	-0.100	0.035	-2.900	0.004***	-0.168	-0.032
LR						
LLEI3	-0.418	0.203	-2.060	0.041**	-0.819	-0.017
LLEI7	-1.641	4.782	-0.340	0.732	-11.095	7.814
LLEI9	0.347	0.208	1.670	0.098*	-0.064	0.759
LLEI11	0.039	0.155	0.260	0.798	-0.266	0.345
SR						
LLEI3(-3)	0.016	0.014	1.180	0.241	-0.011	0.044
LLEI7(-2)	1.731	0.949	1.820	0.070*	-0.145	3.606
LLEI9(-1)	-0.031	0.013	-2.380	0.019**	-0.056	-0.005
LLEI11(-1)	0.081	0.041	1.960	0.052*	-0.001	0.163
***Model* 6: LLAI**						
Adj - LLALCI	-0.088	0.034	-2.600	0.01**	-0.156	-0.021
LR						
LLAI1	2.506	1.409	1.780	0.078*	-0.283	5.295
LLAI7	-4.057	2.315	-1.750	0.082*	-8.637	0.523
SR						
LLAI1(-1)	-0.186	0.091	-2.030	0.044**	-0.367	-0.005
LLAI7(-5)	1.052	0.344	3.060	0.003***	0.372	1.733

Source: Author compilation (***Note:*** ****,** and * indicates significance levels at 0.01, 0.05 and 0.1, respectively*).

In terms of the individually identified leading series of the LALCI, results reveal that the long-run encompasses significant relationships between the LALCI with the series LLEI3, LLEI9, LLAI1 and LLAI7. Thus, in the long-run, a one per cent increase in the series LLEI3 and LLAI7 is associated with a decrease in the log of the All-Commodity Index by 0.0410 and 0.0440, respectively, whereas, a one per cent increase in the series LLEI9 and LLAI1 induces an increase in the log of the All-Commodity Index by 0.3470 per cent and 2.5062 per cent, respectively. Long-run relationships with the series LLEI7 and LLEI11 were not significant. Moreover, short-run relationships were observed between the LALCI and the series LLEI7, LLEI9, LLEI11, LLAI1 and LLAI7. Accordingly, a one per cent increase in the series LLEI7, LLEI11 and LLAI7 respectively induce an increase in the log of the All-Commodity Index in the short-run by 1.7307 per cent, 0.0812 per cent and 1.0523 per cent. Conversely, a one per cent increase in the series LLEI9 and LLAI1 implies a decrease in the log of the All-Commodity Index by 0.0307 per cent and 0.1859 per cent, respectively.

Results of the formerly identified significant leading indicators of the LREER and the error correction adjustment estimations of the overall model of Model 8 and Model 9 of the LREER and business cycle leading and lagging indicators are presented in Table 22. In terms of the correction of errors, about 32.6 per cent and 41.7 per cent of disequilibrium in Model 8 and Model 9, respectively, is corrected each month towards establishing long-run equilibrium. In terms of the recognised individual leading series of the LREER, the series LLEI6 and LLAI7 were suggested to have existing long-run relationships with LREER. On this note, a one per cent increase in the series LLEI6 and LLAI7 induces a decrease in the log of the real effective exchange rate within the long-run. However, short-run relationships for both series LLEI6 and LLAI7 with LREER were revealed to be non-significant.

Table 6.22: Long- and short-run results of identified leading indicators of the REER

	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
***Model* 8: LLEI**						
Adj- LREER	-0.326	0.059	-5.510	0.000***	-0.443	-0.209
LR						
LLEI6	-0.012	0.006	-1.900	0.059*	-0.025	0.001
SR						
LLEI6(-3)	0.002	0.002	0.960	0.341	-0.002	0.006
***Model* 9: LLAI**						
Adj - LREER	-0.417	0.084	-4.990	0.000***	-0.582	-0.252
LR						
LLAI7	-0.549	0.314	-1.750	0.083*	-1.169	0.072
SR						
LLAI7(-5)	0.276	0.343	0.800	0.423	-0.403	0.955

Source: Author compilation (***Note:*** ****,** and * indicates significance levels at 0.01, 0.05 and 0.1, respectively*).

6.6 ESTABLISHING COMPOSITE LEADING INDICATORS OF THE CAPITAL MARKETS

Section 6.6 addresses the set empirical objective focused on providing composites of the formerly identified leading, lagging and coinciding indicators of each capital market, for each of the study's capital markets. Fulfilling this objective ensures that South Africa's respective business cycle indicators can particularly be justified as useful tools that can be used to explain behavioural patterns in financial markets. The use of statistical modelling with graphical illustrations presents a more comprehensive estimation than using the former in isolation. Charting, as a means of graphical illustration, is used in technical analysis to depict market prices and historical patterns in analysing chart patterns for future price predictions according to the extent to which they match (Leigh *et al*., 2002:155). Such features may include spikes, wedges, saucers, head-and-shoulders, pennants, flags, gaps, and various tops and bottoms (Park & Irwin, 2007:802). Parracho, Neves and Horta (2010: 2105) assert that patterns in market prices can report the projections of evolutions about the respective security.

This section shows that the identified leading variables can be collectively combined to form indices which foretell market performance as per turning points of the latter. The applied methodology in constructing the composite leading index of each market ensued that of South

African Reserve Bank (SARB) (Van der Walt & Pretorius, 1994), which is the official method used by the South African Reserve Bank in establishing composite indicators of the general business cycle. This method is similar to the approach used by The Conference Board (2001:47), but with minor improvements and adjustments. The year 2015 was underlined as the base year for each of the constructed indexes (2015 = 100).

From the constructed indices, the cyclical component of each time-series and their respective turning points were extracted to assess their relative performance based on descriptive assessments as presented in the figures that follow. The cyclical components and turning points of the capital markets and the leading series were retrieved from Rstudio. The resulting variables were aggregated cycles retrieved from the HP-filter with prior cleaning of each series. In the figures that follow, all prime turning points of the indicator and the reference cycle series were identified characterised by cyclical peaks and troughs.

Figure 6.2 undelines the price units of the capital market index on the y axis based on the identified x axis periods of the turning points of the All-Share Index and the established composite leading indicator index. The paired consecutive colour signals indicate the direction of up or down turning points in both the input and output series. In Figure 6.2, the leading series was able to lead turning points of most cycles of the All-Share Index for the period. In other words, most turning points or fluctuations in the leading series occurred before those of the All-Share Index following consistently similar patterns. The arrows, based on the same colour coordination, are indicative of the flow of direction of turning points in the two series. Subsequent downturns (upturns) in the leading series ensued a downward (upward) pattern in the All-Share Index. This means that identified composite leading series can provide significant signals of South Africa's All-Share Index. A noticeable feature amongst the two series is that the turning points of the leading index appear to be relatively more volatile than the All-Share Index as of the average period.

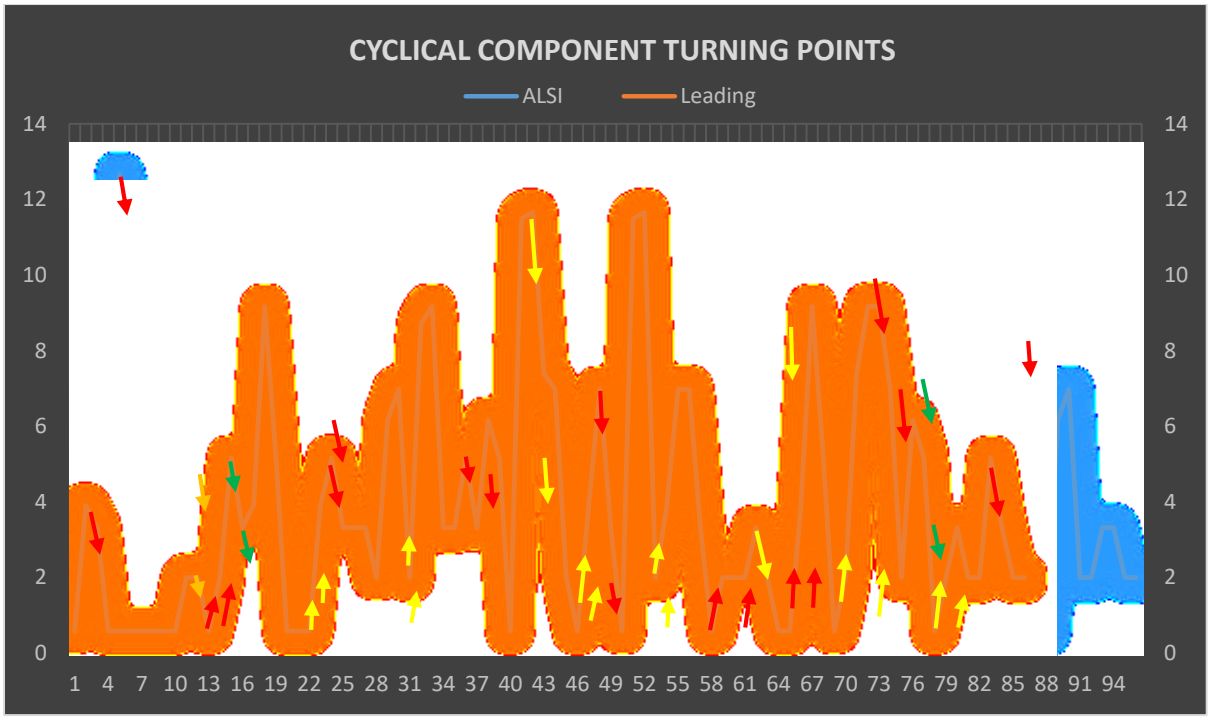


Figure 6.2: Turning points of the All-Share Index and the constructed composite leading indicator index (2015 = 100)

Source: Author compilation

The subsequent y axis in Figures 6.3 to 6.5, also denote the price of the respective turning points of the designated capital maket, accompanied by the turning point periods represented on the x axis. Represented in Figure 6.3 are the turning points of the All-Bond Index and the constructed composite leading index with paired consecutive colour signals indicative of the direction of up or down turning points in both the input and output series. Figure 6.3 provides evidence that the constructed index of the leading series identified for the All-Bond Index is able to provide signals of the latter based on, for the most part, the consistent maximum and minimum turning points of cycles in the All-Bond Index. This justifies that business cycle behaviour can foretell the capital market movements of the All-Bond Index. Notwithstanding, only a single component business cycle indicator was identified as having significant leading properties of the All-Bond Index. To heighten the capacity of the identified leading indicator in leading market signals of the All-Bond Index, more series can be extensively scrutinised to boost the strength of the index. On average, turning points of the leading index consequently appears to be a great deal more volatile than the All-Bond Index as exhibited in the larger size in its observed fluctuations.

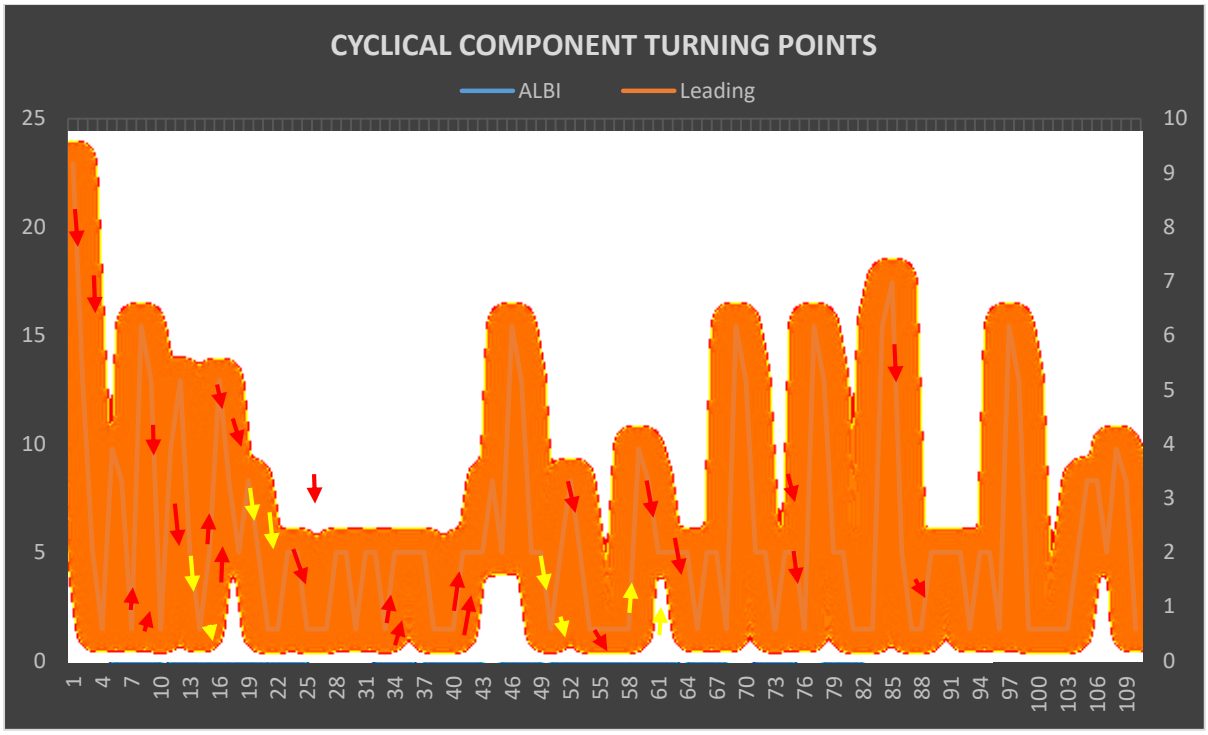


Figure 6.3: Turning points of the All-Bond Index and the constructed composite leading indicator index (2015 = 100)

Source: Author compilation

Figure 6.4 also shows that the leading indicator index identified for the All-Commodity Index exhibits leading minimum and maximum turning points, which suggest alike movements in the All-Commodity Index. These signals are evident across the sample period relative to detected turning points in each series. This evidence shows that some components of the business cycle have properties to lead financial market series, specifically the All-Commodity Index in this case. Thus, business cycle component series indicators can, as relates to the currently identified and constructed index, can be useful in interpreting market performance. Relatively, turning points in the All-Commodity appear to be more volatile than those of the established leading index based on the average period.

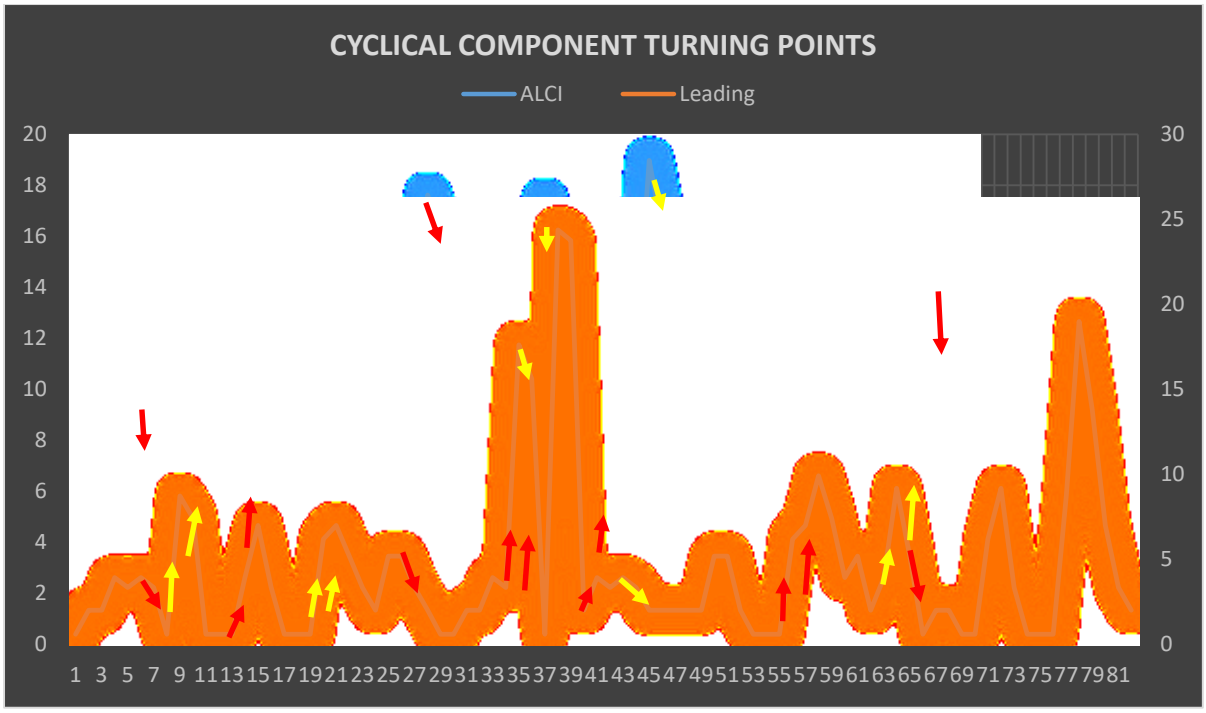


Figure 6.4: Turning points of the All-Commodity Index and the constructed composite leading indicator index (2015 = 100)

Source: Author compilation

Lastly, the graphical demonstration represented in Figure 6.5 illustrates the real effective exchange rate and it's identified leading index constructed from individual series with leading properties. Accordingly, Figure 6.5 suggests some commonality in turning points of the two series. Turning points of the real effective exchange rate tend to ensue those of the leading indicator series across the period, displaying some relatively consistent patterns. Thus, observing the behaviour of the constructed business cycle index can be crucial for maintaining currency soundness and stability. Over the course of the period, the compiled leading index is suggested to be more volatile than those of the real effective exchange rate.

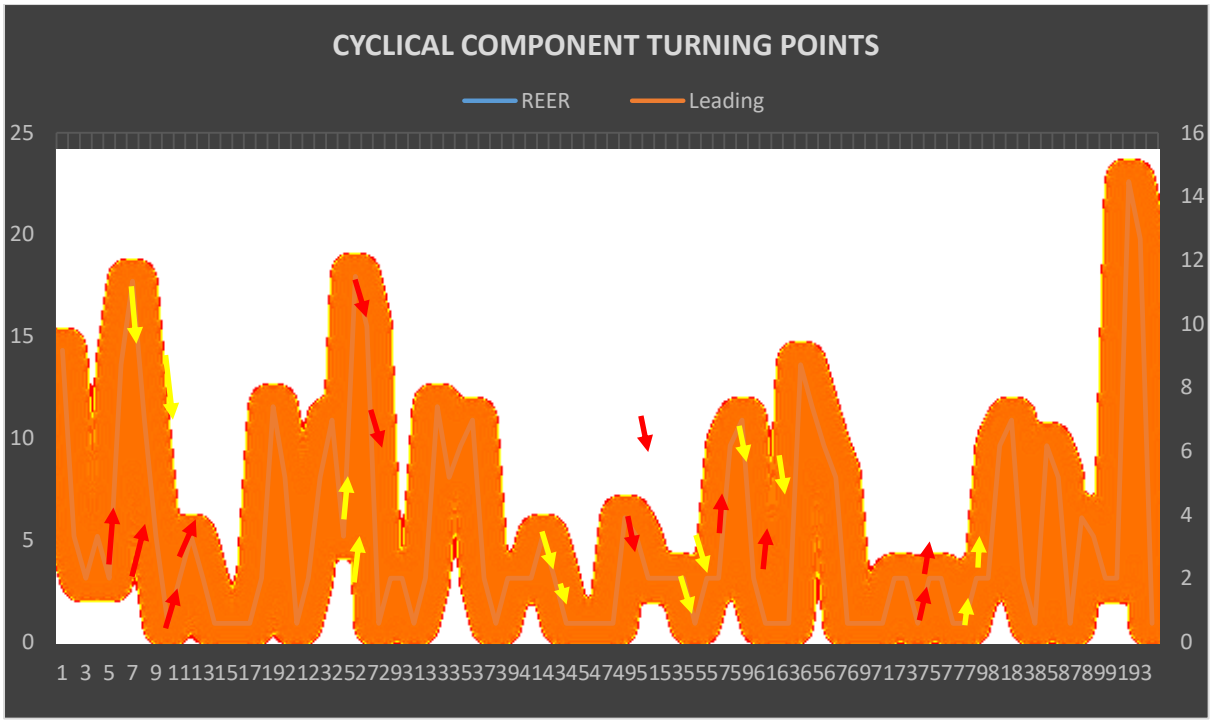


Figure 6.5: Turning points of the real effective exchange rate and the constructed composite leading indicator index (2015 = 100)

Source: Author compilation

6.7 DISCUSSION OF RESULTS

Business cycle component series, or simply fundamentals (Regressors), were tested against segments of the capital market (Regressands) to ascertain their potential in providing signals of the latter. This was specific to their identification under the nature of the three main types of indicators (leading, lagging and coincident). The accompanying methodology was based on the works of Kydland and Prescott (1990), Bergman *et al*. (1998), Gavin and Kydland (2000)), Izani, Raflis and Cheomar (2004), as well as Burger (2010). Methodological frameworks included the cross-correlation tests (as a post-estimation to ARIMA modelling), Granger causality, variance decomposition, as well as the GARCH and ARDL models. Graphical patterns or charts were further presented to provide representations of the constructed indexes in order to justify the usefulness of the indices. Under the scope of theoretical discourses behind the traditional (classical) and behavioural finance theories, the study provides reassurance that South Africa's market trajectories exhibit some form of predictability as empirically proven. Despite not being able to predict the price itself, findings show the ability to predict the direction of capital market prices. Thus, a general consensus can be reached that turning points

in macroeconomic indicators or business cycle series are closely related to financial or capital market cycles.

As established, the selection of various individual indicators to form a common aggregate series is necessary to project a more coherent reflection of movements in the reference cycle, as similarly shown by Canova (1999), Venter (2005a), Van Ruth (2010), Bujosa, García-Ferrer, De Juan and Martín-Arroyo (2018). The constructed aggregate or composite leading indices show that such series fairly explain the gaps in turning points of capital markets as movements in the former tend to precede those of the capital markets. Nevertheless, these findings are in contrast with the preceding and prime assertions of the traditional neoclassical finance theory. Under the efficient market hypothesis (EMH), Malkiel and Fama (1970) purported that prices fluctuate randomly; they incorporate all market information and are accurately valued, thus making them impossible to predict or to attain abnormal profits based on historical information (Del Águila, 2009:52). Established results revealed, in part, a fair degree of predictability of capital markets based on the use of input variables or indicators in contrast to the projected random walk behaviour of market series as declared by the EMH. Such findings under EMH would not be possible as historical information is publicly available and reflected in market prices, making it futile to predict (Illiashenko, 2017:44). Wright, Smithers, Warburton, Pepper, Goldberg, Brodie, Riley and Napier (2013:36) underscore that an indicator of value should be able to say something, however not too much, concerning prospective returns of security prices. To be considered a useful indicator of value, it must assist in forecasting future movements.

Contrary to the projected efficiency of markets by the EMH, Glaser (2004:4) purports that market anomalies which secure the predictability of prices and returns based on specific or event-based forecasts can translate from wrong asset pricing models or inefficiencies, where event-based forecasts can be advanced through earnings announcements or stock splits. Glaser (2004:4) also highlights that a body of research exists which document that markets can be predicted based on input series which exhibit positive or negative autocorrelations of short-term returns. Decision-makers' bounded rationality-induced cognitive errors or biases within behavioural finance theory are responsible for anomalies and irregularities in financial markets which present seasonal cycles, bubbles, turbulence, and predictable trends (Thomaidis, 2004:2).

Abu-Mostafa and Atiya (1996) emphasised this notion that existing autocorrelations and price trends are amongst the main pieces of evidence against the EMH of the traditional neoclassical

theory. For this reason, theoretical and empirical arguments against the EMH has resulted in the shift of focus towards behavioural and psychological elements of market participants from the EMH (Naseer & Bin Tariq, 2015:48). Unlike the traditional neoclassical theory, behavioural finance recognises that the behaviour of market participants is systematic and can, therefore, be modelled (Jolls, Sunstein & Thaler, 1997:1475; Birău, 2012:48; Illiashenko, 2017:30). Rachev, Stoyanov, Mittnik, and Fabozzi (2017:20) also underscore that differing conditional variances relative to the event ensue that a positive fraction of market returns can be forecasted, deeming markets as inefficient. Willman, O'Creevy, Nicholson and Soane (2001:906) make a case that traders do possess perfect information and financial markets are not perfect.

For the All-Share Index, established findings resonate with those presented in the formerly assessed literature, specific to Bilson *et al*. (2001), Glen (2002), Ritter (2005), Ikoku (2010), and Tripathy (2011) for developing countries. As well as Gjerde and Saettem (1999), Dritsaki (2005), Leon and Filis (2008), Chen (2009), and Hsing (2014), when it comes to developed countries. Numerous findings deployed for some developing and developed countries have shown that macroeconomic variables or fundamentals are correlated and cointegrated with stock market movements in these countries. Looking at the causal adequacies of certain component series, Ikoku (2010) also points to the causal properties for fundamentals such as GDP in causing movements in Nigeria's stock market, with a corresponding bidirectional relationship. Amongst the twenty-three variables obtained from South Africa's official component business cycle series, only the variable "Gross operating surplus as a percentage of gross domestic product" was indicated as not having led, coincided or lagged with movements in the All-Share Index. This is similar to findings by Errunza and Hogan (1998), as well as MacFarlane (2011), who found that pass information in macroeconomic variables was not successful in explaining stock market performance, respectively for the UK, Belgium and Switzerland, as well as for South Africa.

In the context of the All-Bond Index, only one series, "index of commodity prices (in US dollar) for a basket of South African-product export commodities", was conveyed as a significant leading indicator of the All-Bond Index. Eight of the remaining variables were lagging series and ten of the variables were coinciding indicators. In terms of such findings, previous empirical findings in developing countries, spearheaded by Cavallo & Valenzuela (2010), Chowdhury *et al.* (2013), Naidu *et al*. (2016), Nkwede (2017) and Suriani *et al*. (2018), concur with this study's findings on the predictive and interactive nature of economic fundamentals

towards the bond market. These results are also reassuring for developNietong nations as empirically shown by Ludvigson and Ng (2009), Costantini *et al*. (2013), Nieto *et al*. (2015), as well as Francová (2018). Consequently, amongst the twenty-three component business cycle series, about five indicators were not revealed as successful to explain the performance in South Africa's All-Bond Index. Such series included "interest rate spread: 1-year gov bonds less 91-dat treasury bills", gross operating surplus as a percentage of gross domestic product, total formal non-agricultural employment, "nominal labour cost per unit of production in the manufacturing sector: percentage change over twelve months" and the predominant prime overdraft rate of banks.

Moving on to the All-Commodity Index, only three component variables were found to be non-significant to fit into categories of leading, lagging or coinciding series. Specifically, the included series were "composite leading indicator of South Africa's major trading partner countries: percentage changes over twelve months", the value of non-residential buildings completed at constant prices and the "nominal labour cost per unit of production in the manufacturing sector: percentage change over twelve months". Just as much, Schaling *et al*. (2014) and Jena (2016) also showed that certain macroeconomic variables showcased no long-run linkages and generally cointegrated with commodity prices. In Jena's (2016) case, South Africa's exchange rate showcased no cointegration with the metal price index. Notwithstanding, about six leading, five - coinciding and nine - lagging series were revealed, with long- and short-run cointegrated estimations for some. These results resonate with findings by Yin and Han (2016), Li *et al*. (2017) and Bangara and Dunne (2018) for developing countries, as well as Frankel and Rose (2010), Karali and Power (2013), and Smolík *et al.* (2015) for developed countries.

Lastly, current findings showed that all the component business cycle series were revealed to be suitable indicators for South Africa's real effective exchange rate in serving as the respective leading, lagging and coinciding series. Specifically, two - leading, ten – coincident and eleven – lagging indicators were recognised for the real effective exchange rate. The long- and short-run linkages were observed for at least most component indicators with the real effective exchange rate. The results resonate with findings established in Pakistan, Turkey, and India, by Kibritcioglu *et al*. (2001), Mirchandani (2012) as well as Raza and Afshan (2017), in light of developing nations. Results also corresponded with findings established by Finnerty *et al.* (1987), Stancık (2006), Yuan (2011), as well as Palombizio and Morris (2012) in the context of developed countries.

The gaps in capital market segments can be explained by the respective business cycle component series, idiosyncratic to each market. This means that in terms of the identified business cycle component series, and subsequently each of the constructed composite leading indices, the latter tends to explain the consecutive turning points in capital market segments. There are also projected long-run and short-run relationships for most of the identified leading, lagging and coinciding series as revealed by cointegration estimates. The observed leading series of the capital makets are crucial in the prior identification of erratic capital market behaviour for the maintenance of market stability together with the provision of investment sureity or confidence, including good enterprise and or institutional performance using relevant macroprudential tools.

6.8 SYNOPSIS

This chapter provided the empirical results on the concordance, causality, cyclicality, conditional variances and the long- and short-run relationships of the stock, bond, commodity and exchange rate market with individual series of the composite BCIs. The study revealed existing relationships between the aforementioned, and most of the series of the BCIs were identified to have leading, lagging and coinciding properties with segments of the capital market. The identified leading variables of each capital market were technically tested using graphical charts through the dating of turning points of the leading established composite index of each leading series for each capital market. The findings proved to be satisfactory and were in line with previous studies which identified existing relationships between the two classifications of variables. Established findings are paramount to the assessment of business cycles and the financial market by scholars, traders or investors, market analysts, and policy makers from both fiscal and monetary avenues. Chapter 7 provides a conclusive outline of the established key findings as propelled by the study objectives. This chapter also presents summaries and insights on key contributions as well as policy and overall recommendations that can be drawn based on the above findings.

CHAPTER 7: SUMMARY, RECOMMENDATIONS AND CONCLUSION

7.1 INTRODUCTION

The present study scrutinised the concordance, co-movement, conditional variances and interrelationships between South Africa's capital markets and the various individual component series of the composite business cycle indicators (BCIs), where the latter is specifically identified as the official leading, lagging and coincident series of South Africa's business cycle performance. The set primary objective of examining the capacity of threshold BCIs to either lead, lag or coincide with heterogeneous capital markets together with the underlining theoretical and empirical objectives spearheaded the study analytics and estimations. In so doing, the time horizon constituted 174 monthly observations for each of the series in the dataset along the period ranging from June 2003 to November 2017. Capital market series were accordingly held as dependent or output variables, whereas, individual subcomponent series of BCIs were considered to be study regressors or input series. The cross-correlations test, Granger causality test, variance decomposition, ARDL models, together with technical charts, were utilised as econometric test and models paralleled by the set empirical objectives. Estimated models were tested based on transformed natural logarithms of each individual variable of the input and output datasets. This chapter provides a summary of the study, an indication of how the objectives of the study were reached, the contribution of the study, limitations of the study and avenues for further research, as well as recommendations and the final concluding remarks.

7.2 SUMMARY OF THE STUDY

Literature (OECD, 2017; Menon, 2018) suggests that South Africa arguably has one of the most, at least if not the most diversified, deepest and developed financial markets in Africa, accompanied by its relatively advanced financial systems, institutions and processes. Such an assertion is re-enforced by the country's relatively strong financial market infrastructure including a sound legal framework (Mtongana, 2018). Notwithstanding its deteriorating macroeconomic outlook, the country was deemed the second-largest African economy in 2018, while occupying the third position in 2019 behind Nigeria and Egypt (PWC, 2018:14; U.S.News, 2019). According to the "Absa Africa Financial Markets Index 2018", South Africa's financial market overtook the rest of the African countries while clinging on to a top position as per set criteria (ABSA, 2018). On a global spectrum, the country's financial system

ranked 18th, while its market size took the 35th position as of the "Absa Africa Financial Markets Index 2018" (Brand South Africa, 2019).

The SARB (2018:3) purports that strong linkages exist between the real economy and financial stability. Thus, the general consensus is that foundations of sustainable economic growth prospects can be provided by a stable financial system, and vice versa, where real economic developments have the potential to affect financial stability. On this accord, the present study sought to identify the usefulness of macroeconomic variables as potentially significant tools for gauging financial market performance. More specifically, the study gravitated towards analysing whether South Africa's macroeconomic or subcomponent series of composite BCIs have the capacity to lead, lag, or coincide with the stock or equity market, bond market, commodity market, and the exchange rate or currency market. Any plausible predictive or interpretive capabilities of business cycle indicators on capital market movements to optimise further understanding of financial market trends for real and financial market stability.

Key empirical objectives were set, therefore, which constituted: 1) examining BCIs' explanatory power towards interpreting the various capital market segments in serving as either leading, lagging, or coinciding signals of the stock, bond, commodity and exchange rate markets; 2) the establishment of the cyclical nature of BCIs in terms of their pro-cyclicality, counter-cyclicality or acylicality with the capital market segments; 3) the modelling of volatility of the equity, bond, commodity and exchange rate market on South Africa's BCIs; 4) the analysis of interplay between BCIs and the stock, bond, commodity and exchange rate market; 5) the provision of indices for likely signals capacitated to lead, lag or coincide with their respective capital markets segments; and 6) the establishment of whether established leading series can explain the performance of turning points in the capital market segments.

Accordingly, the study subsequently comprised the following structure: **Chapter 1** contextualised the background of the study's focus. It provided a footprint and mapping of the study's conceptual and empirical foundations. The chapter also highlighted the problem statement relating to the issues that engineered the undertaking of the underlying topic. Amongst the key and critical issues were the maintenance of market and economic stability in preventing economic and social disruptions such as those witnessed by the 2007/08 World Financial Crisis. Moreover, **Chapter 2** presented an analysis of relevant literature pertaining to the financial and macroeconomic behaviour represented within traditional and behavioural financial theories, as well as macroeconomic theory. The theories were underpinned by the discourse on the predictability of market behavioural patterns as well as the interlinks between

the financial market and real-side of the economy. The chapter also provided definitions and concepts pertaining to the financial market and macroeconomic environment. Furthermore, **Chapter 3** examined the trends and policies specific to South Africa's financial market and macroeconomic environments. The chapter shed lights on South Africa's financialisation processes as of the pre-and post-apartheid periods. The financial market policy was discussed relative to South Africa's capital market regulatory legislation. An analysis of the macroeconomic environment was provided focusing on the composite leading, lagging and coinciding business cycle indicators, the performance of the country's economic growth during the different presidential offices, the CPI, and unemployment trends. **Chapter 4** made a contribution to the extant literature by presenting the empirical findings of the interrelationships between macroeconomic variables and the various capital markets. Such an analysis was undertaken by exploring empirical insinuations of pre-existing findings pertaining to relationships between economic or real-side indicators with the capital market's four primary markets, particularly, the stock, bond, commodity and exchange rate markets. **Chapter 5** indicated the methodological structures of the study which encompassed the used dataset and the myriad forms of modelling techniques. This constituted issues such as the nature of the data and its underlying period which was considered, including the sources of the dataset. Discussions on the modelling techniques involved those of the cross-correlations test, Granger-causality, variance decomposition, the GARCH model, and the ARDL model. **Chapter 6** underscored the application of the set methodological structure in providing the econometric analysis and interpretation of revealed findings in light of the foregoing literature and insights as established in the previous chapters.

7.3 REALISATION OF OBJECTIVES

The following section conceptualizes the synopses of the objectives associated with the study and how they were achieved.

7.3.1 Primary objective

The study's primary objective underpinned the analysis of the capacity for South Africa's subcomponent series of the composite BCIs to lead, coincide or lag with the various capital market segments. In order to address this objective, pertinent theoretical and empirical objectives were undertaken based on relevant steps.

7.3.2 Theoretical objectives

Provision for the understanding of relevant concepts and knowledge base concerning the primary objective and the research problem was undertaken based on the usage and analysis of useful theoretical and literature foundations. Such forms of analysis were driven by the analysis of relevant theoretical objectives which echoed the theoretical aspect of the primary objective. A structured outline and discussion were applied in the various chapters in order to accomplish the fulfilment of the theoretical objectives as subsequently underscored by the following bullet points.

- ***To provide a conceptual distinction of the financial market's capital and money markets, as well as the underlying definitions and concepts of the various capital market segments (the stock or equity market, the bond market, exchange rate market and the commodity market).***

To fulfil this objective, Section 2.2 of Chapter 2 provided a conceptual foundation of the definitions and concepts pertaining to the financial market and its prime components. Distinctions between the money market and the capital market, as the main financial market components, were made with respect to their primary functions. The maturity of financial claims and obligations appeared to be a common frame of distinction, where the money market was underlined as being characterised by short-term security trades. Meanwhile, the capital market was identified as being characterised by the long-term trading of securities. For the purpose of the study, the focus was on capital markets, in line with direct and indirect financing within primary and secondary markets, whilst underlining some of its major components with emphasis on the stock, bond, commodity and exchange rate markets. Chapter 2 also provided an overview of the four important primary markets of the capital market by underlying their functionality and operative conceptual structures. The specified components of the capital market were selected as the basis for gauging and identifying the likely capacity for South Africa's individual component series of the composite BCIs to explain movements in the financial market's capital market.

- ***To review the potential criteria for identifying economic factors as suitable indicators.***

In order to consider the likely capacity for specific time series to form as indicators or significant explanatory variables of South Africa's capital market, Section 2.2.3 of Chapter 2 and Section 5.2.2 of Chapter 5 analysed the criteria for the selection of legitimate indicators based on specified properties. The utilised component series of the composite BCIs collectively fulfilled the prescribed requirements of the criteria, further justified by their capacity to be

utilised as South Africa's official economic indicators. Such properties involved the need for the indicator series to have conformity with the target series and good forecasting properties, must be extensive, continuous, up to date, timely, and portrays economic significance, is readily available with consistent timing in anticipating the target variable's turning points, and need to be smoothed. Relevant steps involving the cleaning and filtering of the series were adapted to each of the series to secure the absence of likely distortions within each of their patterns.

- ***To provide theoretical underpinnings of business cycle definitions and concepts.***

The study provided a conceptual analysis covering the definitions and concepts of the business cycle or macroeconomic factors. Section 2.3 of Chapter 2 delved into the various characteristics of the business or economic cycle, hinging on the myriad forms of cyclical phases specific to the expansion, peak, contraction and trough. Discourse on the insinuations of recessions and recoveries were also discussed in the context of the various economic indicators underlining the leading, lagging and coinciding indicators. The literature survey also discussed the purported associations and causes of the business cycle pertaining to Econo-rhythms and endogenous factors. The former posits that the business cycle phenomenon is that of continuous rhythmic movements in macro-economic magnitudes where the upper (the downturn) and lower (the upturn) turning points are considered endogenous, whereas scholars who align the business cycle to monetary disequilibrium consider the business cycle as an exogenous phenomenon. Section 2.3 also shed light on the approaches to business cycle analysis underlining the various methods of gauging the concordance of business cycles. These techniques were noted as being a collection of methods such as correlations analysis and the dynamic factor model. Various forms of business cycles were highlighted, ranging from short-term cycles, long waves, and economic growth cycles by which their differences are characterised by their duration.

- ***To establish a conceptual analysis of economic theory relevant to business cycles and financial cycles.***

This objective led to the analysis of traditional (neoclassical) and behavioural finance theories. These theories shed light on the contextual assumptions brought forth by main proponents of each of the two centres and foundations of research specific to how economic agents or participants behave and the choices they make based on available information. The traditional financial theory ascribed to the prime assumption that all individuals are at least perfectly rational and all information is actively made readily available to them thus making it impossible

for anyone to beat the market, or at least make abnormal profits. Salient to these assertions is the notion that consumers always obtain maximised utility, or that companies always attain maximum profit within an efficient financial market or processes where security prices mirror all available information.

However, behavioural finance refuted these notions by arguing that markets are exposed to frictions which impede the rationale of traditional finance. Specifically, individuals are exposed to underlying constraints exhibited as decision-making errors or the failure of making perfectly rational decisions. It argues that individuals tend to experience bounded rationality as their level of rationality is limited to their cognitive functions amid limited time to process available decisions in making the supposed "rational decisions". Also, the behavioural finance theory argues that traditional theory to finance does not consider the market's vulnerability to aspects of "insider information" which an array of decision-makers may not be exposed to. Other financial market anomalies and frictions may occur in the form of market disruptions such as market underreaction or overreaction and market bubbles.

Moreover, the study drew on various macroeconomic theories that cover the dynamics of the macroeconomic or business cycle dynamics. Section 2.6 sought to explain the characteristics and causes of business cycle recessions and expansions, together with the critical argument of whether they are systematic or random. Research paradigms, such as the market-clearing model is used by New Classical proponents in explaining and understanding the business cycle, whereas the New Keynesian economists relate fluctuations in the business cycle to heterogeneous market failures. Intertemporal disequilibrium, on the one hand, is used by Austrians to analyse the business cycle. Causes of business cycle expansions and recessions, and whether they are random or systematic, remain an arguable matter. Institutionalists and post-Keynesians both believe conditions which lead to downturns are created by upturns. For Austrians and Neoclassicalists, economic expansions could constitute a continuous outlook with the condition that there is an absence of misguided policy decisions and exogenous shocks. Financial market frictions are a cornerstone of Austrian business cycle theories, labour market frictions within classical theories, and product market frictions for Keynesian based business cycle theories.

- ***To review literature and empirical findings on the relationships between BCIs and the equity market, the bond market, exchange rate market and the commodity market.***

The undertaking of this objective was achieved in Chapter 4 of the study. The chapter attempted to elucidate existing empirical observations relating to the interlinks between economic

indicators with the capital market's equity market, bond market, exchange rate market and the commodity market. Studies on both developing and developed countries were scrutinised to identify potential reoccurring patterns of results in explaining the findings exhibited within the present study. The study's empirical analysis of existing literature established no distinctive sequence of results for the underlying studies that were analysed among developing and developed countries, whereas, most economic indicators were revealed to have showcased existing interrelations between economic indicators and the capital market segments, with the exception of a few indicators within specific countries.

- ***To review the policy insinuations of the financial market environment and the historical performance of financial market cycles relative to BCIs.***

This objective was fulfilled in Chapter 3 of the study. In Section 3.4, a theoretical analysis of South Africa's financial market policy insinuations was presented. South Africa's financial market policy has translated from being characterised by high state intervention following the pre-democratic era to a more liberalised economic and financial system and market during the post-apartheid regime which has witnessed relatively high financialisation processes. It is argued that it is because of such neoliberal and financialisation stances that the country's inequality has widened. Having come from a sanctioned apartheid economy, the country has, however, witnessed an increase in market liquidity in the form of growing levels of short-term portfolios since its reintegration with the global economy, shifting from a net lender to a net borrower.

The regulatory authority for the Financial Markets Act (FMA) 19 of 2012, in terms of the Financial Sector Regulation (FSR) act, is regarded as the Financial Sector Conduct Authority (FSCA), whereas, the primary regulation of financial markets, market infrastructure and securities services, are governed by the FMA. Amongst other functions, the role of FMA is ensuring that markets operate efficiently, fairly and transparently as to mitigate systemic risk, encourage investor confidence and promote the international competitiveness of the country's securities services, while, the regulation of South Africa's financial markets involves a balance between too little and too much regulation.

7.3.3 Empirical objectives

The study proceeded with the estimation of empirical objectives as a means of achieving the empirical aspect of the set primary objective. Chapter 6 presented an analysis of the various empirical elements envisaged by the empirical objectives following the outlined

methodological mapping established in Chapter 5. The empirical objectives of the study were laid out as follows.

- ***To examine the capacity of BCIs in explaining capital market segments or, more simply put, whether BCIs lead, lag or coincide with the capital market's stock or equity market, the bond market, exchange rate market and the commodity market. This objective sought to determine whether BCIs are suitable gauging indicators and predictors of South Africa's capital markets.***

This objective was achieved based on a myriad set of econometric tools and tests and presented executed in Section 6.3 of Chapter 6. To identify the subcomponent series of the composite BCIs as leading, lagging or coinciding indicators of the stock, bond, commodity and exchange rate market, the Granger causality test and cross-correlations test were executed concurrently. Prior decomposition of the dataset was performed in order to ensure that the time-series were clean, filtered and free from potentially existing distortions. As a means of prewhitening the series, the Autoregressive Integrated Moving Average (ARIMA) model was used on the cyclical component of each time-series pre-filtered or isolated using the Hendrick Prescot (HP) filter. Additional econometric testing of the study involved the analysis of variance decomposition to investigate the contribution of the variance of identified potential indicators towards the variation in each of the capital markets as target variables.

For the stock or equity market, five indicators of the individual subcomponents of the composite BCIs have been identified as leading indicators of the stock market; four were coinciding indicators and thirteen were lagging signals. In light of the position of the bond market, one series was a leading indicator, ten were coinciding indicators and eight were lagging indicators. Moreover, six of the subcomponent series were leading indicators of the commodity market, five were coinciding indicators, and nine were lagging signals. Lastly, two of the composite BCI individual series were leading signals of the effective exchange rate index, ten were coinciding indicators and ten were lagging indicators. The series identified as leading signals of respective capital market segments were tested for variance decomposition and each of the variables was revealed to possess, at least, explanatory power in explaining the variation in the capital market segments.

- ***To establish the relative nature of cyclicality of BCIs to capital market segments. Cross-correlation signals were utilised in identifying series as pro-cyclical, counter-cyclical or acyclical.***

Cross-correlations signals were used to identify series as pro-cyclical, counter-cyclical or acyclical. This objective was addressed under Section 6.3.2 of Chapter 6. The signs of the cross-correlations indicated designated forms of cyclicality between the explanatory series and the target variable. Pro-cyclical series exhibited a positive cross-correlations sign of each coefficient value and were understood as ideally displaying resembling patterns between the variables. Component series with negative cross-correlations coefficients had an inverse relationship with reference series and were considered as counter-cyclical. Results that displayed no definitive cross-correlations pattern between the component and reference series suggested that the relationship or patterns were acyclical. On that note, the nature of cyclicality attested to the behaviour by which individual component indicators of the composite BCIs tend to fluctuate what is positively or negatively correlated with each capital market.

- ***To model the volatility of the equity, bond, commodity and exchange rate markets on South Africa's BCIs.***

The underlying objective assisted in analysing the relative price volatility of South Africa's capital markets in accordance with the various BCIs and was achieved in Section 6.4 of Chapter 6. The Generalised Autoregressive Conditional Heteroscedasticity (GARCH) process paved the foundation for establishing the results of such an objective. As such, it was found that the identified leading component series of the various capital markets are characterised with patterns displaying similar conditional variances as those of the capital markets. Results revealed significant volatility in the conditional variances for the leading indicators and the capital markets as displayed by the observed and similar volatility chart patterns.

- ***To analyse the interrelationships or interactions of BCIs and the equity market, the bond market, the exchange rate market and the commodity market.***

The corresponding objective was addressed in Section 6.5 of Chapter 6 and assisted in highlighting the associated short-run and long-run dynamics of South Africa's BCIs and the equity market, the bond market, exchange rate market, as well as the commodity market. The study sought to achieve this objective through the analysis of the Autoregressive Distributed Lag (ARDL) model. As such, long-run and short-run relationships were observed for most leading indicators to which leading properties were identified for respective capital markets. These results reiterated the findings provided by the cross-correlations, Granger causality and variance decomposition analyses. Major deductions can be made that the observed leading series of the BCIs for each capital market hold predictive capacity in explaining South Africa’s capital market segments.

- ***To provide indices of identified leading indicators for the respective capital market segments by selecting the most significant indicators.***

This objective was relevant in order to identify suitable and relevant indicators to be utilised for the development of the leading indices of each capital market. Accordingly, the observed leading variables were grouped to form indices of a single leading series for each capital market to be later tested using chart analysis as compiled and displayed in Section 6.6 of Chapter 6. The method used to oversee this undertaking was based on the method used by the South African Reserve Bank (SARB) (Van der Walt & Pretorius, 1994). This method is similar to the one used by The Conference Board (2001:47), but with minor improvements and adjustment, and it is the official method used in establishing composite indicators of South Africa's general business cycles.

- ***To establish whether South Africa's leading indicators are able to explain future movements or behaviour of the respective capital market segments.***

This objective assisted was formalised in order to relax South Africa's financial market uncertainty for enhanced investor decision-making with reference to the real sector or business cycle performance. This objective was achieved through char turning points of the constructed composite indices versus those of the capital market movements and was conducted in Section 6.6 of Chapter 6. Charting, as a means of graphical illustration, is used in technical analysis to depict market prices and historical patterns in analysing chart patterns for future price predictions according to the extent to which they match.

7.4 CONTRIBUTION OF THE STUDY

The 2007-2008 financial crisis, amongst others, revealed some of the critical and vulnerable effects of market disruptions, detrimental to not only the financial system but because it can crowd-out into the real sector with potentially adverse ramifications. The financial market has proven to be a highly volatile environment and acquiring increased knowledge on its behavioural patterns can help curb some of its potential threatening impacts within the social, political and economic stratospheres. The present study provides a body of critical knowledge into market dynamics and bridges the debate on associated interlinks between the real and financial sector interdependencies. In its own merits, the study's findings provide a practical monument to the formally purported advances within literature upheld by scholars such as Bowyer (1967:457-481) and Brealey (1969:34-35), as well as Latane and Tuttle (1970:293-302). These scholars made initial but cautious references to the likely utilisation of some of the leading economic signals for capital market prices.

The study has shown that the real sector or purely economic time-series signals can be of crucial importance into understanding the random, structural or systemic dynamics of South Africa's capital markets. Such knowledge provides clarity and insight for market participants and monetary policy practitioners to avoid potential oversights based on the applications of more prudential decisions or policies. The study revealed that economic datasets specific to the business cycle can be crucial signals for the direction of capital market turning points. For time-series such as the stock market, which can be considered as leading indicators of economic patterns, the study has shown that since the lead time amongst variables tend to differ, time-series characterised by extended lead times hold the potential to foretell alternative leading signals' turning points with shorter lead times. Economic indicators with potentially longer lead times can thus potentially be used to predict movements in capital markets with shorter lead times (Moolman & Jordaan, 2005:68-78).

Moreover, the use of a single series in predicting or explaining signals of other time-series can prove to be misdirecting; rather, using a more diffused composition of series which contain extended information about the market and the general economy can be seen as a safer route. The study presented indices of South Africa's stock, bond, commodity and exchange rate markets based on the composition of the composite BCIs' subcomponents. While incorporating extensive market and economic information, these indices provide a fair analysis and interpretation of capital market movements based on their significant role in explaining overall economic patterns.

The study also provides important conclusions and lessons upon which market speculators, traders or investors, businesses, government and monetary policy practitioners, as well as market analysts and scholars, can draw timely and decisive planning strategies based on the use of leading variables. Such information would assist in the avoidance of adverse and unforeseen disruptions to the market by market participants, including the extreme loss of investment funds by traders or businesses through obtained financial market insights based on the behaviour of economic indicators provided by business cycle indicators.

7.5 STUDY LIMITATION AND AVENUES FOR FUTURE RESEARCH

The study's limitations may arise from the used HP filter in isolating cyclical components of the time-series variables notwithstanding its vast popularity in business cycle dating. Phillips and Jin (2015) argued that the HP filter fails to eliminate stochastic trends when these are used for removing the trend component. Stochastic trends, known as difference stationarity, relative

to trend stationarity may produce varying dynamics when used in forecasting (Diebold & Senhadji, 1996:3). Henceforth, the use of alternative filtering techniques which eliminate stochastic trends may potentially produce more sound forecasting analysis based on improved indicator filtering processes. Future research can thus be conducted based on filters such as (but not limited to) the trend-cycle (TC) filter, Mohr (2005:6) contends that the TC filter is better improved for real-time properties relative to popular univariate filter such as the HP filter, while the cyclical and trend components are explicitly modelled, and can incorporate structural breaks.

Moreover, composite indices solely for leading signals of each capital market were developed due to the primary focus and research objective of the study. Further research may extend on the construction of South Africa's composite indices of both the lagging and coincident signals of each capital market. These signals may assist in providing more extensive knowledge and information on South Africa's capital market dynamics relative to the lagging and coinciding properties provided by identified economic signals. Additionally, the inclusion of not only economic or business cycle indicators, but other finance specific signals into such indices may prove to be scientifically profitable for capital market analysis, interpretation and coherence. Further opportunities for research may include the use of alternatively comparative models to analyse the concordance between economic time-series and capital market segments. Such may include the dynamic stochastic general equilibrium (DSGE) model and the dynamic factor model (DFM).

Additional means to analysing the co-movement of time-series variables, other than cross-correlations or Granger causality models, may provide a basis upon which sound comparative inferences may be made on the most and best useful indicators of financial market behaviour. Potential studies may also consider an in-depth analysis and modelling of volatility dynamics between financial or capital market time-series and real economic variables to ensure that all aspects of volatility are scrutinised. An extension of research into the duration of lead and lag times will provide extensive insight into the predictive and forecasting period. Moreover, a study on whether market signals form as leading instruments of other markets could also be furthered through the analysis of diverse capital market segments, such as the stock market, on whether they serve as potential indicators of other capital markets, such as the bond, commodity or exchange rate market.

7.6 RECOMMENDATIONS

Research findings from both theoretical and empirical analyses of the study identified key recommendations for maintaining the soundness and stability of the financial market and resultantly the general economic environment. The identified leading, lagging and coinciding signals provide crucial avenues for assessing South Africa's market outlook and curbing potential market disruptions via the provision of relevant policy safety-nets and measures. South Africa's finance sector is a key driver of the country's overall growth performance, making it one of the prime backbones for various economic and social value chains. Below are some notable strategies and recommendations for traders or investors, individual economic decision-makers, and policy practitioners identified from the findings. These recommendations may secure the maintenance of ideal market sentiments and performance, the harnessing of, and capitalising on the potential for market profitability by investors and speculators, as well as savvy decision-making by regular consumers and fund depositors.

Accordingly, important inferences and lessons, although not limited to the country's policy formulation and analysis, that emerge from the present study in regards to the financial market and the component series of the business cycle's composite indicators can be summarised as follows.

- ***Encourage the use of real side or business cycle indicators, together with pure finance signals, for financial market analysis, interpretation and policy formulation.***

The utilisation of both finance and real side signals to form inferences of financial market performance could present extensive robust options and insights to policy practitioners, investors and scholars. Coupled with the utilisation of finance-related indicators, the emphasis of additional consideration of mere real-side economic or business cycle indicators for financial market analysis needs to be heightened, as the risk of solely using purely finance signals could be highly costly on a macro and micro level. Using both finance-related indicators and business cycle signals can provide an overarching overview of potential financial market contingencies and thus the provision of relevant policy safety-nets as well as robust investor or consumer decision-making.

- ***Adoption of quantitative tightening monetary policy options amidst signalled expectations of further stock price increases and investor euphoria***

The ratio of inventories to sales in manufacturing and trade as one of the identified leading variables of the stock market can assist policy-makers in cushioning the market and related sectors from potentially uncontrollable growth outcomes. Empirical findings of the study suggest that the aforementioned leading series as being countercyclical to the stock or equity market with a negative short-run relationship. Such an indicator can thus provide useful indications for short-run expectations of stock market movements and relatable sectors pertaining to further anticipated bullish patterns. In this case, medium-term counter-cyclical effects of unduly declining ratios of inventory to sales in manufacturing and trade as short-term supply shortages offset demand and supply equilibrium. Counter-cyclical short-term shortage pressures may signal further rising stock prices driven by immediate search for funds by businesses to compensate for excess demand amid relatively low-interest rates while more investors hope to take advantage of rising or bullish stock prices. To prevent further exacerbating inflationary pressures, the state may opt for quantitative tightening or interest rate hikes to curb or prevent uncontrollable growth scenarios.

- ***Early or short-run monetary policy adoption of quantitative easing or interest rate cuts amidst signalled expectations of low economic growth outcomes***

Such a policy could be implemented in the face of bearish investor despair and high-interest rates. The proposed short-run counter-cyclical leading pressure between the ratio of inventory to sales in manufacturing and trade would be showcased by unduly high inventory to sales ratios and low or declining stock prices caused by investors' dismay in falling prices amid existing high-interest rates. With high ratios of inventory to sales in manufacturing and trade, this would imply existing excess supply in the face of short-run demand shortages. Monetary policy may cut interest rates or apply quantitative easing for the short-run supply of funds in the market to increase demand propel consumers to purchase more manufacturing and trade inventory to prevent potential economic downturns caused by a lack of demand and investor despair.

- ***Timely investor analysis of short-run bond prices and interest rates through the lens of commodity price signals***

The significantly high short-run inverse relationship between the bond market and prices of South Africa's export products as suggested by the ARDL model. Results purport that investors and traders may take advantage of using commodity price signals for timely and comparative trading of bond securities. This would suggest the purchasing of bonds with fixed income or

coupon payments (interest rates) for the agreed consecutive interest payments with the initial purchasing prices (par value). Due to market dynamics over time, fluctuations in its lifecycle may suggest that such a bond may have increased in par value since its initial issuance in the face of reduced commodity prices and reduced prevailing interest rates and trade at a premium. Relatively, prevailing new bonds issued amidst prevailing lower fixed interest rates may be less favourable as compared to the bond selling at a premium.

- ***Application of fiscal policy instruments on the identified leading indicators of the commodity price index to influence commodity prices and market soundness***

The use of fiscal instruments to influence commodity prices could present ripple or crowding-out effects across the market for favourable economic outcomes based on the significant forward linkages presented by the market for commodities. Policy makers, such as the government, may impose tax practices to influence the sale and purchase of commodity prices (the demand and supply of anticipated commodities) through the reduction or increase of tax in avenues across the identified leading series of the commodity price index which were all identified to be procyclical variables of the latter. For instance, an increase in the number of new passengers, the number of cement sales, and the new balance of manufacturers observing an increase in the average number of hours worked per factory worker (half weight) would imply expected increases in commodity prices. A surge in these leading variables would imply rising economic activities and eventual increases in commodity prices due to positive demand patterns across the leading series. On the other hand, the opposite would also be true for the leading series and their potential impact on commodity prices.

- ***Application of monetary policy instruments on the identified leading indicators of the commodity price index to influence commodity prices***

Commodity prices are regarded as key influencers of other capital markets through push and pull forces of Intermarket linkages. This means that a change in commodity prices, the cost in the primary sector's raw materials may represent subsequent price effects on other markets such as the stock and currency markets based on inflationary or increasing price action. Thus, further increases in commodity prices would imply an inversely deteriorating currency and a subsequent rise in the price of stocks of manufacturing and relevant blockchains. Early analysis of the identified leading variables of commodity prices, may provide monetary policy practitioners foresight on the expected behaviour of the increase or decline in commodity prices for early price action. Relevant monetary policy may be used to curb the contagion of

deflationary pressures through quantitative easing or interest rate cuts, as well as quantitative tightening or increased interest rates in curbing inflationary pressures by observing the leading variables of commodity market prices.

- ***Use of identified leading variables of commodity prices by investors or traders for the buying and selling timing of commodity and manufacturing equities and currency market trades***

Through the lenses of the Intermarket push and pull, leading indicators of commodity prices may provide investors or traders with a proper understanding of when to sell or buy investment instruments such as stocks and currencies. These indicators would include the number of new passengers, the number of cement sales, the new balance of manufacturers observing an increase in the average number of hours worked per factory worker (half weight), the interest rate spread: 1-year government bonds less "91-dat" Treasury bills, the ratio of consumer instalment sale credit to the disposable income of households and the gross operating surplus as a percentage of gross domestic product. For the most part, the indication of an increase in these variables may suggest potential increases in commodity prices and a drop or weakening of the Rand. However, an increase in the leading variables would suggest eventually rising commodity prices and thus potentially positive influences of an increase in relatable stock market prices.

- ***Improved monetary policy understanding of potential currency changes through the lens of the composite leading indicator of South Africa's major trading partner countries***

The variable of "the composite leading indicator of South Africa's major trading partner countries: percentage changes over twelve months", was identified as a potential leading and counter-cyclical variable of South Africa's Rand exchange rate. This would suggest that a positive indication or increase in the composite leading business cycle indicator of South Africa's trading partners is associated with a strengthening Rand. Presumably, this could be driven by an increase in the wealth or growth of South Africa's trading partners and thus a subsequent demand and increase in South Africa's exports accompanied by a net trade surplus in the balance of trade and increased foreign reserves. To avoid the potential for the domestic currency from becoming too strong of a currency accompanied by dwindling exports, monetary policy may apply quantitative tightening measures or interest rate cuts in maintaining equilibrium. Thus, monitoring such situations through the lens of the identified leading variable

may provide perspective as to how to maintain export and growth outcomes in a sustainable manner.

- ***Investors or traders may take advantage of the identified leading indicators of South Africa's currency exchange rate to obtain payoffs***

The "the composite leading indicator of South Africa's major trading partner countries: percentage changes over twelve months" as the identified leading indicator of South Africa's Rand exchange rate would assist currency speculators for the timely decision-making of the buying and selling of the Rand against other currencies. Such a tool may also assist South African businesses that import productive inputs required for their projects and ventures. Such businesses may save on import funds or cut on business costs by proactive harnessing a befittingly strong Rand which makes imports cheaper.

7.7 CONCLUDING REMARKS

It is the conclusion of this research that South Africa's component series of the composite BCIs are statistically significant explanatory signals of the stock, bond, commodity and exchange rate market. Through various means of analyses, mere economic indicators have shown their predictive or explanatory capacity of behavioural time-series patterns of capital markets for market analysis and interpretation. Such a revelation provides statistical evidence that the real and financial sectors and variables at least tend not to operate in isolation of each other, notwithstanding their operative idiosyncrasies. Thus, the direction of macroprudential analysis of financial systems through the lens of both micro-finance specific indicators and business cycle indicators can establish useful inferences for monetary or financial policy formulation and implementation. This includes the formulation of safety-nets for financial market disruptions through observable business cycle interpretation of economic indicators in preventing or at least lessening the impact of potential financial market instability.

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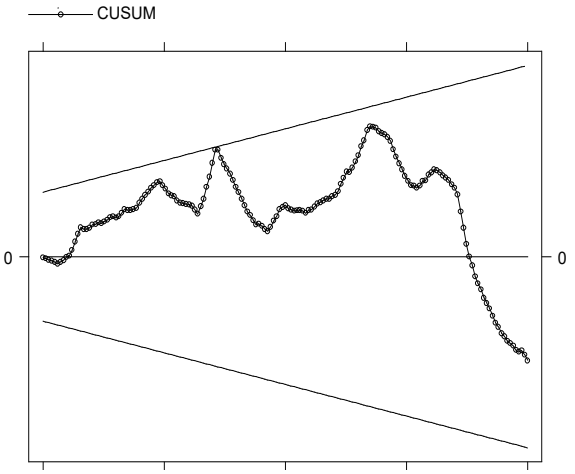
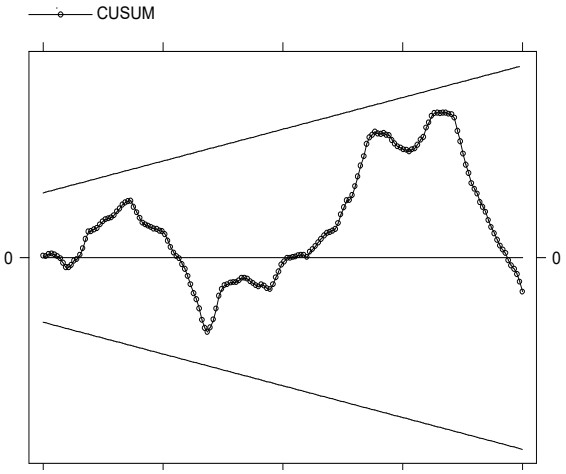
APPENDIX

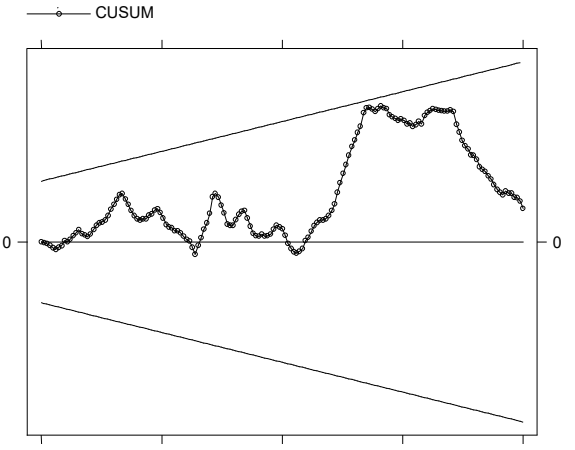
$LALSI_t$ (Eq.1)



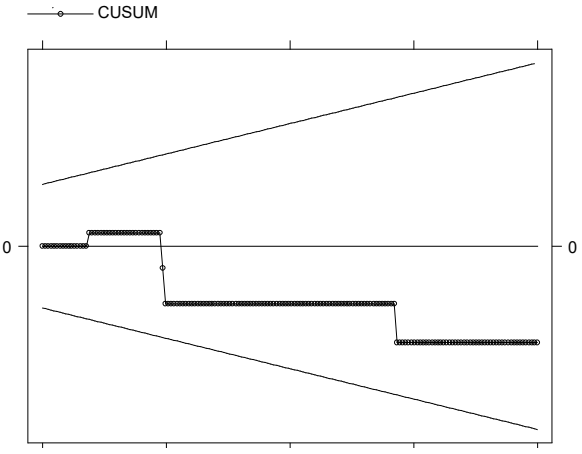
$LALBI_t$ (Eq.2)



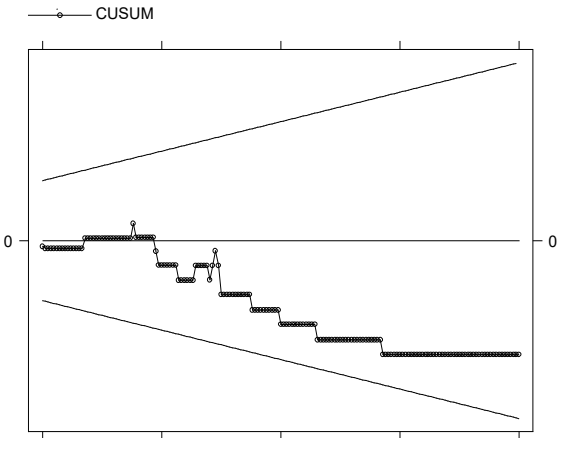
$LALCI_t$ (Eq.3)



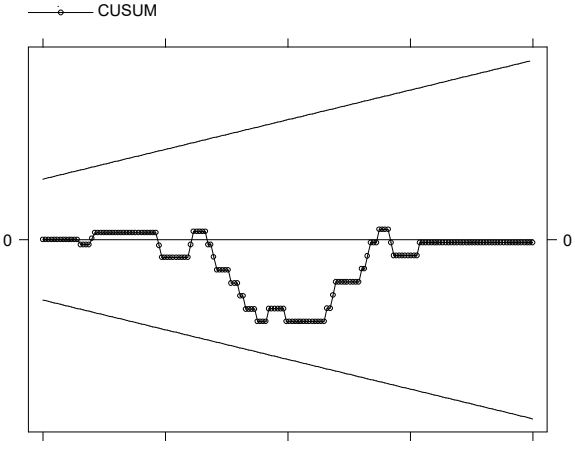
$LREER_t$ (Eq.4)



$LALSI_t$ (Eq.5)



$LALBI_t$ (Eq.6)



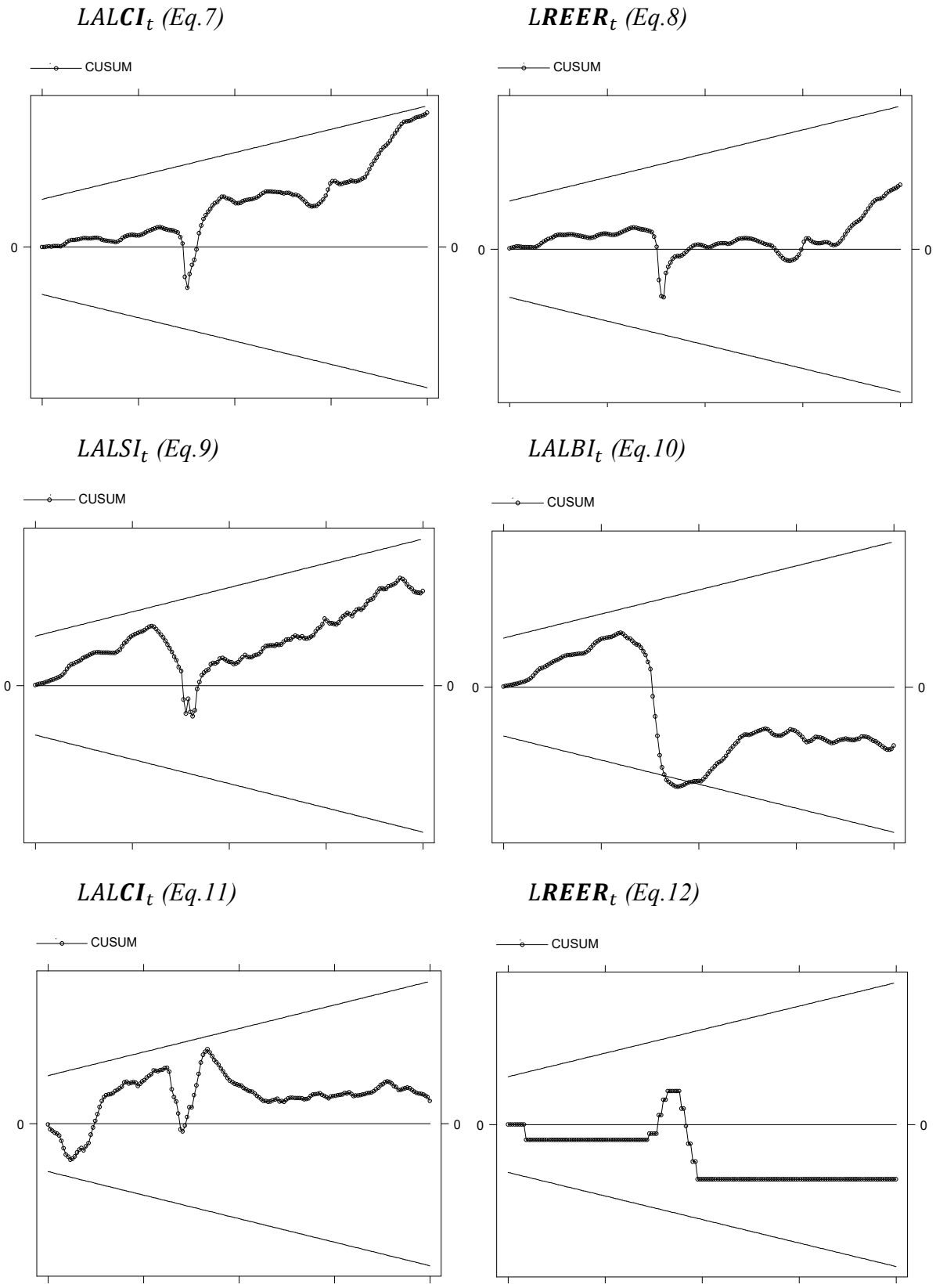


Figure 6.6: Cumulative Sum of Recursive Residuals test results

Source: Author compilation