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Country risk components and financial asset markets interdependence: Evidence from South Africa

by

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DECLARATION

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ABSTRACT

Over the last few decades, financial markets have become more interlinked. As a result, there has been an increased demand for information across markets and thus, a need for country-specific risk ratings. Risk ratings are vital for attracting investments and capital inflows in financial markets by providing signals regarding a country's economic, financial and political fundamentals. However, there remains a lack of consensus on the nature of the relationship between country risk and key asset markets, namely, the stock market, bond market, housing market, and gold and oil markets.

This doctoral study evaluates the impact of country risk components on asset returns and their interlinkages for the period from February 2000 to December 2019 within the South African context. The first analytical paper (presented in Chapter 3) evaluates the dynamic relationship between South African asset markets using the Markov Switching Vector Autoregressive (MSVAR) model. The findings showed that the response of all asset returns to shocks in the economic system was regime-dependent. Moreover, shocks emanating from the exchange rate market and bond market explained most of the variation in the bull and bear regimes.

The second paper (presented in Chapter 4) investigates the impact of country risk on various asset markets ing a Non-Linear Autoregressive Lag model (NARDL). This study fills the gap in understanding the reaction of stock, bond, housing, currency, gold and oil markets to positive and negative innovations in country risk components. The findings show evidence of long-run cointegrating relationships between asset returns and country risk components and indicate that country risk components are effective determinants of domestic asset market returns.

The third paper (presented in Chapter 5) examines the effects of economic, financial and political risk on asset market linkages using a combination of the Dynamic Conditional Correlation Generalised Autoregressive Conditional Heteroscedasticity (DCC-GARCH) and NARDL models. The findings show that the correlation between asset markets was positive in stable market conditions and showed negative comovements during periods of market turmoil. Financial and political risk ratings were found to be the main drivers of asset market comovements in the short run. An increase in South African (domestic) political risk had a larger effect in the long run and was found to be an important determinant of asset return comovements. This result provides evidence suggesting that asset markets are informationally inefficient and changes in financial and political risk ratings can be used to predict price movements.

Overall, this doctoral dissertation's findings highlight the diversification benefits of domestic assets during periods of market uncertainty. Moreover, the results show that examining the different components of country risk provides better insight into the impact of country risk on asset markets. The results of this dissertation have significant implications for asset allocation decisions and risk management. From a policy perspective, it is crucial to formulate policies that address political instability as it plays a pivotal role in determining asset return behaviour, and consequently, the financial stability of the country. Furthermore, the results have implications for traditional asset pricing models that only capture the effects of market risk to predict future asset market behaviour. A more comprehensive understanding of the risks of specific markets is vital for more informed financial decision-making. Future research could extend the scope of the study to investigate the composite political risk factors that explain asset market behaviour.

Keywords: asset markets, economic risk, financial risk, political risk, comovements.

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LIST OF ACRONYMS

ADCC	Asymmetric Dynamic Conditional Correlation
AIC	Akaike Information Criterion
ARCH	Autoregressive Conditional Heteroscedasticity
ARDL	Autoregressive Distributed Lag Model
NARDL	Non-linear ARDL
ARMA	Autoregressive Moving Average
DCC	Dynamic Conditional Correlation
ECM	Error Correction Model
ECT	Error Correction Term
E-GARCH	Exponential GARCH
EMH	Efficient Market Hypothesis
ER	Economic risk
FR	Financial risk
GARCH	Generalised Autoregressive Conditional Heteroscedasticity
GARCH-M	GARCH-in-mean
ICRG	International Country Risk Guide
JB	Jarque-Bera
JSE ALBI	Johannesburg Stock Exchange All Bond Index
JSE ALSI	Johannesburg Stock Exchange All Share Index
JSE	Johannesburg Stock Exchange

KPSS	Kwiatkowski–Phillips–Schmidt–Shin
LB	Ljung-Box
MPT	Modern Portfolio Theory
MSVAR	Markov-switching VAR
PP	Phillips-Perron test
PR	Political risk
SBIC	Schwarz Bayesian Criterion
VAR	Vector Autoregression

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CHAPTER 1: INTRODUCTION

1.1 Background

Over the past three decades, emerging markets have benefitted from substantial portfolio inflows as a result of international investors seeking higher yields (Koepke, 2019). The proportion of emerging markets in global market capitalisation has more than doubled over the last two decades (International Monetary Fund, 2016). In particular, the globalisation of products, services and financial markets has contributed to financial liberalisation that allows companies, investors and businesses to invest or trade within a globalised business environment (Chopra, 2015). Financial liberalisation encourages investment flows to domestic markets from foreign investors seeking diversification opportunities.

Even though African markets are integrated with developed markets, their integration is limited, implying that investors can reap diversification benefits from including African assets in a globally diversified portfolio (Atenga and Mougoué, 2021). However, these markets are characterised by higher uncertainty relative to developed markets which increases the risk exposure for investors. Uncertainty may stem from political, economic, financial and social instability, which contributes to increasing the overall country risk associated with investing in these markets (Damodaran, 2021). Country risk refers to the possible loss an investor may incur as a result of economic, financial, political and social events in that particular country (Liu, Sun, Chen and Li, 2016). Country risk is a broader concept relative to sovereign risk (Nagy, 1979). The conceptualisation of sovereign credit risk is limited to the risk of lending to governments of sovereign economies, thus capturing the risk of default on foreign debt. Country risk, however, extends the definition of sovereign risk to capture other risks related to levels of corruption, legal environment, socioeconomic factors and government effectiveness (Damodaran, 2021). Sovereign risk and country risk are highly correlated due to the government being the main risk driver (Elkhoury, 2009). Empirical research also considers sovereign risk spreads (Hilscher and Nosbusch,

2010) and the yield on sovereign bond spreads (Huang, Wu, Yu and Zhang, 2015) as proxies for country or sovereign credit risk.

The main rating agencies include Moody's, Standard and Poor's and Fitch IBCA, Euromoney, Institutional Investor (II), The Economist Intelligence Unit, International Country Risk Guide (ICRG) and Political Risk Services (PRS) (Arora and Kumar, 2022). The role and functionality of these agencies are pivotal for economic development, and encouraging and destabilising capital flows of emerging markets (Afonso, Gomes and Rother, 2011; Li et al., 2019). In particular, rating agencies provide ratings based on evaluating the economic, financial, social and political risk factors of different countries, and how these factors interact to determine the risks associated with investments in that country (Sun, Feng and Li, 2021). Country risk and sovereign credit ratings are particularly important for developing and emerging economies. The relevance of country risk in emerging financial markets has reignited the interest of finance practitioners and researchers as investments in emerging markets are exposed to various risks beyond market risk, such as political instability, which occurs more regularly in developing countries (Suleman and Berka, 2017). Further, emerging markets have higher sovereign risk ratings because they are more prone to defaulting on their debts (Frascaroli and Oliveira, 2017). Hence, investors are thought to be more cautious when considering investments in developing countries.

The credit rating agencies minimise the information asymmetries associated with investing in African markets (Mutize and Gossel, 2018). In essence, ratings affect investor perceptions of a country. Low-risk ratings induce higher financing costs and reduce refinancing ability, hence worsening liquidity issues (IMF, 2018). In response, agencies revise ratings further downwards thereby exacerbating the worsening macroeconomic environment. Thus, country risk affects the demand and supply of international capital flows (Koepke, 2019) and alters the risk-return features of investment in that country. Consequently, country risk could have significant effects on that country's asset markets.

The efficient market hypothesis (EMH) suggests that financial market behaviour is driven by investors' reactions to new information (Mutize and Gossel, 2019). A country credit rating downgrade is often interpreted as negative news and higher risk for investors. Consequently, investors require a higher rate of return (Pástor and Veronesi, 2013; Warnes and Warnes, 2014). Credit rating revisions should result in a reaction in the various asset markets within the country associated with a particular country risk rating change. However, the literature on the effects of country risk ratings changes on asset markets is rather inconclusive (Christopher, Kim and Wu, 2012; Treepongkaruna and Wu, 2012). Authors such as Treepongkaruna et al. (2012) found that stock markets were more sensitive to credit rating changes compared to currency markets. Findings such as these highlight the importance of understanding the impact that country risk rates have on the various asset markets contained within a given economy.

In the South African context, credit risk scores have been downgraded several times since 2009 (see Figures 1.1 and 1.2). Before the 2007 global financial crisis, foreign currency debt was rated at investment grade by all major rating agencies. South Africa's expanding productive capacity boosted investor confidence and economic activity in the early 2000s. South Africa was able to maintain its investment grade ranking up until 2012 (Bond, 2013). At the beginning of the last quarter of 2012, all three credit rating agencies downgraded South Africa's foreign currency rating to reflect the decline in payment capacity (Karodia, Rehman and Soni, 2016). Credit rating agencies revised these credit ratings and future outlook projections because of sluggish GDP growth, rising fiscal deficits and increasing debt burden (Langohr and Langohr, 2010).

In particular, S&P Global downgraded South Africa to junk status in November 2017 following political instability caused by the controversy surrounding President Zuma's administration and a concomitant decline in equity and bond prices (Ngwakwe and Sebola, 2019). During 2017, there was significant asset price and capital flow volatility caused by political uncertainty and low business confidence. In mid-2017, most asset markets, except for cash, recorded negative returns. For example, the Johannesburg Stock Exchange (JSE) All Share Index (ALSI) declined by 3.49 per cent and the JSE All Bond Index (ALBI) declined by 0.95 per cent. This was attributed to greater political uncertainty and capital outflows (Sanlam, 2017).

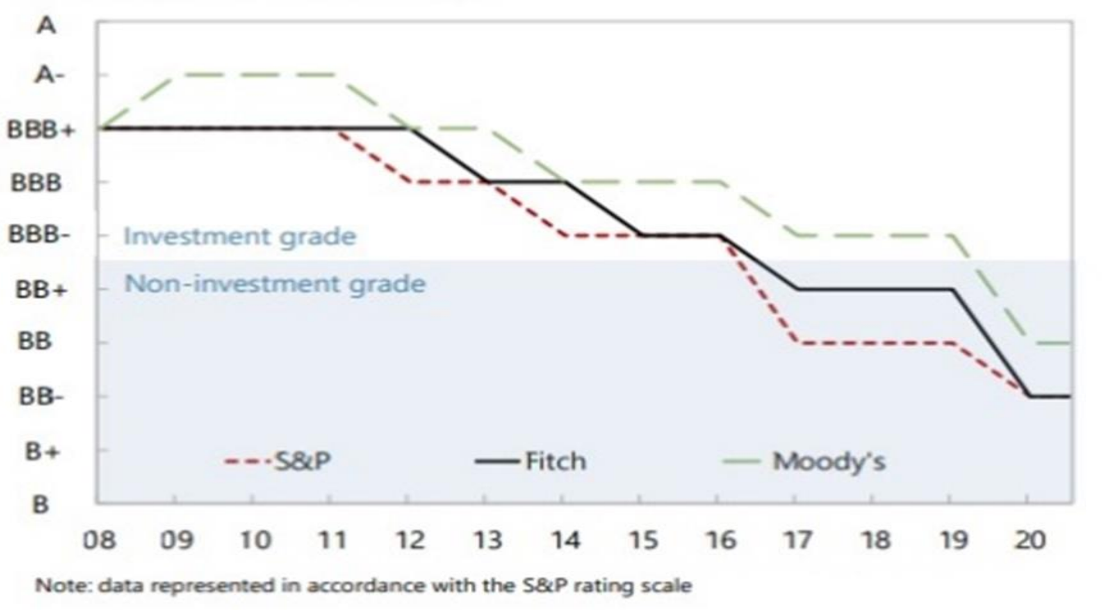

Figure 1.1 South Africa's credit ratings (2008 - 2020)

Source: IMF (2022, p. 10).

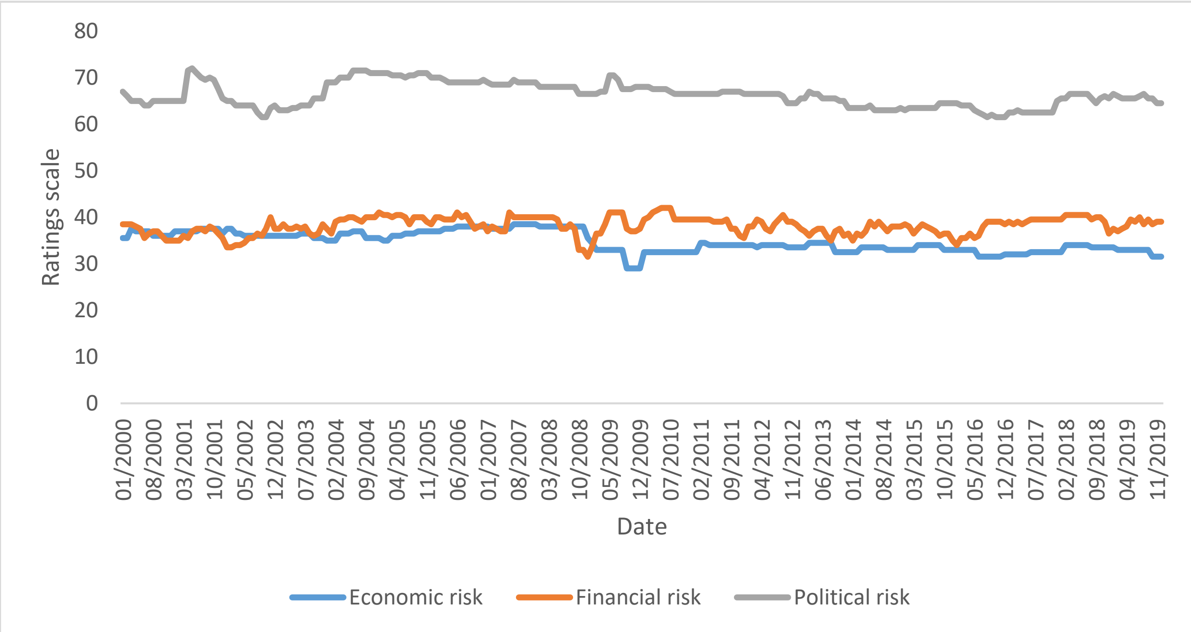

Figure 1.2 South Africa's economic, financial and political risk ratings (2000 - 2019)

Source: Author's own depiction (2022)

In 2019, South Africa went into a technical recession following a decline in GDP in the fourth quarter. Consequently, the domestic currency deteriorated, and asset markets experienced significant losses. The COVID-19 pandemic exacerbated the effects of the crisis. In the first quarter of 2020, the World Health Organisation declared COVID-19 a global health crisis (Ghorbel and Jeribi, 2021). This was followed by disruptions in global supply chains and business operations. Against this background, the JSE ALSI, ALBI, cash, exchange rates and property markets suffered substantial losses. The property or housing markets lost approximately 48% in total returns in the first quarter of 2020 (Sanlam, 2020). These developments provide anecdotal evidence of linkages between credit rating adjustments, global risk and asset market returns.

In the presence of risk, constructing a portfolio of assets that have a low or negative correlation with one another should provide better diversification benefits than a portfolio consisting of only one asset class (Markowitz, 2009). The most basic tenet of portfolio theory is based on the notion that investors can diversify away asset-specific risks and reduce portfolio risk by combining assets with low correlation into an investment portfolio (Sim, 2016). Investors may adjust, or rebalance, their portfolios between risky assets and low-risk assets in a way which best preserves their wealth. Therefore, investors rely on correlation measures between asset pairs to determine the asset combinations that will result in an optimal portfolio.

This basic guiding principle, however, ignores that the joint distribution of various asset returns is time-variant (how they interact with one another is not constant over time). Several studies provide evidence suggesting that the relationship between two asset returns depends on the state of the market (Guo, Chen and Huang, 2011; Guidolin, Hansen and Pedio, 2019). In times of high market volatility, investors often seek to minimise risks associated with traditional assets such as equities and bonds. For instance, the 2008 global financial crisis and its aftermath emphasised the relevance of including safe-haven assets within their portfolios to investors (Bredin, Conlon and Potì, 2015). The 2008 financial crisis was followed by a widespread increase in interdependence among asset markets, which had negative implications for optimal portfolio diversification as correlations between various markets and asset classes increase. The decline in US house prices lead to a drastic decline in equity markets, commodity prices and real estate prices globally (Poshakwale and Mandal, 2016).

During times of economic turmoil, correlated jumps in asset markets have been attributed to information-related shocks affecting all asset markets simultaneously (although not necessarily at the same magnitude), thus translating to an increase in market interdependence(Aït-Sahalia and Xiu, 2016). Given this global development over the last three decades, it is imperative to model the interdependence between assets and establish the direction in which they influence each other, particularly in extreme market states.

Investors holding positions in the South African asset market are often cautious and sensitive to new information regarding the state of the economy, especially when that news is of a political nature (Odera, 2012). Country risk rating adjustments are often considered to provide new information to the market about a change in fundamental factors that could create a negative perception of the market by investors. Although credit ratings have been criticised for being slow to react to signs of a potential crisis (Amstad and Packer, 2015), the announcement of rating changes induces market overreactions and panic (Tran, Alsakka and ap Gwilym, 2019).

This observation is based on the assumption that credit rating changes present new information to financial markets (Agarwal, Chen, Sim and Zhang, 2015). The role of country credit ratings in financial markets remains inconclusive. When a country's credit ratings are downgraded, investors adjust their portfolios to this new information and this may cause a stock market downturn and further worsen economic instability (Pukthuanthong-Le, Elayan and Rose, 2007). Country risk ratings are multifaceted and some markets may be more sensitive than others (Christopher et al., 2012; Sensoy, Eraslan and Erturk, 2016). For instance, Christopher et al. (2012) demonstrated that ratings have an asymmetric effect on stock and bond markets. Ni (2017) established that credit ratings have a significant long-run impact on stock market correlations. In contrast, Sensoy et al. (2016) established that credit rating announcements do not influence stock return co-movements.

From the domestic asset market viewpoint, it remains unclear how country risk components influence local asset market correlation. The relatively high country-specific risk in emerging markets, such as South Africa, implies that investors require higher risk premiums to compensate for the higher level of risk when investing in any of the South African asset markets. Consequently, there is a need to investigate the influence of country risk on asset market correlation. Hence, this doctoral thesis investigated the impact of country risk components on asset markets and the correlations between these markets within the South African context.

1.2 Statement of the problem

Emerging markets, including South Africa, have endured periods of stress caused by the impact of domestic and global shocks. Economic growth has been weak and the growing current account deficit has been financed by volatile capital flows (IMF, 2018). These factors contribute to the economy being susceptible to sudden substantial capital outflows triggered by sovereign credit ratings downgrades or other externalities (Mutize et al., 2019). The uncertainty in the domestic economy has resulted in several sovereign credit rating downgrades over recent years.

For instance, in early 2017, political uncertainty arising from a cabinet reshuffle coupled with the release of a medium-term budget policy statement that reflected further worsening of public debt levels was followed by a downgrade of South African investments below investment grade towards the end of 2017. Net portfolio outflows of one billion US dollars soon followed prompting depreciation in exchange rates and an increase in 10-year bond yields (IMF, 2018). Events such as these indicate that uncertainty and country risk affect domestic asset markets (stock, bond, currency, and property) and this is essential for empirical investigation. In addition, country risk is a multifaceted measure, which considers political, financial, social and economic factors. These factors are often aggregated and categorised into one single measure of country risk (Mutize et al., 2019). In so doing, it becomes impossible to determine which components have greater implications for which financial asset markets. Considering disaggregated country risk data is vital to ensure that asset allocation, investment, and risk management decisions are directly more accurate.

The co-movement of asset markets during crisis periods remains a major concern to investors as it implies that a negative shock arising from unstable country fundamentals could render diversification across asset markets ineffective. Moreover, if investors treat the assets of a particular country as behaving similarly, a negative shock could result in an outflow of capital in all asset markets, regardless of the hedge or safe haven properties of each class of assets. When market volatility is high, investors reduce their exposure to additional risk by reducing their position in the riskier market (Engle, Ghysels and Sohn, 2013). Thus, the correlation between domestic asset markets is of significant importance to investors.

The traditional asset allocation of only combining equities and bonds is no longer feasible because of their increased interdependence during the crisis period (Papavassiliou, 2014). Hence the necessity to consider alternative financial instruments for investors to hedge against domestic and global risk. This informs the gradual shift towards non-conventional asset markets such as commodities and property markets (Chang and Cheng, 2016). However, the diversification benefits of these assets as a set of interlinked markets have not yet been considered under different market states and investment horizons.

It is hypothesised that, if asset markets react differently to country-specific fundamentals, then asset returns should move in various (some different, some the same) directions depending on how each market interprets the change in country risk ratings, thus causing a change in how the markets relate to each other. Contemporary asset market theories such as the Adaptive Market and Fractal Market hypotheses (AMH and FMH) point to the significance of market conditions or timing on asset return behaviours. Thus, it has become essential to study the interdependence between the different asset markets and how they react to the different components of country risk under different market conditions.

1.3 Research objectives and questions

This doctoral study aims to investigate the impact of country risk components on asset market returns and the interdependence between the various South African asset markets. The primary research objectives are as follows:

i. To assess the interdependence between South African asset markets in different market conditions.

ii. To evaluate the impact of country risk components on various South African asset market returns in different market conditions and different investment horizons.

iii. To investigate the effects of political, economic and financial components of country risk on the interdependence of South African asset market returns.

These objectives relate to the following research questions:

i. How do South African asset markets interact in different market conditions? What is the nature of this relationship during periods of financial distress?

ii. What is the nature of the relationship between economic risk, financial risk and political risk, and asset returns? How do asset returns respond to positive and negative shocks in country risk components? Is the response symmetric or asymmetric?

iii. What is the effect of changes in country risk components on the correlation between asset market returns? How are asset market correlations related to economic risk, financial risk and political risk in the short- and long-run?

1.4 Methodological scope

This study examines the dynamic relationship between asset markets and the impact of country risk on asset returns. Consequently, this thesis employs a quantitative research approach consisting of secondary data of asset market returns in domestic and global markets (stock, bond, currency, housing, gold and oil markets), and South African country risk ratings (economic risk, financial risk and political risk) to achieve these research objectives.

The sample period is over nineteen years, starting from February 2000 to December 2019. The period is marked by significant financial market developments and events which impacted local and global markets. These events have contributed to the dynamic relationship between asset markets and have influenced the interactions between markets. Monthly frequency data is used due to the inclusion of country risk data which is released monthly. As the first article of this dissertation was published in

2019, the COVID-19 period is not considered to ensure that the three pieces of the empirical analysis can be viewed against one another.

This doctoral thesis adopts different methodologies to determine asymmetric and regime-dependent behaviour. The first objective is achieved by employing the Markov Switching Vector Autoregressive model (MSVAR) to examine the nature of the relationship between the six asset markets. The second objective is achieved by employing the Non-linear Autoregressive Distributed Lag model (NARDL) to analyse the impact of economic, financial and political risk ratings on asset market returns. The third objective extends this analysis by first determining the dynamic correlation of asset returns using the Dynamic Conditional Correlation Generalised Autoregressive Conditional Heteroscedasticity (DCC-GARCH) model. The NARDL is then employed to investigate the impact of country risk components on asset market co-movements.

1.5 Significance and original contributions of the thesis

Original contribution chapter 3

The first objective evaluates whether domestic assets can be used to diversify risk during crisis periods. The globalisation process has fostered the financial and economic development of developing countries by providing investors with opportunities to diversify their assets globally. However, globalisation also increases the co-movements of assets in extreme events, thus increasing the likelihood of joint crashes across all markets (Zhang and Ding, 2021). Empirical studies have found that African markets are partially integrated with global markets (Fowowe and Shuaibu, 2016; Boako and Alagidede, 2018) and mostly integrated with other emerging economies (Chinzara and Kambadza, 2014).

The primary benefit of financial liberalisation is international risk diversification. However, despite such a benefit, investors have shown a preference for domestic assets, resulting in investments being disproportionately more in domestic assets than in foreign assets (Sercu and Vanpée, 2007). Many emerging market investors are restricted by government regulation from investing above a certain proportion in foreign assets. Therefore, even in the presence of market integration, portfolios may be insufficiently diversified, thus making country risk relevant (Sanvicente, Sheng and

Guanais, 2017). The correlation of assets is important for portfolio management and asset allocation. The comovement of asset returns is a key component in hedging decisions, managing risk and optimising portfolio performance.

Chapter 3 makes the following contributions to knowledge. Firstly, the sample of asset markets includes conventional financial assets (stock and bonds) and also considered the real estate, currency and commodity markets (gold and oil). There are limited studies on asset market comovements in the South African context. Most of the existing literature focuses on the interactions between stock and bond markets, stock and currency, and stock and commodity markets. It is only recently that studies have begun to examine interactions between three (Baruník, Kočenda and Vácha, 2016; Mensi, Al Rababa'a, Vo and Kang, 2021) or four (Basher and Sadorsky, 2016; Zhang, Wang, Xiong and Zou, 2021) asset markets. Although, the asset markets examined in this study are not unique to this strand of literature, considering the six markets collectively allows this dissertation to offer a more nuanced perspective on contagion effects, the flight-to-quality and flight-from-quality phenomenon in the South African context. In doing so, this dissertation makes its first contribution to knowledge in this space. The results of this chapter provide valuable information to domestic and foreign investors regarding the potential for South African commodity and housing markets to serve as a hedge or diversifier for traditional stock and bond market portfolios.

Original Contribution Chapter 4

The relationship between asset returns and country risk is an important issue for international investors seeking diversification opportunities in emerging markets, particularly in South Africa. This chapter evaluates the impact of economic, financial and political components of country risk on asset returns of six asset markets: stock, bonds, housing, currency, gold and oil.

To the author’s knowledge, this is the first study to examine the impact of positive and negative country risk on the long-run and short-run relationship between stock returns, bond returns, currency returns, gold returns and oil returns. The analysis extends existing empirical research investigating the correlations between South African asset markets and global commodities markets. Considering the widely acknowledged dynamic nature of the relationship between asset markets, this dissertation makes a significant contribution by investigating the time-varying linkages between South African asset markets, and examining the asymmetric response of asset markets to changes in country risk.

It is also of interest to assess whether there are any noteworthy differences the response of each market to country risk fluctuations. This contribution holds practical implications for portfolio management and the implementation of asset allocation strategies. For portfolio managers, the analysis helps achieve better returns whilst minimising risk. In particular, long-term investors, such as pension funds, benefit from from understanding a country's fundamentals to formulate strategies that target hedging risk. Understanding the relationship between asset markets and their key drivers provides policymakers with information about the state of financial markets and the expectations of investors. Furthermore, understanding the impact of rating changes on asset markets is essential for understanding the price discovery process and the type of information financial practitioners should consider in the asset pricing process.

Original Contribution Chapter 5

The third objective of this dissertation was to determine the impact of country risk components on asset market linkages. The financial crisis increased the linkages between asset returns, thus revealing the risk-minimising benefits of assets that have traditionally been considered safe havens. Asset classes such as bonds, currencies against the US dollar, real estate and commodities have been identified in the literature as safe-haven assets (Singhal, Choudhary and Biswal, 2019).

While empirical literature has investigated the role of macroeconomic fundamentals in explaining asset market contagion and dependence has been investigated in existing literature (Asgharian, Christiansen and Hou, 2016; Perego and Vermeulen, 2016; Yang, Yang, Ho and Hamori, 2019), there is mixed evidence concerning the specific set of macroeconomic factors that are primary drivers of asset returns and their covariance. Asset market returns are driven by economic, financial and political fundamentals, and thus, their interactions with each other would be expected to change. This issue has not been addressed in related finance literature on drivers of asset market comovements. Thus, this doctoral dissertation contributes to existing knowledge by providing an understanding of the extent to which the interaction of asset markets is affected by economic, financial and political risk. The analysis determines the time-varying correlation between domestic asset markets and oil by applying the DCC-GARCH model. Secondly, the NARDL was employed to examine the asymmetric response of asset correlations to changes in country risk. From a policy intervention perspective, understanding the key drivers of comovements has profound implications for effective diversification and asset pricing. A better understanding of the factors determining asset market correlations may also curb the transmission of future crises by allowing for more targeting risk management to be implemented.

This study is the first to analyse the asymmetric response of asset return correlations to country risk components during a period where there were pivotal changes in the South African political landscape. The impact of country risk ratings on asset markets can extend and magnify the negative effects of a financial crisis. At a higher risk rating, investors expect to receive a higher risk premium for holding domestic assets. Furthermore, changes in country risk contain valuable information for credit rating agencies. Higher country risk ratings indicate deteriorating country fundamentals and thus are generally followed by a credit rating downgrade (Duyvesteyn, Martens and Verwijmeren, 2016). Therefore, from a policymaking perspective, identifying the key drivers of interdependence across different asset markets is important for formulating appropriate policy interventions.

1.6 Delimitations of the study

The study focuses on six core asset classes that are available in the South African market. While other asset classes exist, the asset markets chosen for this study are considered the most widely traded and were considered to offer sufficient diversity and coverage of the broad asset classes. For the data, risk ratings from one rating company, the ICRG, were used. Various rating agencies release rating data used in the existing literature. However, the ICRG data was considered more suitable based on the frequency in which the data is released.

1.7 Structure of Thesis

This thesis is written in the style of an introduction and theoretical review, which is then followed by a set of three papers, each aligned to a single objective of the overall dissertation.

Chapter 1 - Background of the Study. This chapter provides the background context of the study. It discusses the research problem which informs the motivation for the study, outlines the objectives and research questions, and briefly introduces the methods of analysis.

Chapter 2 - Theoretical Framework. This chapter provides an overview of theories relevant to portfolio diversification and asset pricing. Theories discussed include asset pricing theories, prospect theory and modern portfolio theory. While empirical literature is discussed in Chapters 1 and 2 as appropriate, the focused empirical literature reviews of each of the three objectives are discussed in the relevant section in Chapters 3, 4 and 5. This applies to the discussion of data and methodology too.

Chapter 3 presents the first objective, which examined the nature of the relationship between asset markets. The sections of this chapter include; the introduction, literature review, empirical methods, results and discussions. Chapter 4 presents the second objective, which determines the impact of country risk on asset returns. The sections of this chapter include; the introduction, literature review, empirical methods, results and discussions. Chapter 5 presents the third objective, which examines the impact of country risk on asset market co-movements. Finally, an overarching conclusion and summary are presented in Chapter 6.

CHAPTER 2: THEORETICAL FRAMEWORK

2.1 Introduction

This chapter provides the theoretical framework of this thesis. This chapter will discuss the Efficient Market Hypothesis (EMH) and how this is linked to traditional understandings of the risk-return relationship. Following this, the behavioural finance theory, the Prospect theory, the Adaptive Market Hypothesis (AMH) and the Fractal Market Hypothesis (FMH) are discussed as well-known extensions of understanding some of the real-world challenges to the traditional theories of this field.

2.2 Theoretical review

The theoretical framework for analysing the relationship between financial assets originates from the modern portfolio theory (MPT) pioneered by Markowitz (1957) which is based on the mean-variance analysis used in portfolio choice and investment decisions. MPT formed the foundation for understanding the functioning of financial markets, the quantification of risk and allocating capital to maximise returns (Bernstein, 1993). Traditional finance theory is based on the underlying arbitrage principles of Miller and Modigliani, with contributions from Markowitz (1952) with portfolio theory, and later extensions from Sharpe (1964), Linter (1965) and Black (1972), and Black and Scholes (1973), through the introduction of capital asset pricing theory and option pricing theory, respectively.

Traditional finance theories were designed to provide mathematical explanations to simplify the portfolio selection process. These theories were based on the underlying assumption that markets are efficient, investors are rational and wealth maximising. The emergence of behavioural finance has challenged the underlying assumptions of these theories, however, the principles established by traditional finance theories remain relevant in explaining investment decisions. Various applications of behavioural biases in investment management and asset pricing have been proposed, but there is no consensus on the most appropriate method to account for behavioural biases.

Arbitrage Pricing Theory (APT) and the Capital Asset Pricing Model (CAPM), along with several other foundational theories, are predicated on the EMH. Various behavioural versions of these theories have been introduced, including utility theory (Kahneman and Tversky, 1979) and portfolio theory (Shefrin and Statman, 2000).

2.2.1 Portfolio theory with mean-variance analysis

The relationship between risk and return is explained in the extensive body of work based on portfolio theory and capital market theory (Markowitz, 1952, 1959; Sharpe, 1964). The theoretical foundations of MPT originate from Markowitz's (1952) mean-variance theory. Markowitz (1952) was the first author credited with developing the concept of a risk-return tradeoff in investment decision-making, and for introducing a mathematical formula for portfolio selection. Markowitz (1952) developed methods which simplified the quantification of risk, ways to minimise risk and capital allocation amongst individual securities. Markowitz established that portfolio selection is determined by the expected portfolio return and expected variance of an entire portfolio. Markowitz discredited the widely accepted notion that investors would select portfolios based solely on selecting individual securities that maximise the expected returns as this disregards investors' risk preference and is contrary to the principles of diversification. He demonstrated that the risk-return tradeoff of investment opportunities is influenced by the expected return, variance, and correlation of assets.

Consequently, the optimal portfolio is formed not only by focusing on the expected returns of individual asset classes or securities but is largely dependent on how the changes in returns of one security relate to the changes in returns of the other securities within a portfolio (Kim and Francis, 2013). Thus, the theoretical rationale for diversification holds when the combination of asset classes or individual securities in a portfolio maximises the portfolio's expected to return at a given level of risk.

To formulate the mean-variance portfolio, it is assumed a given portfolio consists of χ number of assets with w_i as the weight or proportion of the investor's wealth allocated to the i_{th} asset in a portfolio, such that the sum of the weights of all assets in the portfolio is one, $\sum_1^n w_i = 1 \ldots . i = 1, 2,3 \ldots n,$. The expected returns ($r_p$) of the portfolio can be expressed as follows:

$$E(r_p) = \sum_{i=1}^{\chi} w_i E(r_i) \quad (2.1)$$

and the variance (σ_p^2) of the portfolio can be expressed as follows:

$$\sigma_p^2 = \sum_{i=1}^{\chi} \sum_{j=1}^{\chi} w_i w_j \, \sigma_{ij} \quad (2.2)$$

Where σ_{ij} is the covariance of the expected return of assets i and j.

The portfolio's expected return is thus the weighted sum of the expected return of individual assets. However, the portfolio risk is not a simple summation of the expected variance. The portfolio risk or variance is determined by the variance of individual assets and also the covariance of the two assets. Portfolio variance can be minimised by specifying the weights of the individual assets. The portfolio formation process highlights the need to hold assets with heterogeneous characteristics to ensure it is diversified. The total variance of a portfolio is reduced by combining securities with low-return covariances.

The expected return and variance on all possible portfolios are determined by the weights w_1 and w_2 as follows:

$$E(r_p) = w_1 E(r_1) + w_2 E(r_2) \quad (2.3)$$

$$\sigma_p^2 = w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2 w_1 w_2 \rho_{12} \sigma_1 \sigma_2 \quad (2.4)$$

$$\sigma_p = (\sigma_p^2)^{1/2} \quad (2.5)$$

The covariance of the two assets can be expressed as follows:

$$\sigma_{12} = \rho_{12} \sigma_1 \sigma_2 \quad (2.6)$$

The correlation coefficient, ρ_{12}, is one when securities are perfectly positively correlated, and the standard deviation of the portfolio is the weighted average of the standard deviations of two securities. The expected return and standard deviation will be weighted averages, thus they will both increase linearly as the weight of each security is adjusted.

The optimal allocation between the risky portfolio and the riskless asset will depend on the investor's level of risk tolerance. Risk-averse investors seek to avoid risk, and therefore, when provided with a choice between alternative assets with the same expected return, they would choose the asset with the lower level of risk. Risk-seeking investors are indifferent to the degree of risk and will choose investments with the highest expected return among alternative investments. Risk-averse investors seeking to maximise utility as a function of risk and return will opt to hold more of the risk-free asset relative to the risky asset, and risk-seeking investors will choose to hold more of the risky asset portfolio. Investors will choose to hold higher-risk assets, only if the increase in expected return exceeds the increase in risk. The asset allocation will be determined by the risk-return tradeoff. The set of optimal portfolios that an investor can choose lies on the efficient frontier. The efficient frontier is derived using quadratic programming, by maximising expected return subject to a given level of expected risk, or by minimising risk subject to a given level of expected returns.

Asset allocation has been found to explain more than 90 per cent of a portfolio's total returns (Brinson, Hood and Beebower, 1986; Ibbotson and Kaplan, 2000). Ibbotson and Kaplan (2000) found that the relative performance of two multi-asset class funds was determined by asset allocation. Other factors included style, market timing, trading costs and security selection (Andonov, Bauer and Cremers, 2012).

Naseer & Tariq (2016) summarises the assumptions of the MPT as follows: Investors make rational, utility-maximising decisions, meaning investors choose a combination of individual securities to form a portfolio that maximises expected return for a given level of risk. Even though investors are assumed to be risk averse, the desired level of risk and return is determined by risk preference. This means that, given two assets with the same expected return, an investor will choose the asset with the lower level of risk. Investors require a high rate of return to accept higher risk. The theory only considers the expected returns, variance and covariance as important components to consider for designing an optimal portfolio. That is, it does not take into consideration factors such as skewness, kurtosis, time-varying volatility and other fundamentals, which affect the distribution of returns. Furthermore, it assumes that the covariance and correlations between assets in all portfolios are determined in a single period. The theory assumes there are no transaction costs and taxes, expected returns, variances and covariances of all assets are known. Empirical research has widely acknowledged that asset returns are not normally distributed. Static correlation measures, such as Pearson's correlation, fail to sufficiently capture the time variance in asset correlations.

2.2.2 Tobin's (1958) portfolio separation theory

Tobin (1958) contributed the liquidity preference to the analysis of mean-variance portfolio theory. Tobin developed a theory to explain the decision-making behaviour of economic agents. Investors have the option of also investing in riskless assets with a guaranteed return, such as government bonds and treasury bills. Riskless assets do not correlate with risky asset and their variance is equal to zero. The liquidity preference theory of (Keynes, 1936) describes the asset allocation process amongst assets with varying degrees of liquidity. Tobin (1958) explained this process in the portfolio separation theory which separates the investor's decisions into two steps. In the first step, the investor chooses the optimal combination of risky assets, and in the second step, the investor includes a risk free asset to achieve a desired level of risk. The theory is based on the assumption that each investor's risk-return preference can be determined by the indifference curve.

2.2.3 Markowitz's Modern Portfolio Theory (MPT)

Drawing on the foundations of the mean-variance framework developed in 1952, Markowitz (1959) extended the portfolio theory framework incorporating the findings of Tobin (1958), to find the mean-variance optimal portfolio. The opportunity set of portfolios an investor selects from is derived from calculating the expected return and variance for all possible combinations of investment portfolios. The standard form of asset allocation envisions a portfolio comprising two asset classes, one risky asset portfolio and one riskless asset (Bodie, Kane and Marcus, 2022). The feasible risk-return $(\sigma, E(r))$ combinations are presented in the capital allocation line (Bodie, Kane and Marcus, 2022). The correlation coefficient between two asset classes is assumed to be $\rho_{12} = 0$.

Portfolio management theories form the basis for why and how investors allocate their assets in a portfolio. Portfolio selection theory and asset pricing theory provide the underlying framework for specifying and measuring portfolio risk and determining the linkages between expected asset returns and their associated risk (Bodie et al., 2022).

When selecting assets for an investment portfolio, it is important to consider how a price change in the asset relates to a change in the price of other assets making up the portfolio. The risk exposure of an asset can be minimised by diversifying a portfolio across different asset markets. Emerging markets present a high risk when considered individually, however, their low correlation with global markets provides diversification benefits. International investors can significantly improve a portfolio's risk/return tradeoff by including assets from emerging markets in a diversified portfolio. Global events, such as the global financial crisis, have raised concerns regarding diversification being adequate to protect against loss (Koumou, 2020). The time-variance in correlations or linkages between markets violates the MPT assumption of static correlations (Erb, Harvey and Viskanta, 1994; Ang and Chen, 2002).

2.2.4 The Capital Asset Pricing Model (CAPM)

The mean-variance analysis of Markowitz (1952) provided the foundations of the Capital Asset Pricing Model (CAPM), which later led to the contributions of Sharpe (1964), Linter (1965), Treynor (1965) and Mossin (1966) in the 1960s. The CAPM simplifies the quantification of the risk-return tradeoff compared to Markowitz's MPT. Sharpe (1964) and Lintner (1965) extended Markowitz's model by introducing additional assumptions. These include assuming that investors can borrow and lend at a risk-free rate of return, which is the same for all investors (Elbannan, 2015). In addition, they assumed investors have homogeneous expectations.

The CAPM asserts that rational, profit-maximising investors want to hold a completely diversified market portfolio of risky assets and they borrow or lend to arrive at a risk level that is consistent with their risk preferences. Therefore, under these conditions, Markowitz (1952) and Sharpe (1964) argued that an individual asset is exposed to two types of risk: systematic and unsystematic risk. The risk relevant for an individual asset is its co-movement with the market portfolio, known as its systematic or market risk. That is, the underlying assumption in financial literature is the risk-return tradeoff is a constant investment opportunity set over time which implies that the only risk exposure is market risk (Glosten, Jagannathan and Runkle, 1993).

Systematic risk measures the asset's covariance with the market portfolio. Unsystematic risk measures the variance of an individual asset that is not related to the market portfolio and stems from an asset's unique features. Unsystematic risk is considered insignificant as it can be eliminated in a large, well-diversified portfolio (Sharpe, 1964). Increasing the number of securities composing a portfolio reduces unsystematic risk, whilst systematic risk remains unchanged. Therefore, based on these assumptions, diversifiable firm-specific risk does not contribute to asset pricing. Investors are rewarded for bearing systematic risk; thus the risk premium of an individual asset is a function of the asset's systematic risk with the aggregate market portfolio of risky assets.

The CAPM is an equilibrium model that describes the relationship between risk and return and determines the required return for a given level of risk. Beta is the covariance of the asset's return with the market return divided by the variance of the market return and is a measure of the risk that cannot be diversified away. The Security Market Line (SML) offers another way of describing the relationship between systematic risk and return. Mossin (1966) demonstrates how the required rate of return is an increasing function of beta, which is a measure of market risk. This suggests that an increase in uncertainty or risk results in investors increasing the required rates of return. The slope of the SML is positive and represents the risk premium of a given security. The SML indicates the risk-return combinations of risky assets in the capital markets for a given time. Securities plotted above the SML are undervalued because they provide a higher expected return for a given level of systematic risk. Securities plotted below the SML are overvalued and provide a rate of return below that would be earned for the given level of risk. Investors select investments based on their risk preferences. The location of the asset combination will change based on the changes in perceived risk of the investment, or a change in the attitudes of investors towards risk. When an investor's risk changes due to a change in one of its fundamental risk sources, it will cause a change in the combination of assets selected.

The CAPM shares the same assumptions as the MPT. Thus, Sharpe (1964) suggests that under these assumptions, all investors desire to hold a mean-variance portfolio or market portfolio because the market is always in equilibrium.

2.2.5 *The Efficient Market Hypothesis (EMH)*

The Efficient Market Hypothesis (EMH) introduced by Fama (1970) proposes that asset pricing is determined by information associated with a particular security. The arrival of new information will immediately reflect in current prices of securities and thus, securities will always be fairly priced. This implies that active management strategies that seek under or over-valued securities through the analysis of past price trends or past company performance are unprofitable and result in the formation of imperfectly diversified portfolios within an efficient market (Bodie, Kane and Marcus, 2022). Markets follow a random walk which means that asset price movements are unpredictable and that prices will move when new information is randomly available in the market. The competition between market participants to profit from new information ensures that markets are informationally efficient. The states that the market portfolio is the optimal portfolio every investor wants to hold as it contains all available information.

Much of the traditional finance theory is based on the Efficient Market Hypothesis (EMH) (Fama, 1970). In an efficient market, investors are not able to earn abnormal profits from capital market transactions. Investors can earn higher profits by investing in higher-risk assets. The hypothesis is based on the premise that all information available in the market is fully, accurately and instantaneously incorporated into security prices. It thus implies that security prices in an efficient capital market are the best estimate of the intrinsic value of the securities. The EMH has an important role in investment decision-making. If the market is inefficient in pricing securities, investors would be able to earn abnormal returns by exploiting the inefficiencies in the capital markets.

Market participants are assumed to be rational beings that optimally make decisions. According to Fama (1970), security prices are influenced by different types of information and thus, the EMH can be distinguished into three forms of market efficiency distinguished based on the type of information that determines asset prices: weak-form efficiency, semi-strong form efficiency and strong-form efficiency.

A weak-form efficient market implies that the information contained in historical prices cannot be used to forecast future prices. This form implies that asset prices follow a random walk. Therefore, investors cannot earn abnormal returns by using investment strategies that entail analysing past prices or volume to predict future prices. Investors will be unable to earn higher profits from market inefficiencies in the long run. Appiah-Kusi and Menyah (2003), Simons and Laryea (2006) and Ntim, Opong, Danbolt,and Senyo Dewotor (2011) examined the weak-form efficiency of African stock markets. Jefferis and Smith (2005), Simons et al. (2006) and Heymans and Santana (2018) found evidence of weak form efficiency in South African stock markets. This suggests that asset returns follow a random walk and past price movements have no predictive power on successive security prices and returns. Gräter and Struweeg (2015), in contrast, found that South African stock markets were inefficient.

For a semi-strong efficient market, security prices adjust immediately to publicly available information. Thus, investors are unable to earn excess returns by using fundamental or technical analysis techniques to predict future prices (Bodie et al., 2022). Early empirical research found contrary results, finding that fundamentals such as financial ratios and economic indicators have significant predictive value for stock returns (Lewellen, 2004; Chen, 2009). Campbell and Shiller (1988) found that the dividend yield ratio had relevant predictive power of returns on the stock market. This result was further supported by Lewellen (2004) who showed that dividend yield ratios were superior predictors of US stock market returns relative to the price-earnings ratios and book-to-market value ratios.

Markets are considered strong-form efficient when the prices of securities reflect both private and public information. Hence, limiting excess profits from insider information for investors. This form represents complete market efficiency whereby a company's management will not be able to earn abnormal profits using insider information. Information asymmetries which result in informed traders generating abnormal profits would suggest markets are not strong form efficient. Grossman and Stiglitz (1980) demonstrate the importance of the cost and quality of information, and the degree of risk aversion are key determinants of equilibrium informativeness.

The occurrence of a crisis contradicts the EMH. Peters (1994) suggests that the EMH assumes asset prices are independent of liquidity. This is a shortcoming of the EMH when explaining market crashes and bubbles. Peters (1994) found that the EMH and

MPT held during normal or stable periods, however, there are theoretical deficiencies when they are used to explain market crashes. Financial assets have different degrees of liquidity. Empirical analysis of asset market liquidity has found that the liquidity premia of assets are time-varying, and the variance is greater during periods of market crisis. During crisis periods, investor risk aversion increases and thus their preference for liquid assets increases. Less liquid assets become riskier as a result of increasing market betas (Vayanos, 2004).

The EMH does not make provision for extreme events in financial markets due to the assumption that investors have equal access to information and this information has an equal effect on investors. Shiller (2000) notes in his research that stock prices are too volatile for markets to be considered efficient. The study concluded that stock market bubbles are a consequence of excess volatility observed in stock prices.

EMH has been criticised for its limitations. Fama (1970) identified a joint hypothesis issue in tests of market efficiency. Tests of efficiency determine whether the properties of expected return estimated by models of market equilibrium can be found in actual returns. Roll (1977) critiques Sharpe’s (1964) definition of a market portfolio. Roll (1977) argued that the market portfolio cannot be observed in reality and using a market index as a proxy for the market portfolio resulted in biased outcomes.

2.2.6 Arbitrage Pricing Theory and Multifactor Asset Pricing Models

One of the fundamental issues in finance is discovering the factors that explain cross-sectional differences in expected returns. The Arbitrage Pricing Theory (APT) was introduced by Ross (1976) to challenge the assumptions of the CAPM, in particular the assumption that expected returns are a function of only market risk. Ross (1976) posits that expected asset returns are a linear function of macroeconomic or firm-specific characteristics measured by factor betas. Investors are compensated for bearing these risks such that the expected return is a function of K systematic factors and the risk exposure to these factors is measured by factor betas. The expected return is thus expressed as follows:

$$E(r_i) = r_f + \gamma_1 \beta_{i1} + \cdots + \gamma_K \beta_{iK} \qquad (2.7)$$

Where β_{iK} is the factor-beta on the kth factor and γ_K is the risk premium for $k = 1,2, \ldots, K$.

APT assumes that expected returns are determined by K factors via a linear regression equation:

$$\tilde{r}_{it} - r_{ft} = \alpha_i + \beta_{i1}\tilde{f}_{1t} + \cdots + \beta_{iK}\tilde{f}_{Kt} + \tilde{\varepsilon}_{it} \qquad (2.8)$$

Where $\tilde{f}_1, \tilde{f}_2, \ldots, \tilde{f}_k$ are random systematic factors driving asset returns, $i = 1,2, \ldots, N$ and $\tilde{\varepsilon}_{it}$ is the random asset-specific risk factor.

A limitation of the APT is that it does not specify the factors nor the number of factors that determine the expected returns. Following empirical analysis of cross-sectional determinants of US stock returns, Fama and French (1993) developed a three-factor model, an extension of the CAPM that captures the effects of two additional risk factors: size and book-to-market. Early empirical tests found risk premiums to small companies (Banz, 1981; Reinganum, 1981) and to high book-to-market value (Lakonishok, Shleifer and Vishny, 1994), that was not explained by the market beta in the CAPM of Sharpe (1964) and Lintner (1965). (Fama and French, 2015) later developed a five-factor model derived by augmenting the three-factor model to include profitability and investment factors. Further, there is a strand of literature which specifies macroeconomic variables as key drivers of expected returns (Bilson, Brailsford and Hooper, 2001; Chen and Wu, 2013; Engle et al., 2013).

The MPT with mean-variance analysis, CAPM and EMH have been criticised for their simplistic assumptions and limited practical application. The next section discusses some of the critiques of these models and their proposed alternatives.

2.2.7 Behavioural finance

Traditional finance theories were developed with the underlying assumptions that economic agents act rationally when making investment decisions that are consistent with utility maximization, moreover, they are efficient and unbiased processors of information (Brooks and Byrne, 2008). It is based on the notion that economic agents are subject to behavioural biases, which implies they do not always act rationally when making investment decisions. The underlying foundations of behavioural finance theory stem from the cognitive psychology literature, applied within the context of finance and investment decision-making. The theory presents a list of psychological traits that debunk the assumptions of rational investors that seek to maximise the utility of expected wealth.

The discussion will focus on the key behavioural theories and biases related to the topic of this study. A full description of all these biases is beyond the scope of this theoretical review. Shefrin et al. (2000) and Barberis and Thaler (2003) provide a detailed description of each bias.

Empirical evidence has documented that behavioural biases, such as risk preferences and liquidity requirements, are associated with human-decision making in the event of uncertainty and are inconsistent with the requirements of rationality proposed by the EMH (Statman, 2014). Investors would generally react differently towards the information available. Behavioural finance has found that investors behave irrationally which violates the efficiency hypothesis. Pedersen (2019) argues that inefficiencies in markets are limited. The competition amongst investors ensures that market participants are compensated for the costs and risks arising from market inefficiencies.

2.2.8 Prospect theory

The prospect theory developed by Kahneman and Tversky (1979) provides a basis for understanding the behaviour of markets and investors during periods of uncertainty and high volatility (Ciner, Gurdgiev and Lucey, 2010). The theory was presented as an alternative to the Expected Utility theory of (Allais, 1953). Kahneman and Tversky (1979) showed that investor utility is not a function of total wealth but is instead determined by gains and losses relative to a reference point.

Prospect theory has generally been applied to the understanding of why some securities have higher returns. The CAPM assumes that investors evaluate risks based on their expected utility. According to this model, investors expect higher returns when the security has a high beta such that the returns of the security vary more than the variation in overall market returns. This suggests that investors will react differently to the losses and gains of an investment. The behaviour of economic agents is thus inconsistent with the rational, utility-maximising assumptions of the CAPM (Shiller, 2003). The theory argues that the underlying utility functions are based on expected returns on assets, rather than consumption or wealth as proposed in the EMH, CAPM or other traditional theories.

The value function is defined based on gains and losses rather than total wealth. In the function, the gains and losses are not weighted linearly. Importantly, the emotional impact of losses to economic agents far outweighs the gains (Antony, 2020). Investors are risk-averse to gains and risk-seeking when faced with losses (Kahneman and Tversky, 1979). This theory proves that investors are more sensitive to losses in comparison to gains. Behavioural Finance, therefore, challenges the use of conventional utility functions based on risk aversion.

Kahneman and Tversky (1979) suggest that the outcomes of investment decisions can be assessed against a subjective reference point, such as a stock's purchase price. The investors are loss-averse, exhibiting risk-seeking behaviour when faced with sure losses and risk-averse behaviour when faced with gains. Shefrin and Statman (1985) found that investors are more inclined to hold losing stocks for extended periods and sell winning stocks prematurely. (Peterson, 2010) attributes this outcome to the endowment effect, which suggests investors overvalue their possessions. Kahneman and Tversky (1979) found that investors do not select efficient, well-diversified portfolios, and in some cases, they ignore covariance and hence, choose that lie below the mean-variance efficient frontier (Shefrin and Statman, 2003). Because investors may act irrationally and are not always risk-averse, the assumption of market efficiency fails to hold, and thus prices do not immediately reflect all new information. Investors have a lagged response to new information up to a point where it becomes overwhelmingly obvious. Therefore, current prices may be influenced by past information.

Markets become inefficient when an investor's reaction to new information results in the price adjusting incorrectly due to the irrational behaviour of the investors. In a market made up of investors that are highly sensitive to new information, the share price movement will create an inefficient market, where the share price is not reflective of the current information. Over time, when the market realizes the share is mispriced, the share price will adjust to an equilibrium where they are equal to the intrinsic value. De Bondt and Thaler (1985) compare this adjustment to the mean reversion process, where large movements in share prices are followed by a subsequent larger movement in share prices in the opposite direction.

Due to loss aversion, there is a sudden movement of capital from high-risk assets to low-risk assets during periods of high market uncertainty or extreme market conditions. As a result, some assets exhibit safe-haven properties during periods of extreme market volatility (Kopyl and Lee, 2016; Mensi, Hammoudeh and Tiwari, 2016; Nguyen and Liu, 2017).

Standard asset pricing models fall short of explaining investor portfolio decisions and the time variance in asset correlations (Karolyi and Stulz, 2003). The tail dependence problem is that it is often unclear whether increased dependency during market stress periods is a result of commonalities in time-varying volatilities across asset classes or due to common jumps. Further, the investment horizon considered has a significant influence on the behaviour of investors.

2.2.9 Adaptive Market Hypothesis (AMH)

The AMH is a hybrid theory that incorporates aspects of the EMH and behavioural finance. Despite its theoretical relevance, the MPT has been highly debated and criticised for its simplistic assumptions which do not reflect real-world applicability. The MPT is based on the underlying assumption of efficient markets. The EMH suggests that the prices of assets traded in the market reflect the information available at the time of trading. Therefore, it is not possible for an investor to consistently earn returns above average market returns on a risk-adjusted basis (Shleifer, 2000). However, real-world events have revealed that financial markets are inefficient. Moreover, the presence of market anomalies proves that markets do not converge to efficiency over time. While the EMH implies that the market is static, this has been challenged (Lo, 2004). The Adaptive Market Hypothesis (AMH) implies that although there exists a relationship between risk and returns, the relationship is time-varying due to changes in market conditions (Lo, 2005). The AMH suggests that the presence of irrational investors and arbitrage opportunities are necessary conditions for markets to arrive at a level of efficiency as proposed by the EMH, however, never reach a steady-state efficiency level, due to the market constantly evolving.

Consequently, asset risk premiums are presumed to be time-changing. The AMH denotes a more complex market dynamic, characterised by cycles, trends, panics, manias, bubbles, crashes, and other phenomena (Lo, 2005). These provide a theoretical basis for the evaluation of the portfolio of securities or MPT theory within the time-varying context. This is a foundational aspect of why this dissertation uses models which can capture time-varying effects, and consider different market states. In doing so a more realistic analysis is produced.

2.2.10 Fractal Market Hypothesis (FMH)

The Fractal Market Hypothesis (FMH) by Mandelbrot (1966) outlines the importance of information and investment horizon on the behaviour of investors (Li, Nishimura and Men, 2014). The FMH relaxes the constraints attached to asset price movements. The heterogeneity of financial markets is a result of the different preferences of economic agents. Investors differ in their risk tolerance levels and their assimilation of information is often restricted by institutional regulation or beliefs. These traits are closely associated with investors' perception of investment horizons (Bredin et al., 2015).

The FMH makes provision for the occurrence of financial crises. According to this hypothesis, markets consist of agents trading at different investment horizons, ranging from seconds to longer-term investment periods over several years, continuously adjusting their portfolios at different frequencies. These actions drive asset price behaviour and therefore investors realize heterogeneous returns at different time scales (Bhatia, Das and Kumar, 2020). Because shorter horizon investors use technical information and crowd behaviour more than fundamental information. In contrast, long-term investors rely on fundamental information.

According to the theory, stability of the market is achieved when investor investment horizons are different such that, a buying opportunity of a long-term investor is met by a short-term selling (Weron and Weron, 2000). The market is deemed unstable when there is a mismatch between short-term and long-term trades. Thus, financial crises are explained by the dominance of one investment horizon compared to another. During a financial crisis, the short investment horizon activity is suggested to exceed long-term investment activity (Kristoufek, 2013; Dar, Bhanja and Tiwari, 2017).

Two scenarios could occur during a period of high market uncertainty. One of the reasons for this observation is that during periods of increased uncertainty, long horizon investors liquidate their positions in the short term, thus resulting in an increased number of short-term transactions. Secondly, long-term investors are risk averse and tend to wait for markets to stabilize and trade at normal prices before entering the market, therefore causing short-term activities to dominate. However, in normal market conditions, investment activity in the short term does not display any dominance. Thus, in addition to the AMH, the FMH supports the need to evaluate risk-return association over different investment horizon and market conditions.

2.3 Theoretical framework summary

In the last decades, global markets have experienced episodes of extreme bear markets, such as the tech bubble, the global financial crisis, the sovereign debt crisis and the COVID-19 crisis, which have challenged the effectiveness of traditional finance theories, such as the efficient market hypothesis, capital asset pricing theories, modern portfolio theory and other extensions of these. Due to the evolution of financial markets, alternative theories such as the behavioural finance school of thought, adaptive market and fractal market hypotheses have developed, which posit that investors act irrationally and markets are not always efficient. These theories form the foundations for empirical research which seeks to explain the pivotal role of macroeconomic factors and market sentiment as determinants of asset returns. Despite the influence of traditional finance theories, they are subjected to continuous criticisms in terms of their underlying assumptions and their incorrect predictions in empirical tests.

The foundational theories are based on the assumption that investors are risk averse and thus will invest in high-risk assets only if the expected return is commensurate with the level of risk. Therefore, investors should allocate assets with a low covariance with other assets in the portfolio for effective diversification. The debate regarding market efficiency has attracted a lot of attention from researchers, regulators and finance practitioners. The EMH has been criticised in empirical research and some studies have argued that markets are inefficient. Despite the critique of the EMH, it is still widely used in the pricing of assets.

The evidence of time-varying asset market linkages contradicts the weak-form efficiency hypothesis. Furthermore, the time-varying linkages can be explained by behavioural finance theory. The AMH and FMH assume that market behaviour is time-varying, contrary to the EMH which assumes market behaviour is static. These hypotheses and theories explain the time-varying behaviour of markets due to changing market conditions. The FMH also assumes different investment horizons. The investment horizons influence investors' investment decisions and therefore influence their asset allocation decisions.

CHAPTER 3: THE RELATIONSHIP BETWEEN ASSET RETURNS IN BULL AND BEAR MARKET CONDITIONS

3.1 Introduction

The comovement of asset markets has attracted significant attention in international finance, primarily due to the increase in financial market integration. The comovement of asset markets plays a pivotal role in portfolio formation and risk management (Papadamou, Fassas, Kenourgios and Dimitriou, 2021). The interdependence between asset markets can provide insights into investor sentiment and the overall state of the economy. In the context of asset allocation decisions, the selection between various asset classes largely is contingent on their level of correlation, particularly during times of market contractions when losses are more significant (Baruník et al., 2016). Ideally, the most effective approach to hedging portfolio risk is to allocate investments to assets that exhibit weak or negative correlation, whose price movements are independent from each other (Baele, Bekaert, Inghelbrecht and Wei, 2020).

Subsequent to the 2008 global financial crisis, several documented incidences have arisen where the correlation of asset market returns has been observed to increase during periods of market turmoil (Alqaralleh and Canepa, 2021). The global financial crisis, that was triggered by declining US housing prices, resulted in a significant decline in equity markets, real estate and commodity prices across the globe, affecting developed and emerging economies (Celık, 2012). The decline in the commodity markets with the simultaneous downturn in the equity markets created an increase in the correlation between both markets (Cheng and Xiong, 2014). Thus, posing diversification challenges and increasing the risk of concurrent losses.

In addition to the effects of the crisis, extant empirical literature has also noted the tendency for stock markets to exhibit comovements during periods of financial turmoil (Bekiros, 2014; Seth and Panda, 2020). Before the crisis period, most of the literature focused on cross-country comovements for stock markets and provided evidence on the existence of contagion between different stock markets (Forbes and Rigobon, 2002; Gonzalo and Olmo, 2005; Gkillas, Tsagkanos and Vortelinos, 2019). Hence, it was posited that during periods of stock market uncertainty and contagion, risk-averse investors could divest into lower risk safe assets such as bonds, real estate and commodities (Ciner, Gurdgiev and Lucey, 2013; Kopyl et al., 2016; Ji, Zhang and Zhao, 2020). However, strong interdependence was observed between these safe assets and stock markets during the financial crisis (Raza, Shahzad, Tiwari and Shahbaz, 2016). Consequently, it is pivotal to investigate whether domestic asset diversification would be effective during periods of increasing global risk.

The prevailing empirical research also demonstrated that asset market returns exhibited non-linear dependencies and time-varying behaviour (Baur and Lucey, 2010; Aboura and Chevallier, 2015). Liow and Ye (2018) and Dua and Tuteja (2021) showed that the relationship between asset returns changes depending on market conditions. The changing economic state affects expected returns, and the correlation between asset returns in normal states and crisis states varies over time (Forbes et al., 2002; Baur and Lucey, 2009; Balcilar, van Eyden, Uwilingiye and Gupta, 2017; Chiang, Sing and Wang, 2020). It is, therefore, important for portfolio managers to be aware of how markets react in different market states and the change in the relationship between the different assets following a change in the market state.

Although there is vast literature on asset market linkages (Papavassiliou, 2014; Guidolin et al., 2019; Antonakakis et al., 2020; Chiang et al., 2020), the cross-market co-movement between South African asset markets has not been explored extensively. Moreover, there are very few studies that have examined the cross-asset interdependence (stock, bond, exchange rate, housing, commodities) in emerging markets under changing market conditions. It would thus be beneficial to test whether South African asset markets' correlations are affected by changing conditions to establish whether these asset markets can provide a hedging or diversification benefit to international investors.

This study contributes to the literature by also exploring the decoupling hypothesis. The theory posits that emerging markets are resilient to external shocks, thus these markets offer diversification benefits to investors during global crises (Cayón and Sarmiento, 2020). This evidence suggests that the repercussions of global financial crises, for example, increasing market integration, are essentially a developed country’s affair and emerging markets are not significantly affected. Therefore, during periods of global market uncertainty, investors would be able to hedge their risk exposure by investing in emerging markets.

The purpose of this study is to examine the relationship between asset markets, namely bonds, foreign exchange, housing and commodities, across the different market states and determine whether these markets can act as safe-haven assets for equity investors during periods of market stress and *vice versa*. Understanding the linkages between different asset markets is important for portfolio formation and portfolio rebalancing. According to Guidolin and Timmermann (2008), optimal strategic asset allocation can only be achieved when investors have information about the joint distribution of asset returns. Research over the years has pointed to the joint distribution of asset returns being time-varying.

This study provides a different perspective on the dynamic relationship between domestic and international asset markets. It is useful to examine domestic asset interlinkages to ascertain whether these markets can provide diversification for international investors during global events. The time variance in correlation has implications for portfolio diversification. Portfolio managers need to identify conditions in which the relationship between asset returns varies. Asset market dependence is also important for financial regulators and policymakers. Strong asset market linkages during market crises have implications for successful government intervention policies. To contribute to the knowledge of structural changes in asset market linkages, this study employed a Markov regime-switching framework, which enables the estimation of the joint asset return distribution and assesses their regime-dependent linkages.

This chapter will shed light on the relationship between asset returns in different market conditions. The nature of the relationship between asset market returns will be examined over the period between February 2000 and December 2019. The Markov-switching vector autoregression framework is used to endogenously identify crisis and non-crisis periods in the data series. The subsequent sections of this chapter are outlined as follows: Section 3.2 presents a review of the literature on asset market co-movements in developed and developing markets. Section 3.3 describes the data and methods applied for the analysis. Section 3.4 reports the preliminary test results and a discussion of the empirical results. Finally, Section 3.5 provides the conclusion and recommendations for future research.

3.2 Review of the empirical literature

This section presents the conceptualisation of asset market linkages, followed by a review of the existing empirical literature on the nature of the relationship between asset markets. This section highlights the different regions, asset markets and methodological approaches used in the studies. The evolution of the methodologies in existing literature and measures of asset market linkages informed the analysis and approach used in this chapter.

Due to the important role of asset allocation in diversification, there has been extensive research on understanding the drivers of asset market comovements. The key drivers are interdependence and contagion. The relationship across various asset markets, particularly domestic assets, at different market conditions, has not been given enough attention in the literature. Most of the studies focus on cross-country linkages (Alagidede, 2008; Arouri and Nguyen, 2010; Marozva, 2017) or cross-asset relations of different countries (Cappiello, Engle and Sheppard, 2006; Connolly, Stivers and Sun, 2007; Baur et al., 2010; Hakim and McAleer, 2010). It is only recently that studies have examined the relationship between the domestic assets of a country (Duncan and Kabundi, 2011; Papavassiliou, 2014; Chang et al., 2016; Guidolin et al., 2019). Furthermore, the existing literature has investigated the association between two or three assets at a time, determining the relationship between stocks and bonds (Christiansen and Ranaldo, 2007; Baur et al., 2009; Tachibana, 2020), stocks and currency ((Jebran and Iqbal, 2016; Dong and Yoon, 2018), stocks, bonds and REITs (Yang, Zhou and Leung, 2012; Chiang et al., 2020) and stocks and commodities (Shahzad, Raza, Shahbaz and Ali, 2017; Morema and Bonga-Bonga, 2020; Mensi, Al Rababa'a, et al., 2021). The testing of more than three markets (Papavassiliou, 2014; Chang et al., 2016; Guidolin et al., 2019) at a time is becoming more popular, as multi-asset portfolios become a preferred portfolio diversification strategy.

3.2.1 Conceptualisation of asset market linkages

The literature has identified various channels through which asset markets are related. Terms such as relations, comovement, correlations, linkages and interdependence are often used synonymously in the literature to describe relations between asset markets. The increase in financial integration and instability caused by financial crises has prompted interest in researching contagion. Contagion is characterised by significant and abrupt changes in cross-market linkages between two markets following a shock affecting one market (Forbes et al., 2002; Baele and Inghelbrecht, 2010; Billio and Caporin, 2010; Brière, Chapelle and Szafarz, 2012; Ghorbel et al., 2021). Papavassiliou (2014) defines contagion as an increase in correlation between financial market returns caused by positive or negative shocks.

The existence of contagion is a topic that is continuously debated in the literature and there is no consensus on its definition, nor is there an agreed-upon technique for identifying contagion effects. In the past literature, cross-market linkages have been measured by correlation in asset returns. Boyer, Gibson,and Loretan (1999) and Forbes et al. (2002) found that identifying contagion based on comparing correlation coefficients in tranquil and crisis periods had the potential to produce misleading conclusions due to the heteroscedasticity in the market returns. The definition provided by Ciccarelli and Rebucci (2003) is that contagion is a temporary shift in cross-market or cross-asset linkages during a crisis period. The contagion effect is thus reflected by parameter instability in a model. Bekaert and Harvey (2003b) propose a contagion test, which investigates whether there is a correlation in the model's residuals after correcting for economically driven correlation. However, it is difficult to characterise the fundamental linkages in an environment of time-varying market integration.

Forbes et al. (2002) define interdependence as a state where the cross-market linkages remain constant or are in a constant state of change, in both normal or tranquil period relations. Interdependence is assumed to be driven by both markets responding similarly to changes in transmission mechanisms (Baele et al., 2010; Billio et al., 2010). Interdependence is a long-term phenomenon that takes place in tranquil periods. Contagion is a transitory change in the linkages that occur in the left tail of the asset series distribution.

Contagion is described as being transmitted via economic news in one market directly affecting cash flows of securities in other markets (Longstaff, 2010). The literature identifies four channels that explain financial contagion episodes (Guidolin and Pedio, 2017). Transmission is viewed as being transferred from more liquid markets or markets with more rapid price discovery compared to other markets (Pritsker, 2001; Kaminsky, Reinhart and Vegh, 2003; Guidolin et al., 2017), known as the correlated information channel. The correlated information channel is one in which shocks in one market with more rapid price discovery, provide other markets with information that is incorporated in the valuation process of other markets (Kaminsky et al., 2003). Others find that transmission may be via a flight-to-quality mechanism, whereby investors may suffer losses in one market as they shift capital investments to other markets, resulting in contagion via liquidity shocks (Papadamou et al., 2021), also known as the liquidity channel. It is perceived that the correlation between stock and bond markets is positive during stable market conditions because investors have positive expectations regarding the future performance of both markets. However, during periods of increasing market turmoil, the correlations between the two markets decrease and become negative due to the increase in equity risk premiums relative to the bond risk premiums to compensate for the higher risk exposure (Christiansen et al., 2007). Flight-from quality is decreasing correlation accompanied by a rise in stock markets. The contrast between global increase within each asset class and correlation decrease across asset classes is identified as the flight-to-quality phenomenon (Baur et al., 2009). This phenomenon leads to a decoupling effect in which cross-market linkages increase, however, the relation between domestic asset markets is a negative correlation between government bonds and equities (Gulko, 2002).

Safe haven assets are those that have a low or negative correlation with equity markets during periods of market distress. The correlation of a safe haven asset does not always need to be negative all the time and can be positive or negative during normal/bull market conditions. The underlying theory suggests that investors' risk aversion drives investors to seek out liquid investments, in safer alternatives, during high market volatility periods (Lee, Lee and Zhang, 2019), thus compensating the investor for the losses during crisis periods. The movement of capital from one risky asset market to a safer alternative is referred to as the flight-to-quality or flight-to-safety phenomenon and most of the empirical research in this area has associated this phenomenon with the interaction between equity and bond markets (Baur et al., 2010; Baele et al., 2020). The flight-to-quality phenomenon leads to decoupling (Gulko, 2002). The decoupling hypothesis holds that stocks in developed and emerging markets are not integrated and shocks emanating from global markets do not result in losses in the emerging markets; thus, leading many practitioners and researchers to believe that emerging markets can provide diversification benefits for global investors during market downturns.

There are several theoretical studies examining flight-to-quality phenomena. Vayanos (2004) proposes a theoretical model that estimates time-varying liquidity premia and increases with volatility, such that flight-to-liquidity is high during periods of increasing/high stock market volatility. According to the model, at high levels of market volatility, investors are more risk-averse and have a preference for high-liquidity assets. High-risk aversion results in an increase in the required risk premium of an asset; thus, the returns of a risky asset and the volatility of said asset become more negatively related during flight-to-quality episodes. Lei and Wang (2012) developed a model to show that investors have heterogeneous investment horizons and consequently, their sensitivities to changing transaction costs in the stock and bond markets. High volatility and illiquidity in stock markets increase trading costs, which results in investors shifting capital to bond markets. Thus, there is a higher weighting of bond holdings among equity investors and investments are held for a longer period in the new equilibrium. The study shows that flight-to-quality is determined by liquidity. The study shows that high bond yield spreads are observed during periods when stock markets are highly illiquid and are characterised by high volatility and low returns.

Lastly, transmission has been explained by the risk premium channel. The risk premium channel refers to a mechanism where a negative shock in one market, increases investor risk aversion and consequently increases the risk premium of all assets and their future returns (Vayanos, 2004; Acharya and Pedersen, 2005; Longstaff, 2010). Acharya et al. (2005) developed a liquidity-adjusted asset pricing model that explains how asset prices are influenced by liquidity risk.

3.2.2 Empirical literature on asset market linkages

Early empirical analysis of dependencies between financial asset markets largely focused on linkages between equities and bonds. However, due to the financialisation of commodities and the growing interest in including these assets in a portfolio, there has been a growing strand of literature establishing the relationship between financial assets and commodities. Most of this literature has mainly examined the stock-gold or stock-oil nexus (Daskalaki, Kostakis and Skiadopoulos, 2014; Narayan, Sriananthakumar and Islam, 2014; Adams and Glück, 2015; Reboredo and Uddin, 2016; Adewuyi, Awodumi and Abodunde, 2019). In most cases, these studies seek to determine the safe haven or hedging properties of these assets during crises. However, during the financial crisis it was observed that the prices of commodities declined simultaneously with stock prices (Creti, Joëts and Mignon, 2013); thus, resulting in a strand of literature investigating whether these assets provide safe haven or contagion effects exist. This subsection presents an empirical review of the nexus among the market.

3.2.2.1 Stock and bond linkages

The interlinkage between stock and bond markets has been a key input in portfolio diversification. The early literature imposed a constant, time-invariant relationship between the two markets. Campbell and Ammer (1993) and (Ilmanen, 2003a) found evidence suggesting that the relationship between stock and bond markets is driven by two main drivers, which are inflation and interest rates. The relationship between asset markets has been analysed using linear modelling, which assumes time series are linear when they could potentially be non-linear. The previous literature on cross-asset and cross-market linkages has largely been based on the following methodological approaches: regression analysis (Longstaff, 2010), VAR analysis (Duncan et al., 2011; Flavin and Sheenan, 2015), Granger causality tests (Luchtenberg and Vu, 2015; Chang et al., 2016) and GARCH models and their various specifications, such as the EGARCH, GJR-GARCH and GARCH-M (Tsay, 2012). These approaches are restrictive in their application and provide a linear analysis of the correlations. Baur (2010) examined the stock-bond co-movements and their cross-country linkages. The study finds a decrease within country stock-bond correlation, contrasted by an increase in cross-country correlation between stock and bond markets. Furthermore, the study reports that the flight-to-quality phenomenon between stocks and bonds, and the contagion effect in cross-country stock markets, take place simultaneously. Similarly, Baur and Lucey (2010) showed that cross-country stock market comovement and flight-to-quality from stocks to bonds occur concurrently. They attribute this phenomenon to globalisation, which allows investors to move to safer asset markets beyond country borders.

The application of these techniques can result in misleading analysis because the dependence on asset markets has been proven continuously to be time-varying, nonlinear and asymmetric (Ilmanen, 2003b; Panchenko and Wu, 2009; Skintzi, 2019). The nonlinearity is attributed to the asymmetric response of asset returns to economic cycles (Kaminsky and Reinhart, 2002; Tsai, Lee and Chiang, 2012). Kaminsky and Reinhart (2002) showed that extreme events, such as the global financial crisis, the Persian Gulf war and other crises, resulted in significant changes in asset market comovements. Time-varying dependence describes a characteristic of the joint distribution of returns whereby the dependence between a stock and the market during market downturns differs from that observed during market upturns (Patton, 2004). One of the central issues in the financial market literature is investigating the linkages between asset markets in tranquil and crisis periods. The relationship between assets is explained as non-linear because, according to Granger and Yoon (2002), the time series can have hidden cointegration if positive and negative components of the series are cointegrated. Furthermore, asymmetry and structural breaks affect market dynamics, particularly when the sample period includes a period of financial crisis.

In this context, Ilmanen (2003b) showed that the correlations of stock and bond markets were positively related during periods of economic expansions and negatively related during periods of economic contractions. Ilmanen (2003b) argued that during periods of high inflation, changes in common discount rates dominate changes in cash flow expectations and led to positive stock-bond return correlation. The time-varying observation resulted in a strand of literature examining the flight-to-quality phenomenon (Connolly et al., 2007; Baur et al., 2010). Connolly et al. (2005) showed that the negative correlation between stock and bond returns could be attributed to the flight-to-safety phenomenon. This suggests that during times of economic uncertainty, investors move their capital from high-risk stocks to low-risk bonds. Cappiello et al. (2006) showed that asymmetry existed in the conditional correlation between stock and bond markets. In particular, the study showed that equity markets respond more strongly to negative shocks. Similarly, Andersen, Bollerslev, Diebold,and Vega (2007) and Baele et al. (2010) found evidence of time-variation in stock and bond correlation, such that these markets were negatively correlated during weak economic conditions and positive during periods of expansion of the economy.

Several studies analysed the comovement of asset markets in crisis periods. Most of the early work was conducted by King and Wadhwani (1990) and Baig and Goldfajn (1999). Forbes and Rigobon (2002) used an unconditional correlation measure to examine contagion between asset markets during crisis periods (the 1997 Asian crisis, the Mexican devaluation crisis in 1994 and the US market crash in 1987). The study found no evidence of contagion effects during the crisis periods; however, they noted that the comovement between assets was consistent throughout the sample period, concluding interdependence between markets. A limitation of early works in this research strand is that the measures used failed to account for the direction of shock or contagion. To gain more insight, many studies used the causality approach (Hartmann, Straetmans and Vries, 2004).

Over the years, financial markets in emerging markets have become more liberalised; thus, integration with global markets has strengthened. As a result, several studies sought to investigate the impact of stock market integration on the relationship between stock and bond markets. The integration of emerging markets with other global markets affects the price discovery process of domestic financial assets, thus affecting the correlation between the financial asset markets. Regarding the literature on emerging economies, one of the early studies conducted by Kelly, Martins,and Carlson (1998) showed that the comovement between stock and bonds markets in emerging markets is stronger compared to developed markets because domestic bond markets exhibit equity-like returns. Panchenko and Wu (2009) examined the stock market integration and stock-bond return decoupling in 18 emerging markets in Latin America, the Middle East and Africa, Asia and Emerging European regions over the period January 1995 to December 2005. Using logit regression analysis for the conditional probability of concordance of stock and bond returns, the study showed that an inverse relationship existed between stock market integration and stock and bond return comovements. In other words, the results show that the comovement between stock and bond returns decreases as stock market integration strengthens.

Sakemoto (2018) investigated the interlinkages between equity and bond markets in developed and emerging markets. The study found that equity market comovements and equity-bond comovements are important in developed markets and have similar effects in developed equity markets. Similar to Panchenko and Wu (2009), the study found that equity market integration is a key driver of equity-bond comovement. The study further shows that equity and bond market comovements respond differently to the crisis. The findings indicate that the global financial crisis had a significant effect on the developed economies' bond markets, however, no effect was found for emerging bond markets. Furthermore, VIX, a measure for market uncertainty, was identified as a key driver of asset market comovements.

Soylu and Guloglu (2019) examined the flight-to-quality, flight-from-quality and contagion effects between eight emerging market stocks and US bonds. The study used Granger causality tests to examine the tail distributions and sample period from January 2002 to February 2016. The study found that US monetary policy, represented by US two-year bond yields, had an impact on emerging markets, except for Malaysia. Evidence of flight-to-quality was found for five out of the eight markets examined. The authors attribute this effect to the expansionary monetary policy intervention following the crisis. Lee (2021) investigated the comovement between stocks and treasury bonds in Europe for the period between 1994 and 2015. Using linear OLS and quantile regressions, the study found evidence of flight-to-quality in European equity and bond markets.

In a recent study, Papadamou et al. (2021) examined the effects of the recent COVID-19 pandemic on the dynamic linkages between stock and bond returns for different countries in Europe, Asia, the US and the Australian regions for the January 2020 to April 2020 period. The study found evidence consistent with the flight-to-quality phenomenon during the crisis period. Piplack and Straetman (2010) reported a simultaneous downturn in stock and bond markets during the 2007/8 global crisis period. Thus, raising a new strand of literature, which seeks to determine possible safe haven properties of assets outside of the traditional stock-bond portfolio formation. Since the financial crisis, most of the research focused on providing evidence of cross-asset contagion and the implications of the crisis on this relationship (Longstaff, 2010; Chang et al., 2016; Das, Kannadhasan, Tiwari and Al-Yahyaee, 2018; Guo, Li and Li, 2021).

3.2.2.2 Stock and commodity linkages

An increasing number of investors are including futures-based commodity indices in their portfolios. The argument is that these funds increase diversification, enhance returns and serve as an inflation hedge (Daskalaki and Skiadopoulos, 2011). Besides their traditional role as an inflation hedge and input in the production process, commodities are also considered a financial asset class, providing a hedge for equity price risk, particularly during periods of financial stress and stock market downturn (Chkili, 2016). By adding these assets to a portfolio, the investor can minimise the downside market risk associated with deteriorating market conditions. Empirical evidence (Baur and McDermott, 2010; Capie et al., 2005; Gorton and Rouwenhorst 2006; Daskalaki and Skiadopoulos, 2011; Narayan et al., 2010) suggested that adding commodities to a portfolio significantly lowered the risk and increased the expected return of a portfolio of traditional assets. However, recent studies have found that assets, traditionally considered safe havens, have become increasingly correlated with risky equity markets, hence minimising their diversification benefit in a portfolio. Following the advent of the crisis, the decline in the commodity markets with the simultaneous downturn in the equity markets created an increase in the correlation between both markets (Narayan et al., 2013; Creti et al., 2013; Cheng et al., 2014; Adams & Glück, 2015; Reboredo and Uddin, 2016) because of the increased speculation in the markets affecting volatility and information sharing (Adam and Glück, 2015).

Concerning the role of gold, Baur and McDermott (2010) showed that there exists a short-term relationship among stock, bond and gold markets and found that gold is a haven for stock markets during periods when stock prices are declining. In addition, Capie et al. (2005) examined the linkages between gold and currencies and found that gold can act as an inflation hedge; thus, hedge against the depreciating dollar. In contrast, Piplack and Straetmans (2010), when comparing the hedge and safe haven properties of bonds and gold, indicated that at extremely negative market conditions, the safe haven property of gold fails to hold up. Also, treasury bonds provided a safe haven when stock markets decline.

Several studies have examined the presence of contagion effects between equity and commodity markets. Sumner, Johnson and Soenen (2010) showed that during periods of financial turmoil, a decline in stock markets increased gold prices. Therefore, gold is an important asset class that holders of South African stock can use to diversify their portfolios. Wen et al. (2012) employed dynamic copulas to examine the contagion effect of energy and stock markets during the global financial crisis. The data were divided into two subsamples to indicate the pre-crisis and post-crisis periods. The results showed a significant increase in the comovement between stock and energy markets, thus implying the presence of contagion effects. Conversely, Chkili (2016) also showed that gold acts as a safe haven asset against extreme stock market movements in BRICS economies during major crises. Subsequently, suggesting better diversification benefits for a portfolio containing stock and gold assets.

Crude oil is considered the most volatile commodity. The volatility in crude oil prices is influenced by various factors, including (i) demand and supply shocks, (ii) changes in the business cycles and instabilities in the economic, (iii) political environment, and (iv) financial environment (Nadal, Szklo and Lucena, 2017). For example, political instability during the Gulf wars resulted in diminishing oil supplies, whilst, during the 2008 financial crisis fluctuations in oil prices were a result of financial market inefficiencies (Yıldırım, Erdoğan and Çevik, 2018).

The relationship between gold and oil is closely linked to inflation. An inflation channel can explain the theoretical underpinnings between the two assets, namely: rising oil prices usually influence the aggregate price level (Hunt, 2006) and generate inflationary pressures that prompt hedging against inflation in the form of investments in gold (Narayan et al., 2010). Baffes (2007) showed that the prices of precious metals, including gold, strongly responded to the price of oil. A similar result is produced by Zhang and Wei (2010), who, based on daily data (2000–2008), found that a rising oil price increased the price of gold, but they did not find a reverse link.

Studies analysing the impact of oil prices on stocks across the market show that stock prices and oil prices are inversely related (Huang et al., 1996; Sadorsky, 1999; Faff and Brailsford, 1999). In contrast, Fratzscher et al. (2013) present an argument that oil was not correlated with stocks until 2001. However, as oil started to be used as a financial asset, the link between oil and other assets strengthened. Driesprong et al. (2008) found that the oil price determines future stock returns across developed and emerging economies. Jones and Kaul (2012) assess the comovement between stock returns and oil prices in the US, UK, Canada and Japan and found evidence of the significant impact of global oil price shocks on US and Canadian stock returns. Reboredo and Rivera-Castro (2014) found a positive interdependence between oil price shocks and stock market returns during crisis periods.

Hammoudeh et al. (2014) examined the dependence structure between stock markets in China and global commodity markets. Using copula functions, the study found a positive, but low, correlation between the commodity futures markets and stock markets. Sim and Zhou (2015) examined the dependence between oil prices and US equities. The study found that negative oil price shocks have a positive impact on US equities when US markets were performing well; whereas, positive oil price shocks had a negligible impact. This suggests that the dependence between US equities and oil prices is asymmetric.

Mensi et al. (2016) examined the dependence between oil and foreign exchange at different market conditions and different investment horizons. To capture the different investment horizons, the oil and foreign exchange series is decomposed using the *Haar a Trous* wavelet (HTW), variational mode decomposition, and empirical mode decomposition. To capture the dependence at extreme lower and upper tails, different specifications of copula functions were employed. They found that the linkage between foreign exchange and the oil market differs across the investment horizons and different market conditions. Using DCC, ADCC and GO-GARCH to compare the hedging properties of oil, gold and oil for emerging market stocks, Basher et al. (2016) found that oil provided a better hedge for stock markets compared to bonds and gold. Bouri, Gupta, Tiwari,and Roubaud (2017) examined the cointegration and nonlinear causality among global gold and oil implied volatilities and stock. Using an autoregressive distributed lag (ARDL) bounds test and symmetric and asymmetric non-causality tests, the study found evidence of positive effect of gold and oil implied volatilities on India's stock market.

Most of the studies conducted in South Africa have not explored the potential diversification benefits of commodities, however, they have focused on examining the impact of commodity prices on stock markets. Adewuyi et al. (2019) examined the relationship between gold and stock markets in South Africa and Nigeria. The study explores the cross-market asymmetric shock spillover using a VARMA-BEKK-AGARCH model and quantile regression for the period between June 2002 and May 2017. The results show that a relationship between gold and the Nigerian stock market exists when accounting for and not accounting for structural breaks, whereas, a relationship between the South African stock market and gold exists only when structural breaks are not taken into consideration. The quantile regression analysis shows that in the absence of structural breaks, gold markets respond to South African stock market shocks when the stock market is in the lower- to intermediate quantile. When accounting for structural breaks, the impact of stock return fluctuations in both countries has an immediate impact on gold in all quantiles. Regarding the hedge effectiveness of gold for stock investors in both countries, the study shows that the hedging effectiveness of gold in South African stock markets is low, whereas, an equity investor in the Nigerian stock market would benefit from investing in gold when stock market volatility is high.

Ayadi, Gana, Goutte,and Guesmi (2021) examined the contagion effects between equity and commodity markets in the USA, Europe and BRICS economies. The study considers 16 categories of commodities. The study uses the three-factor international capital asset pricing model (ICAPM) of Bekaert, Ehrmann, Fratzscher,and Mehl (2014) and the DCC-GARCH approach to examine the interlinkages across four crises, which include the global financial crisis, the Irish banking crisis, European debt crisis and BREXIT. The evidence shows there is a significant decoupling effect between equity and commodities during a crisis, except for the BREXIT period, where positive contagion was found. Mensi et al. (2021) use the spillover index of Diebold and Yilmaz

(2012; 2014) to examine the asymmetric return spillovers between crude oil futures, gold futures and ten sectors of the Chinese stock markets. The results of the study show that the global financial crisis (GFC) and the European debt crisis (ESDC), the oil price crash and the COVID-19 pandemic are key drivers of the asymmetric spillovers between stock and commodities markets. The results show that oil and gold futures provide significant hedge effectiveness for equity investors in the short term compared to other investment horizons. Moreover, gold provides superior performance in hedging against losses in the equity markets during periods of high stock market uncertainty.

In South Africa, Aye (2015) uses a bivariate GARCH-in-mean VAR approach to examine the impact of oil price uncertainty on South African stock market returns between July 1995 and August 2014. The response of stock returns to oil price uncertainty is negative and varies in magnitude. When oil prices are denominated in US dollars, the results show a weak, negative impact of oil price uncertainty on stock returns. The impact of oil price uncertainty remains negative; however, the effect on stock markets is stronger when oil prices are converted into the domestic currency, suggesting that an increase in oil price uncertainty causes a decrease in stock returns. The response of stock returns to oil price uncertainty is asymmetric and the impact of positive oil price shocks is more significant compared to negative oil price shocks. Seetharam and Bodington (2015) examined the hedge and safe haven properties of gold for the South African stock and bond markets. The study uses a regression analysis approach similar to Baur and Lucey (2010). The results of the study show that gold displays hedging and safe haven properties for equity investors in South Africa. This result suggests that holding a portfolio consisting of gold will minimise losses during bear market conditions. The results further show that gold can also be used as a safe haven asset to minimise losses in bond markets during crisis periods. The hedging effect of gold for bonds is lagged, such that losses in the bond market are hedged in the next month. Further, Gourène and Mendy (2018) examined the comovement between oil prices and the six largest African stock markets. The study shows that African stock markets have diversification benefits for investors in the oil market.

Morema et al. (2020) investigate the effects of gold and oil price volatility on the volatility of the South African composite stock market index and financial, industrial and resource sector indices and the magnitude of the optimal portfolio weights, hedge ratio and hedge effectiveness among them, using a vector autoregressive asymmetric dynamic conditional correlation generalised autoregressive conditional heteroskedasticity (VAR-ADCC-GARCH) model. The study shows that the conditional correlation between gold and stock markets is found to be negative during crisis periods; thus, suggesting safe haven properties of gold for South African equity investors (Chkili, 2016). In contrast, the dynamic correlation between oil and stock markets is positive and increases during periods of market stress. The correlation between resource stocks and gold and oil markets is generally positive; this is explained by the resources industry being linked to commodity markets. Regarding the hedge effectiveness, it is found that the weight of stock investment relative to commodity investment declines during crisis periods. Investors place a higher weight on gold than stocks in an optimal portfolio. Interestingly, the study also shows that investors prefer to hold only gold rather than hold a portfolio comprising gold and resource stock during financial crisis periods. The oil offers hedging benefits for resource stock markets. Existing studies have paid little attention to existing non-linearities between stock, gold and oil (Gao et al., 2012; 2015).

3.2.2.3 Stock and currency linkages

There are various explanations for the linkages between stock and exchange rate movements. The existing literature has presented two theoretical explanations for the relationship between foreign exchange rates and stock markets. First, the flow-oriented model of Dornbusch and Fisher (1980) showed that the linkages between stock and exchange markets can be explained by the capital account and cross-border activities. A depreciation in domestic currency makes local firms more competitive in the global trade market and increases the demand for exports and increases expected cash inflows. Subsequently, stock prices will increase due to the prospects of higher future cash flows. This perspective suggests that the relationship between stock and foreign exchange will largely depend on the ratio of importers versus exporters in the stock market (Aloui, 2007). Increasing stock prices attracts capital inflows from foreign investors seeking to earn higher returns. Increasing stock prices also increase the wealth of domestic investors and thus increases the demand for domestic currency, leading to an increase in domestic interest rates. The higher interest rates, consequently, attract more foreign investor capital flows, resulting in further appreciation of foreign exchange. For a decrease in stock prices, the effect would be *vice versa*. A second explanation is presented by the stock-oriented model (portfolio balance approach), which suggests that causality runs from the stock market to foreign exchange markets (Branson, 1983). The changes in exchange rates as a result of changes in stock price may be a result of investors selling foreign currency and buying domestic currency to purchase domestic financial assets, therefore, resulting in the domestic currency increasing due to increasing demand for domestic currency. Both explanations suggest a positive relationship between stock and exchange markets.

The existing empirical literature on the relationship between stock and exchange markets has found mixed results. Some studies found a positive relationship between stock and exchange markets (Phylaktis and Ravazzolo, 2005; Hakim et al., 2010; Kal, Arslaner and Arslaner, 2015; Dong et al., 2018). Using cointegration analysis and multivariate Granger causality, Phylaktis et al. (2005) found a positive relationship between stock and foreign exchange markets in a sample group of Pacific Basin countries.

Other studies foundevidence of bidirectional causality. Pan et al. (2007) examined the dynamic relationship between stock and foreign exchange markets using a VAR approach. The results show evidence of bidirectional causality between the exchange rates and stock markets of seven East Asian countries before the Asian financial crisis. Currency depreciation increases the demand for a nation’s exports and results in an improvement in the trade balance. Thus, depreciation stimulates aggregate demand and increases the level of economic activity in a nation. Similarly, the stock-oriented model and the arbitrage pricing theory hypothesise a relation between exchange rate movements and stock returns (Mitra, 2017).

Chkili et al. (2011) examined the dynamic linkages between exchange rates and stock returns for four emerging economies (Hong Kong, Malaysia, Mexico and Singapore) using a Markov switching EGARCH approach. The results show that the link between stock and foreign exchange markets is regime-dependent. Moreover, there was evidence of an asymmetric response of stock markets to shocks affecting foreign exchange markets. Lin (2012) conducted a study investigating the integration between exchange rates and stock prices for a few Asian emerging markets and shows that the comovement between the markets was strengthened during crisis periods. Chkili and Nguyen (2014) examined the dynamic relationship between exchange rates and stock market returns for BRICS countries. The study employs a Markov switching VAR for the period 1997-2013. The study finds that the causality is unidirectional, such that stock markets are found to have a significant impact on exchange markets particularly during the crisis regime, however, exchange rates have no significant impact on stock markets. Worth noting is that there was no evidence found of a relationship between stock and foreign exchange returns, regardless of the regime, suggesting a diversification benefit during the up and down regime.

Other studies examined this relationship across investment horizons. Diamandis and Drakos (2011) investigate the relationship between stock and foreign exchange markets in four Latin American countries and the linkages between these markets with US stock markets. The results of the study found a positive relation between the stock and foreign exchange market based on Johansen's cointegration analysis. Moreover, the Granger causality test indicates that causality is from exchange rates to stock prices for markets in Argentina and Brazil. Causality from stock to foreign exchange markets was established for Mexico and bi-directional causality for Chile's stock market and foreign exchange. Upon analysing the interaction of these markets with the US markets, the results show that the US stock market acts as a transmission channel, thus providing evidence of increasing integration of these markets.

Aloui, Aïssa,and Nguyen (2013), using a copula-GARCH approach, examined the interaction between crude oil prices and five U.S. dollar (USD) nominal exchange rates for developed markets. The sample period is 2000-2011. The results show that the relationship between oil and exchange rates is symmetric. The oil prices and foreign exchange were found to be negatively related, such that, an increase in oil prices was associated with a depreciation of the dollar. In contrast, Mensi et al. (2016) using the *Haar a Trous* wavelet (HTW), variational mode decomposition and empirical mode decomposition, found that the linkage between foreign exchange and oil market differs across the investment horizons and different market conditions. Similarly, Srinivasan

(2014) examined the interactions between stock price, gold price and exchange rate in India and shows that there exists a long-run relationship between gold price and stock price with the exchange rate while there are no significant links between fluctuations in stock price, gold price and exchange rates in India in the short run.

Dai, Wang, Zha,and Zhou (2020) examined the dynamic dependence and risk contagion between oil, gold and US dollar foreign exchange markets for the data period from 1997 to 2018. In recent years, there has been growing literature conducted in African countries. In South Africa, certain studies found that stock markets respond to shocks emanating from exchange rates markets (Adjasi, Biekpe and Osei, 2011; Mlambo, Maredza and Sibanda, 2013; Sikhosana and Aye, 2018). Mlambo et al. (2013), using a GARCH model, show a weak and positive relationship between exchange rate volatility and stock markets, such that a one percentage point increase in exchange rate volatility only results in a 0.004 percentage point increase in stock market capitalisation.

In addition, Fowowe (2015) examined the linkages between stock prices and exchange rates in South Africa and Nigeria. Without accounting for structural breaks, the study shows there is no long-run co-integrating relationship between stock markets and exchange rates in South Africa, while co-integration was found in Nigeria. The reverse is the case when accounting for structural breaks. The results of the causality test indicate that the Nigerian stock market responds to fluctuations in exchange rates; thus, suggesting a flow channel in Nigeria. However, no causality was found between South African stock prices and exchange rates. Moreover, the results show that South African and Nigerian stock prices are influenced by London stock markets. From the reviewed studies, limited studies exist on the forex-stock relationship in boom and recession, while there is no account for the interaction between forex and stock and other asset markets during stable and crisis periods in emerging African markets such as South Africa.

3.2.2.4 Stock and housing market linkages

It is only in recent years, with the increasing availability of data, that the strand of literature examining the role of housing markets as financial assets has grown. Due to rising financialisation, housing or real estate has become an important store of value for investors (Fernandez and Aalbers, 2016). The relationship between the stock and the housing market is explained by two hypotheses. First, is the wealth effect, which suggests that an increase in wealth causes an increase in consumption. Thus, when the price of one asset increases, it increases the wealth of the investor and induces the investor to invest in other assets. The wealth effect, therefore, suggests a positive relationship between stock and housing markets (Tsai et al., 2012) and the second effect, the capital-switching effect (Case and Shiller, 2003), predicts a negative relationship between asset markets. During periods of high stock market volatility, investors switch their investments to safer, more stable markets such as housing markets. Consequently, the price of real estate increases when stock prices decrease.

The results of existing empirical studies on the role of real estate markets in a portfolio are mixed. Gordon, Canter,and Webb (1998) found that real estate securities have diversification benefits for a mixed asset portfolio consisting of stocks, corporate bonds, real estate and international common stock. In contrast, Quan and Titman (1999) found that the relation between housing market returns and stock returns is statistically insignificant. Lee and Ting (2009) report that the addition of property shares to a mixed-asset investment portfolio provided minimal diversification benefits. Olaleye (2011) examined the diversification benefits of including listed property stocks in a mixed-asset portfolio consisting of South African assets. The asset classes considered were the stock market, bond market and the listed property market indices. The study found that real estate stock increased the performance of a mixed asset portfolio when the listed property stock replaces T-bills and bonds in a mixed asset portfolio. The results also show that there is cointegration between stock and stock markets.

In Australia, Heaney and Sriananthakumar (2012) used the DCC-IGARCH approach to examine the dynamic relationship between three asset classes of real estate (listed A-REIT, direct investment in commercial and residential real estate) and stock returns over the period 1986 to 2009, which includes the economic events such as the 1987 stock market crash and 2008 global financial crisis. The study finds that the relationship between the stock and real estate market is time-varying and the GFC had a significant impact on the correlation between the two markets, as the correlation between the markets was positive during the crisis, thus reducing the diversification benefits of real estate investing for stock investors. Luchtenberg and Seiler (2014) used Granger causality, VAR and the state-space model to investigate the lead-lag relationship between REITs (equity REITs and securitised mortgage REITs) and stock markets. The results of the Granger causality and VAR indicate low integration between markets before the subprime and global financial crisis. However, the linkages between real estate and stock markets increased following the financial crisis.

Caporin, Gupta,and Ravazzolo (2021) examined contagion effects between REITs and equity markets in the US using a quantile-on-quantile approach and four subsample analyses to allow for examining the contagion effects, before, during and post the crises. The results show that the spillovers between REITs and equity markets vary in the different subsamples, however, similarities are noted in the pre-financial crisis and post-European debt crisis periods. The contagion effects of REITS on the stock market during the financial crisis were found to be lower than the pre-crisis levels. However, the contagion effects were observed to increase during the European debt crisis.

Chiang et al. (2020) used a Markov switching VAR to investigate the relationship between stock and housing market returns in the US for the period between 1987 and 2017. The results show that the autocorrelation between the two markets is regime-dependent. Positive spillovers from the housing market to the stock market take place in the crisis regime; thus, suggesting that housing financial assets can be included in a portfolio to hedge against high stock market volatility. While certain studies have accounted for the up and down period in the housing cum stock market relationship using sub-period analyses, a superior estimate can be achieved using a technique that accounts for different conditions without breaking the sample period, such as MSM. There is a gap between the use of superior techniques on the one hand and the examination of multiple assets along with real estate on the other hand.

3.2.2.5 Multi-asset linkages

Longstaff (2010) examined the relationship between the returns of asset-backed CDOs and treasury, corporate bonds, stock market returns and the VIX index. The study employed linear regression analysis and differentiates periods before the crisis, the subprime crisis and the global crisis. When comparing the relationship between asset markets across the different periods, the study found evidence of an increase in the linkages was more notable in the subprime crisis period than compared to the other two crisis periods. Limitations of the study include that the analysis approach used assumes exogenous structural breaks. Chan, Treepongkaruna, Brooks,and Gray (2011) employed a Markov switching model to investigate the relationship between stock, bonds and real estate assets in the United States and global gold and oil returns. The study found flight-to-quality from gold to stocks during stable market conditions when stock returns are higher and volatility is low. However, during crisis periods, stocks, oil and real estate record negative returns. Moreover, during this period, bonds offer diversification benefits causing investors to shift from stocks to treasury bonds.

Guo et al. (2011) used impulse response functions of the two-state MSVAR model to examine the presence of contagion effects between stock, real estate, credit default swaps and energy markets in the United States from October 2003 to March 2009 period. The study found that the contagion effects are state-dependent and the contagion effects are stronger in the risky regime, which is characterised as a period of low mean returns and high volatility. The study did not find evidence of contagion in the stable regime. Guidolin et al. (2017) used an approach similar to Guo et al. (2011) to investigate cross-asset contagion between European yield series, such as sovereign and corporate bond yields, repo contracts and stock yields to explore the presence of four contagion channels, which include flight-to-quality, flight-to-liquidity, risk premium and correlated information channel. The results of the study are similar to Guo et al. (2011) in terms of finding contagion effects in the crisis or risky regime. However, the authors note that this effect is weak and the contagion is attributed to the flight-to-quality channel.

Ciner et al. (2013) evaluated the dynamic linkages between major asset classes, including stock, bond, gold and oil in the US and UK markets. Their results show that the bond market can act as a hedge for stock markets during periods of turmoil and gold can act as a hedge for exchange rate volatility. Hood and Malik (2013) found a similar result in terms of gold providing insufficient hedging benefits for US stock markets. Furthermore, Nguyen and Nguyen (2014) investigated the cross-asset dependence of equity, bond and money markets in Australia and the US, as well the cross-country linkages of these various assets between the two countries. The study used a copula model, which they described as offering a flexible way to model dependence as it separates model margins and dependence structure and it was found that the markets boom and crash simultaneously. In addition, Chang et al. (2016) applied a VAR model to examine evidence of cross-asset contagion among multiple asset markets, including real estate investment trusts (REITs), money, stock, bond and currency markets in the US from 2006 to 2012. Contagion is established by observing the Granger causality before and after the crisis. The study found contagion effects between medium-term bonds and equity markets, and currency and equity markets. The study, however, could not find evidence of a positive relation between equities and REITs, money markets and short-term bonds. The study concludes that contagion originates from the bond market, which indicates that cross-asset diversification benefits are reduced when investors hold bonds and equity during a crisis.

Using a time-varying Joe-Clayton copula to examine the dynamic relationship between long-term government bonds, equity, oil and gold, Baur et al. (2010) studied 11 international equity markets in Europe, North America and East Asia to determine possible safe haven properties of these assets for an investor. Safe haven assets are weakly positively correlated or negatively correlated with markets; therefore, can minimise the risk of losses during market stress periods (Baur et al., 2010). The findings indicate that the safe haven properties of bonds, gold and oil are time-varying. Worth noting is that gold and oil provide superior performance as safe-haven assets during crisis periods when compared to government bonds in all the markets examined. Furthermore, investors can reduce losses of the equity index during periods of market stress by investing in Japan, Australia and New Zealand markets.

Liow et al. (2018) used the Markov regime-switching model to examine the relationship between stock, money, bond, securitised real estate and foreign exchange markets in economies. The results found that the effects of stock returns and foreign exchange market returns have a significant and positive impact on the securitised real estate market during periods of high volatility in the securitised property market. In contrast, stock and bond markets are shown to be negatively related to the securitised real estate market. Guidolin et al. (2019) examined the effect of the US subprime crisis on the relationship between ABS higher grade, treasury repos, treasury notes, corporate bonds and stock markets in US financial markets with the aid of a Bayesian estimation technique. Unlike other studies, which use contemporaneous correlations to identify contagion episodes (Kohonen, 2014), this particular study differentiates itself by defining contagion by examining the changes in coefficient matrix of a VAR. The study finds evidence of cross-asset contagion between the financial markets. Upon further analysis, the findings show that the contagion effect can be explained by the flight-to-liquidity channel, risk premium channel and correlated information channel. This study does not consider the up and down period.

Liu, Wang,and Li (2019) used a VEC copula GJR-GARCH-skewed-t model to analyse the interdependence between the stock and treasury bond cash and futures in the United States during the global financial crisis. The model allows for modelling dynamic dependence and tail dependence. The study shows increasing comovement between the stock and bond markets during times of crisis.

For studies conducted in African financial markets, Duncan and Kabundi (2011) adopted the method of Diebold and Yilmaz (2009) to determine the direction of volatility transmission between South African asset classes. The study finds weak but positive correlations between currencies and equities and equities and bonds. Furthermore, currencies and equities are found to be net transmitters of volatility to bonds. The use of innovations from VAR to measure the time-varying correlations between different asset classes reveals that the relationship between asset markets depends on the state of the financial market. Periods of high volatility lead to high correlation across markets and periods of low volatility lead to low correlation in volatilities. Time-varying currency spillovers have a stronger impact on bonds than equities, particularly during or following periods of domestic currency crises. Equities are net transmitters of domestic volatility spillovers. Periods of the domestic and global crisis are characterised by increasing interdependence of volatility in SA asset classes. The concluding results are that bonds are net receivers of volatility transmissions from other asset classes. Additionally, increases in volatility spillovers coincide with periods of domestic and global crises.

Boako and Alagidede (2016) studied the relationship between the stock markets of eleven African countries and five global commodities. There is a need for evaluating of correlation between a variety of asset markets (stock, bond, currency, gold, crude oil) during different investment horizons and market conditions, to shed more light on the possibility of domestic diversification. Kang, Maitra, Dash,and Brooks (2019) examined the connectedness, market integration and contagion between equity markets, bonds, commodities and VIX indices. The study considers eighteen stock markets, in emerging markets, including BRICS economies and developed markets, including G7 economies, six commodities, two bond indices and two implied volatility indices. The results show that emerging economies are generally net receivers of shocks and developed markets are net transmitters. Commodities and other asset/financial markets are receivers of spillovers from the stock markets of developed countries. Moreover, the results show weak connectedness between commodities markets and other financial markets.

3.2.3 Summary of empirical review

The study contributes in the following manner. First, the majority of the studies cover a period during the subprime and global financial crises and few have covered the European debt crisis. Also, South Africa underwent a crisis period in the latter part of 2019. It would be of interest to see how these markets are related in crisis periods. Second, a large proportion of studies on multi-asset linkages have been conducted in developed markets, while less attention has been given to emerging markets, particularly African markets. While most of the literature in developed markets concludes that there is contagion between asset markets, this evidence is inconclusive in South African asset markets. Only a few studies examined the relationship between a large subset of assets in the South African context. Thus, the lack of empirical evidence on cross-asset linkages in the South African markets needs further investigation.

This study will provide fresh insight into the dynamic relationship between domestic and international asset markets. It is useful to examine domestic asset interlinkages to ascertain whether these markets can provide diversification for international investors during global events. The time variance in correlation has implications for portfolio diversification. Portfolio managers need to identify conditions in which the relationship between asset returns varies. The study employs a Markov regime-switching framework, which enables the estimation of the joint asset return distribution and allows for the relationship between asset returns to vary across bear and bull market states. Asset market dependence is also important for financial regulators and policymakers. Strong asset market linkages during market crises have implications for successful government intervention policies.

3.3 Data and methodology for examining asset market linkages in different market conditions

This chapter investigates the relationship between asset markets in different market conditions using a quantitative approach. The study employs secondary data for the period spanning from February 2000 to December 2019. This section comprises three main parts. This section begins with a description of the sample data and data sources and the statistical methods used to analyse the data. This is followed by a discussion of the descriptive characteristics of the time series data and the results derived from the estimation techniques.

3.3.1 Data and sample for asset markets

This section summarises the data used for the analyses. Monthly datasets, spanning from February 2000 to December 2019, were employed to conduct empirical analyses for this study. Monthly data frequency was selected based on the availability of country risk data used in Chapters 4 and 5. The selected sample period includes periods of major global events, such as the global financial crisis of 2007 and the European sovereign debt crisis of 2012 (Eraslan and Ali, 2018). The sample includes the monthly closing prices for equity, bond, currency, real estate, gold and oil indices collected from the Bloomberg Terminal and I-Net BFA. These assets were chosen because they are the main investment assets common in investors' portfolios globally (Chang et al., 2016). Though monthly data are useful and produce valid findings, daily data would be better than monthly data; however, the latter was selected and employed due to the lack of daily data. Monthly data are appropriate for identifying regime shifts (Aloui and Jammazi, 2009). Low-frequency data (daily) may be too noisy and result in biased results (Basher and Sadorsky, 2006). Moreover, country risk data employed in Chapter 4 and Chapter 5 is only available in monthly frequencies and therefore, to maintain consistency throughout the chapters, monthly frequency of asset price data was used.

The Johannesburg Stock Exchange (JSE) All Share Index (ALSI) is recognised as the official proxy for South Africa’s stock market. The index tracks the performance of all companies listed on the JSE in South Africa. The index represents 99 per cent of the free-float market capitalisation on the JSE (JSE, 2019). Bonds are represented by the All Bond Index (ALBI), an index composed of the top 20 vanilla bonds, with more than one year left to maturity, ranked according to their liquidity and market capitalisation. At least 50 per cent of the bonds composing the index are government bonds (JSE, 2019).

The foreign exchange market is represented by the real effective exchange rate. The real effective exchange rate accounts for the change in the currency of main trade partner countries and removes the inflation factor. The real effective exchange rates are based on US Dollars ($). The US Dollar is still considered to be the world's reserve currency (Paulson Jr, 2020), despite the recent literature indicating a rise in the desirability of the Chinese renminbi (Huo, 2021) and the Euro (Dabrowski, 2020).

The FNB house price index (HPI) was used to represent the property market. It tracks the performance and growth of the housing property market. An alternative measure of housing property performance, the ABSA HPI, is popular, albeit its discontinuation in 2016 due to methodological issues (Kisten, 2019).

The commodity market is proxied by the futures prices of gold and oil. Cheng et al. (2014)argued that futures prices are more reliable than spot prices because of informational frictions in global supply, demand and inventories of commodities. The futures price data for gold and oil were retrieved from Bloomberg. These futures prices correspond to futures contracts nearest to maturity. Following the existing literature, the study used the generic futures series provided by Bloomberg. The generic series is constructed by rolling over contracts that correspond with a range of days to maturity. The underlying contracts of the generic series chosen for this study include, Gold futures traded on the Commodity Exchange Inc (COMEX) and the West Texas Intermediate (WTI) crude oil futures traded on the New York Mercantile Exchange (NYMEX). The Bloomberg ticker GC1 (gold futures) and CL1 (crude oil futures) were chosen as they represent the prices of the shortest maturity contracts traded at any point in time. Bloomberg provides daily data on energy futures contracts for any maturity. It rolls over contracts to create a fixed maturity time series that contains contracts that fall within a certain range of days to maturity. Short-dated contracts are relatively liquid and their prices reflect market dynamics (Chantziara and Skiadopoulos, 2008).

Gold is one of the most liquid and tradeable assets globally due to the financialisation of commodity markets (Jena, Tiwari and Roubaud, 2018). Gold is used for portfolio diversification, as an inflation hedge and as an investment asset through gold exchange-traded funds. A crude oil futures contract is one of the most traded in the NYMEX energy sector (Tudor and Anghel, 2021). The prices of the futures contracts are quoted in US dollars and cents per barrel. Crude oil is a primary energy source; thus, a change in crude oil prices significantly affects the performance of key macroeconomic indicators and the price of other assets (Delgado, Delgado and Saucedo, 2018).

The returns for the different asset markets were computed as the first difference of the natural logarithm of two successive monthly closing prices, computed as follows:

$$r_{it} = \log(p_{it}/p_{it-1}), \qquad (3.1)$$

where r_{it} is the price return of the ith market, p_{it} is the monthly closing price of each asset market index, *i=1…6,* at time t.

3.3.2 Method of analysis for asset market linkages

This section of the chapter discusses the method used for analysing the interdependence between the six asset markets described in Section 3.3.1. This section will first present a description of the empirical approach applied for the analysis, the Markov switching vector autoregressive model.

3.3.2.1 Markov switching vector autoregressive model

To determine the dynamic nature of the relationship between the selected asset markets. This study employed the vector autoregressive apporach and the multivariate Markov switching vector autoregressive (MSVAR) model (Krolzig,1997). This study evaluated how asset markets respond to shocks emanating from other markets, using a regime-switching framework to differentiate between the economic states. The study first considered the linear vector autoregressive model outlined as follows:

$$y_t = \Psi_0 + \sum_{j=1}^{p} \beta_j \, y_{t-j} + \mu_t \tag{3.2}$$

Where Ψ_0 is the intercept term, β_j is the vector of autoregressive parameters and μ_t is the variance or heteroscedastic parameter. In empirical studies, scholars show that asset return series exhibit characteristics such as fat tail distribution, asymmetry and mean reversion (Balcilar, Hammoudeh and Asaba, 2015; Kang et al., 2019). Hence, it was necessary to investigate the interdependence of asset markets using the MSVAR model that is able to capture the non-linearity characteristics asset returns and better describe behaviour of asset returns in different market conditions.

The MSVAR addresses some of the limitations of the linear autoregressive and vector autoregressive models. The multivariate Markov switching vector autoregressive (MSVAR) model developed by Krolzig (1997) is an extension of the MS-AR model introduced by Hamilton (1989). The Markov switching framework does not require *a priori* identification of crisis periods, the crisis periods are determined endogenously; thus, avoiding the problem of sub-period analysis or threshold dating. Moreover, the Markov switching framework is able to model financial data series characteristics, such as volatility persistence and clustering (Cont, 2010). A vector autoregressive (VAR) model with Markov-switching coefficients allows for the identification of bull and bear market states. Models are further distinguished depending on the number of VAR parameters that vary across regimes. The VAR parameters include the intercept or mean, autoregressive coefficients and the variance-covariance matrix.

Krolzig (1997) developed various models belonging to the MSVAR class. These models are classified into two categories; models with switching intercepts (MSI) and models with switching means (MSM). According to Krolzig (1997), the MSI(m)-VAR(p) model where only the intercept varies across regimes is defined as follows:

$$y_t = \Psi_{0s_t} + \sum_{j=1}^{p} \beta_j \, y_{t-j} + \mu_t, \qquad (3.3)$$

Where the residuals are assumed to be normally distributed, conditional on the regime, such that; $\mu_t \sim NID(0, \sum_{s_t})$. $y_t = (y_{1t}, \dots \dots, y_{Mt})$ and t=1,… T is an M-dimensional time series vector, χ_{s_t} are the matrices of the regime-switching intercept term, β_j are the matrices of autoregressive parameters, p indicates the number of lags of the autoregressive term and $\sum_{s_t}$ is the variance-covariance matrix of a Gaussian zero-mean error process, μ_t. In equation 3.3, the autoregressive parameters and variance-covariance matrix are homogenous across the regimes and the intercept term is allowed to depend on an unobserved regime variable, s_t. The unobservable state-dependent parameter s_t is a random variable, which results in y_t changing from one regime to another. The intercept parameter, χ_{s_t}, regime-dependency is as follows:

$$\chi_{s_t} = \begin{cases} \chi_1 \; if \; s_t = 1 \\ \vdots \\ \chi_K \; if \; s_t = K \end{cases}$$

In general, s_t is assumed to follow an irreducible ergodic M-state Markov stochastic process with a transition matrix:

$$P = \begin{bmatrix} p_{1,1} & \cdots & p_{1m} \\ \vdots & \ddots & \vdots \\ p_{m1} & \cdots & p_{mm} \end{bmatrix} \qquad (3.4)$$

where $p_{ij} = PR(S_t = j | S_{t-1} = i)$; $i, j = 1, \dots \dots, m$ is a transition probability of switching from regime i in time t-1 to regime j in time t. This suggests that the current regime s_t depends on the previous period's regime, S_{t-1}.

The MSM(m)-VAR(p) model allows for regime dependency in the mean. The equation is written as follows:

$$y_t - \mu_{s_t} = \sum_{j=1}^{p} \beta_j \, (y_{t-j} - \mu_{s_{t-j}}) + \mu_t, \mu_t \sim NID(0, \sum_{s_t}) \qquad (3.5)$$

The MSM-VAR and MSI-VAR may also be specified to include regime-dependent autoregressive and error covariance parameters. The study also considered the Markov switching model with regime-dependent intercepts and heteroscedasticity (MSIH), specified as follows:

$$y_t - \chi_{s_t} = \sum_{j=1}^{p} \beta_{j,s_t} y_{t-1} + \mu_t, \qquad (3.6)$$

The general form of the MSIAH is represented as follows:

$$y_t = \chi_{s_t} + \sum_{j=1}^{p} \beta_{j,s_t} y_{t-1} + \mu_t, \qquad (3.7)$$

where $y_t = (y_{1t}, \dots . y_{nt})$ refers to an n-dimensional time series vector for the six asset returns examined in this study. χ_{s_t} is a vector of mean returns in a state s_t and β_{s_t} is a 6 x 6 matrix of autoregressive coefficients in the state s_t.

$\mu st_{nt} \sim N(0, \sum_{s_t})$,

where $\mu_t = (\mu_{1t}, \dots, \mu_{nt})$ and $\sum_{s_t}$ is a n x n variance-covariance matrix conditional on S_t:

$$\sum_{s_t} = \begin{bmatrix} \sigma_{1,1,s_t} & \cdots & \sigma_{1,6,s_t} \\ \vdots & \ddots & \vdots \\ \sigma_{6,1,s_t} & \cdots & \sigma_{6,6,s_t} \end{bmatrix} \qquad (3.8)$$

and

$$\rho_{v,w,s_t} = \frac{\sigma_{v,w,s_t,}}{\sigma_{v,s_t}\sigma_{w,s_t}} \qquad (3.9)$$

is the contemporaneous correlation between the returns on assets in a state S_t.

The transition probabilities provide the expected duration that the system is expected to remain for a particular regime:

$E(D_v) = \frac{1}{1-p_{v,v}}, v = 1,2, \dots m$ where D_j denotes the duration of regime v.

The conditional distribution of y_t (conditional on the state s_t and on past information is:

$$f(y_t|y_{t-1}) = \sum_{i=1}^{M} f(y_t|S_t, y_{t-1})\, Pr(S_t|y_1, \ldots, y_{t-1}) \quad (3.10)$$

where M represents the number of possible regimes. The log-likelihood function is then:

$$L = \sum_{t=1}^{T} ln[f(y_t|y_{t-1})], \quad (3.11)$$

where T is the number of observations in the data set. The expected maximisation (EM) algorithm developed by Dempster et al. (1977) is used to maximise the log-likelihood value over the parameters μ_{s_t}, β_{s_t} and $\sum_{s_t}$ for s_t=1,…., M and for the transition probabilities P. The EM starts with estimates of hidden data and iteratively produces a new joint distribution that increases the nonlinear probability of observed data.

3.3.2.2 Impulse response functions

One of the advantages of using a Markov switching framework is the derivation of regime-dependent impulse response functions (IRFs), which can determine the state-dependent responses of variables to a shock in the economic system (Ehrmann, Ellison and Valla, 2003). The IRFs allow for further investigation of the performance of different markets in the various regimes. The IRF can measure the magnitude of asymmetrical effects on market performance and the direction in which markets respond to shocks in the VAR system (Shahrestani and Rafei, 2020). The IRFs trace the effects of innovation in the economic system over time. The conventional method of conducting impulse response function analysis in the absence of structural shifts can result in misleading conclusions about the dynamic relationship between asset returns; thus, regime-dependent impulse response functions are used to describe the relationship between endogenous variables and fundamental disturbances within each Markov-switching regime. The IRFs was thus estimated according to the prevailing regime at the time the shock impacts the system and throughout the duration of the response.

Assuming that the shock transmitted to the N_{th} endogenous variables in t_0, the contemporaneous response vector will determine the effect of the N_{th} random disturbance on the endogenous variables in t_0. The general form of the impulse response functions for a shock to the economic system, ε_t^0 is denoted as follows:

$$G_s = E[X_{t+N}|\varepsilon_t = \varepsilon_t^0, \Psi_{t-1}^0 - E(S_t + {}_N\Psi_{t-1}^0)] \quad (3.12)$$

where the history of the process up to period t-1 is known and denoted by the information set Ψ_{t-1}^0. The IRFs are estimated assuming that:

$\varepsilon_t \sim N(0, \sum)$,

and $E(\varepsilon_t|\varepsilon_{wt} = \delta_w) = (\sigma_{1w}, \sigma_{2w}, \dots, \sigma_{mw})'\sigma_{ww}^{-1}\delta_w$, where $\delta_w = (\sigma_{ww})^{-1/2}$ denotes a one standard error shock. However, when considering a nonlinear context, the effects depend on shocks that occur between t and t+N, and on the history of past shocks, j_{t-1} . Guided by a similar approach used by Ehrmann et al. (2003), the regime-dependent generalised IRFs of a variable v for an arbitrary shock to variable w denoted by $\varepsilon_{wt} = \delta_w$ and historical shock j_{t-1} are denoted as follows:

$$GIRF(N, \delta_w, j_{t-1}) = E(Y_{i,t+N}|\varepsilon_{wt} = \delta_{w,} w_{t-1}) - E(Y_{i,t+N}|w_{t-1}) \quad (3.13)$$

The usefulness of regime-dependent IRF analysis depends on whether the regimes are highly persistent and the time horizon of the regime (Shahrestani et al., 2020). One of the important features of the GIRF is that the generalised responses are not affected by the ordering of the variables in the system, which is an advantage compared to the orthogonality approaches. Because of this, the GIRF allows for a meaningful interpretation of the initial response of each variable to shocks emanating from other variables. To identify flight-to-quality episodes, an analysis of the IRFs will be performed. The flight-to-quality phenomenon would take place when following a shock, investors sell a risky asset and buy a safer asset. Thus, evidence of the flight-to-quality effect will be observed when the price of the risky asset falls and the price of the safer asset rises. The correlated information channel is identified through the non-linear effect captured by the MSVAR (Guidolin et al., 2017), specifically, the effect generated by a shift to the crisis regime.

3.4 Results and Discussion

Allocating assets amongst different financial markets is important, particularly during periods of market downturns. The principle of portfolio diversification suggests that investing in assets that are weakly correlated minimises the losses that may occur as a result of a market crisis. Therefore, this study determines if price contractions in South African assets occur at the same time, particularly during crisis periods. The first section of the results reports the descriptive statistics, followed by the results of the model selection process and preliminary tests. The results and discussion for the MSVAR model, IRF and variance decomposition, then follow. The final section provides a summary of the results and concludes the chapter.

3.4.1 Descriptive statistics

When analysing logged financial asset returns, many data properties have been found to hold in different securities and different financial markets. Therefore, it is important that when applying a chosen statistical model, those properties are adjusted to ensure that the model is correctly specified. The stylised facts include leverage effects (asymmetry in gains and losses), heavy-tailedness, serial correlation and volatility clustering (Basher et al., 2016; Morema et al., 2020). The descriptive statistics measures, such as the mean, median, maximum and minimum, standard deviation, skewness, kurtosis and Jarque-Bera statistics were computed for each of the asset return series.

Table 3.1 displays the descriptive statistics for the monthly returns of equity, bond, housing and foreign exchange markets and commodities markets (gold and oil). The mean of historical monthly returns of the stock, bond, housing and exchange markets and commodities markets is positive, which reflects a bull market during the sample period. The highest average monthly return is observed for stock, bond and gold, where the monthly average returns are 0.84, 0.84 and 1.02 per cent, respectively. The returns are generally low and there is a significant disparity between the maximum and minimum monthly returns for the sample period.

The oil market has the highest return and standard deviation over the sample period, whilst the housing market has the lowest return and standard deviation. This implies that of the observed periods, the oil market experienced high volatility, while the housing market experienced small changes compared to other variables in the study. Additionally, consistent with the literature (Andersen et al., 2007; Morales, Moreno and Vio, 2014), analysis of the return series indicates a high standard deviation in monthly stock returns, which indicates that the market was the most volatile during the sample period. The foreign exchange market exhibits less risk in comparison to the bond market. The risk-return tradeoff for the asset markets is consistent with portfolio theory.

The skewness indicates if the market has higher losses or gains and also indicates, which market has the highest probability of experiencing losses or gains. Return distribution skewness relates to the risk aversion of market participants (Wen, Huang, Lan and Yang, 2007; Wen, He and Chen, 2014). Wen et al. (2007) suggested that the negative skewness in financial returns is related to market information efficiency. Negative skewness is an indicator of risk and risk-averse investors require compensation for bearing such risk through a higher risk premium and higher asset returns (Lin, Lehnert and Wolff, 2019). Hence, the stock and oil markets, which exhibit negative skewness, have a higher standard deviation and maximum return compared to other markets. The bond, currency and housing markets are characterised by positive skewness. Traditionally, bonds, foreign exchange and gold are considered haven assets during periods of high stock market uncertainties (Panchenko et al., 2009; Dimic, Kiviaho, Piljak and Äijö, 2016; Raza et al., 2016).

In line with the empirical properties of asset returns series, the kurtosis parameter value is greater than three for all asset returns, suggesting that the return series were found to display leptokurtosis or have fat-tailed distributions. This result also confirms the results of the Jarque-Bera test, which rejects the null hypothesis of a normal distribution of asset returns at a level of significance of 5 per cent. Thus, all asset return series exhibit asymmetric properties.

The stationarity of the return series is determined through the Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests. Identifying whether the series has a unit root is an important step before determining the long-run relationship between asset markets. The presence of unit roots in the explanatory variables will most likely result in spurious regression when the variables in a VAR system are estimated using the least squares method (Granger and Newbold, 1974). The results of the unit root tests are presented in Table 3.1. The results of the PP and ADF unit root test found that all return series (excluding the housing market) were significant at all levels, thus rejecting the null hypothesis that the series contains a unit root. The housing price index returns were found to be stationary at first difference. As a result, the first difference in housing market returns will be obtained and used for the empirical analysis. This result is consistent with other studies (Chan et al., 2011; Guo et al., 2011) that found that the housing market series is integrated with order 1.

The KPSS test for all return series was insignificant at all levels, suggesting a failure to reject the null hypothesis that the series is stationary. The unit roots tests may not be reliable in the presence of structural breaks, hence the Zivot-Andrews (ZA) test was performed (Zivot and Andrews, 2002). Overall, the results from all unit root tests employed indicate that all variables of interest are not I (2), which permits the estimation of the MSVAR model. Figure 3.1 displays the monthly asset returns for the six asset markets. All markets depict variance during the 2008 global financial crisis. The asset return plots also confirm the stationarity result of the unit root tests, which show that all asset return series, except for the housing market, were stationary at levels.

The unconditional correlation among the asset markets is presented in Table 3.2. Overall, the correlation between the markets is low and ranges between -0.41 and 0.34. Between the asset markets, the lowest correlations were observed between the oil and bond markets (-0.41). The highest correlation is noted between the stock and oil futures market (approx. 0.34). Consequently, the correlation between stock and bond markets is significantly low. This observation suggests that bonds can be used as a haven asset for oil markets and stock markets. It is also noted that the exchange rate is negatively related to the stock, bond and housing markets. And the commodities markets are negatively correlated with the bond market. The housing market is negatively correlated with the exchange market and the gold futures market. Correlation is significantly low, almost negligible, for the exchange rate and commodities markets. This suggests diversification benefits for investors. Out of the markets examined, stock markets are negatively related to the exchange rate.

Table 3. 1 Descriptive statistics

Variable	STOCK	BOND	HOUSING	FOREX	GOLD	OIL
Mean	0.0084	0.0084	0.0068	0.0035	0.0102	0.00625
Median	0.0098	0.0076	0.0051	0.0009	0.0135	0.0081
Maximum	0.1313	0.0864	0.0302	0.1834	0.1859	0.2355
Minimum	-0.1503	-0.0563	-0.0139	-0.1021	-0.1504	-0.3080
Std. Dev.	0.0463	0.0208	0.0079	0.0377	0.0564	0.0947
Skewness	-0.2521	0.1999	0.6987	0.7401	0.0967	-0.4540
Kurtosis	3.6547	3.9874	4.1518	5.9528	3.7176	3.4316
J-B	6.7710***	11.2525***	32.5231***	108.1913***	5.4777*	10.0240***
PP	-15.9697***	-14.4259***	-3.2514*	-11.2505***	-17.2581***	-15.4672***
ADF	-15.9777***	-14.4515***	-2.8241	-11.3350***	-17.2741***	-15.3308***
KPSS	0.0527	0.0497	0.0422	0.0627	0.0526	0.0293
ZA	-16.3932***	-14.73941**	-5.2007***	-11.4991***	-17.5292**	-15.5740***
BDS test	0.0152***	0.0134***	0.1650***	0.0167***	0.0085*	0.015524***
Q(12)	6.5013	9.2520	78.004***	10.583	13.344	16.580
Q^2(12)	77.261***	7.6919	38.521***	10.424	21.145**	23.117**
ARCH LM	8.3511***	3.2634*	319.3077***	0.1359	1.3766	8.8519***

Notes: (*) Significant at 10%; (**) Significant at 5%; (***) Significant at 1%. unit root tests are performed for the intercept. Zivot and Andrews (ZA) (1992) were performed allowing for one structural break in the constant. BDS has two dimensions.

Source: Author's estimation (2022).

Table 3.2 Unconditional correlations between asset markets

	Stock	Bond	Housing	Forex	Gold	Oil
Stock	1.0000					
Bond	0.0422	1.0000				
Housing	0.1330	0.0661	1.0000			
Forex	-0.0939	-0.2733	-0.0975	1.0000		
Gold	0.1186	-0.1910	-0.0089	0.3378	1.0000	
Oil	0.3385	-0.4073	0.0081	0.1058	0.2931	1.0000

Source: Author’s estimation (2022).

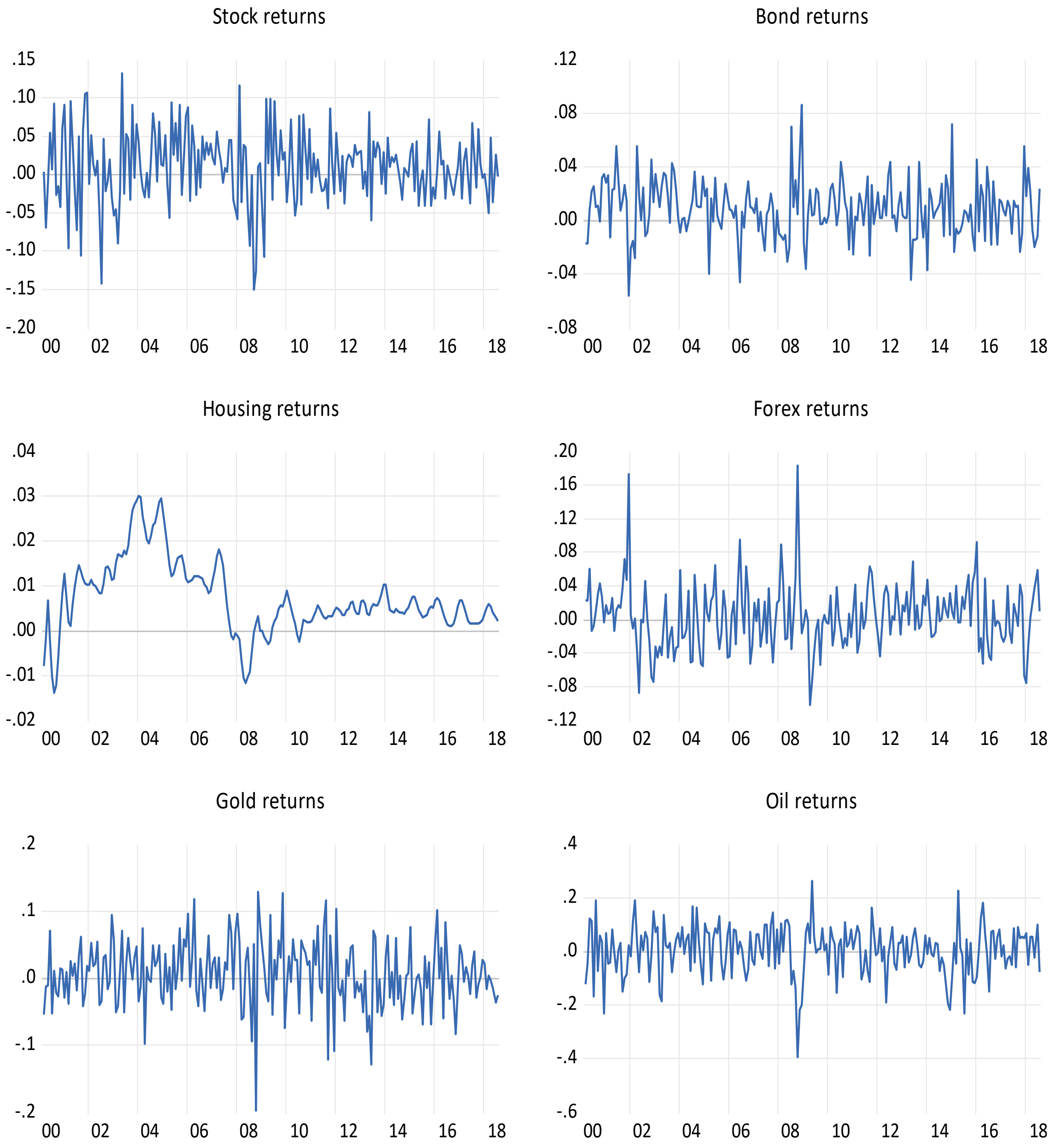

Figure 3.1 Asset return series

Source: Author’s estimation (2022).

3.4.2 Regime-switching behaviour of asset market returns: Preliminary analysis and model selection

First, it is important to examine the asset return series for evidence of non-linearities. Following a similar approach to Reboredo (2010) and Chen, Zhu,and Zhong (2019), the Brock, Dechert and Scheinkman (BDS) test for nonlinearity was applied to the residuals of the time series model. Table 3.1 presents the results of the test. Most of the probabilities are less than 5 per cent; thus, the null hypothesis of linear dependence is rejected, resulting in the conclusion that the asset returns series exhibit nonlinearity. This result further provides reasoning for using a non-linear model, namely the MSVAR.

Subsequently, the information criteria and likelihood ratio test are performed to select the best models. The MSVAR parameters can switch in means, intercepts, autoregressive coefficients and variance/covariance parameters. Five types of the MSVAR model are considered: Markov switching with regime-dependent intercept (MSI), Markov switching with regime-dependent intercept and variance (MSIH), Markov switching with a regime-dependent mean (MSM), Markov switching with regime-dependent intercept and autoregressive parameters (MSIA) and Markov switching with regime-dependent intercept, variance and autoregressive parameters (MSIAH) (Krolzig, 2013). The optimal lag length of the VAR model is selected based on the log-likelihood, Akaike Information Criteria (AIC), Schwarz Bayesian Information Criteria (SIC) and Hannan-Quinn Criterion (HQC) (Brooks, 2019). The optimal number of lags based on the AIC and FPE is two and the optimal number of lags based on the SIC and HQC is one. The SIC and HQC had the highest probability of correctly identifying the optimal lag length for larger sample sizes (120 and higher observations) (Liew, 2004). Thus, the optimal number of lags chosen is one.

The various specifications of the MSVAR model are compared using the log-likelihood, AIC, HQC and SIC criteria and also examining the LR statistic of the models to determine the optimal model for the empirical analysis. To select the optimal model specification, this study examined 2- and 3-state models. The AIC and HQC support the two-regime model. These criteria are used by various studies to determine the optimal number of regimes for MS-VAR specifications (Chen et al., 2019; Chiang et al., 2020; Shahrestani et al., 2020). In addition, the two-regime model is correctly specified. Table 3.2 compares the information criteria for different regime-switching specifications. The results show that the MSIAH (2)-VAR (1) has the lowest AIC value and the highest log-likelihood value. The AIC of the model is -27.6384 and the highest for the MSIAH (2)-VAR(1), the log-likelihood is 3389.330 and is the highest for the MSIAH (2)-VAR(1). The analysis indicates that the MSIAH (2)-VAR (1) specification outperforms the other regime-switching models, similar to Roubaud and Arouri (2018) and (Chiang et al., 2020). Several studies have shown that a two-state MS model is sufficient to capture the regime-switching behaviour in financial time series (Balcilar et al., 2015).

The likelihood ratio test is performed to further determine whether the asset returns exhibit regime-switching behaviour. This analysis is achieved by conducting a likelihood ratio test introduced by (Garcia and Perron, 1996), where the null hypothesis of no regime changes is tested against the null hypothesis of regime-switching behaviour. The likelihood ratio (LR) test is conducted by calculating the difference between the log-likelihood values of the restricted and unrestricted models. The likelihood ratio test statistic is calculated as follows:

$$LR = 2 \times [logL_{MS-VAR} - logL_{VAR}] \quad (3.13)$$

Where logL is the log-likelihood of the linear VAR model and the MS-VAR model. The most appropriate model specification is selected based on Davies (1987) critical values. The test statistic, $\chi^2(q)$, is a distributed chi-squared where the degrees of freedom, q and is determined by the difference between the value of the degrees of freedom of the unrestricted and restricted models. The p-values are used to determine the approximate upper bound for the significance level (Davies, 1987). When the nonlinearity has been established, the likelihood ratio statistic and AIC are used to choose the optimal MS-VAR model.

Panel B of Table 3.3 presents the results of the likelihood ratio test. It is noted that the log-likelihood value and information criterion values of the linear VAR were significantly lower than the value of the MSVAR. The results of the likelihood ratio test indicate a rejection of the null hypothesis of no regime shifts, thus suggesting that the time-varying behaviour of asset returns can be best modelled using a non-linear model. The null hypothesis of no regime changes is rejected, thus suggesting that asset returns exhibit regime-switching behaviour. This result is similar to results derived from other studies investigating asset market behaviour in emerging markets (Walid, Chaker, Masood and Fry, 2011; Aloui and Jammazi, 2015). Furthermore, the AIC and SIC also support the MS-VAR model as being better fitted to model the relationship between asset markets.

Table 3.3 MSVAR model specification

Panel A: Model Selection Criteria				
Model	**LL**	**AIC**	**SIC**	**No. of coeff.**
Linear VAR(1)	3268.377	-27.3422	**-26.7257**	42
MSM (2)-VAR(1)	3243.727	-26.7741	-25.7351	71
MSMH (2)-VAR(1)	3238.197	-26.6008	-25.3424	86
MSIH (2)-VAR(1)	3316.896	-27.2143	-25.8681	92
MSA (2)-VAR(1)	3295.213	-26.9554	-25.4774	101
MSIA (2)-VAR(1)	3345.666	-27.4463	-25.8759	107
MSIAH (2)-VAR(1)	3389.330	**-27.6161**	-25.7374	128
MSIAH (3)-VAR(1)	**3481.256**	-27.2546	-24.9876	195

Panel B: Likelihood test			
	VAR	**MSIAH (2)-VAR(1)**	**LR test stat**
Log-likelihood	3268.377	3389.330	241.906***

Notes: (*) Significant at 10%; (**) Significant at 5%; (***) Significant at 1%.

Source: Author’s estimation (2022)

3.4.3 MSVAR transition probabilities and expected regime properties

Asset market linkages were assessed based on the multivariate Markov Switching Intercept Autoregressive heteroscedasticity (MSIAH) model of Guidolin and Timmermann (2007). In this model, the constant coefficient, the coefficients of the lagged endogenous variables and the variance-covariance matrix of the residuals are regime-dependent. Table 3.4 reports the results for the autoregressive coefficients, regime transition probabilities, ρ_{11} and ρ_{22} and the expected durations for the MSIAH (2)-VAR (1) model. The model captures two latent regimes in the asset markets. The regimes are identified by observing the mean returns that differ across regimes, thus suggesting first moments distinguish the regimes. Regime 1 is identified as the bull market state (bull regime), with positive mean returns in the stock, housing and oil markets. This result is consistent with the flight-from-quality hypothesis, which suggests that during expansionary periods, investors have a preference for high-return investment assets.

In regime 2, the mean returns of forex and gold are positive, 0.47 and 0.67, respectively. This result provides evidence in support of the flight-to-quality phenomenon, which results in the price of currency and gold increasing when other markets are declining during an economic crisis (Baur, Prange and Schweikert, 2021). Investors trade off investing in higher-risk assets, such as stock and oil markets, in preference for investing in safer assets, thus leading to an outflow of capital from stock and oil markets. Regime 2 is thus classified as the bear market state (bear regime) with relatively lower returns and high volatility in asset markets.

The results indicate that the autoregressive parameter estimates are mostly insignificant at all levels of significance in the bull regime compared to the bear regime. In the bull regime, the oil and stock markets have positive average returns while the returns on bonds, currency and gold are negative. However, these values were insignificant. In the bear regime, the average returns of the stock, bond, housing and oil markets are negative, indicating a likelihood of these markets simultaneously experiencing financial distress.

Panel b of Table 3.4 displays the regime properties for the MSVAR system. The probability of remaining in a stable regime, given that the current regime (p_{11}) is stable, is 0.91 and the probability of transitioning from a stable period to a recessionary regime in the next period is 0.66 (p_{12}). The duration of the regime indicates the persistence of one state compared to the second state. The duration of the economic expansion regime is five times longer than the economic contraction regime. The average duration of the bull market periods (regime 1) is 10.80 and is higher than the duration of bear market periods (regime 2), which is 2.92, indicating that the low volatility regime is more persistent. This result is consistent with\Guidolin et al. (2017), Chiang et al. (2020) and Yousefi and Najand (2022) who found that the low volatility regime is more persistent in comparison to the high volatility regime.

The turning point of the regimes is determined from the smoothed probabilities of the bull market regime displayed in Figure 3.2. These periods coincide with economic, financial and socio-political factors globally and domestically in South Africa. The peaks in the smoothed regime probability graph coincide with economic and financial events for certain periods. For example, the markets reacted significantly during periods coinciding with the 2001-2002 Dotcom crisis, the 2007-2008 global financial crisis period and the 2010-2011 European debt crisis (Mensi, Nekhili, Vo and Kang, 2021; Umar, Jareño and Escribano, 2021).

Table 3.4 Parameter estimates of the MSIAH (2)-VAR(1)

Panel A: Estimated parameter values						
	Stock	**Bond**	**Forex**	**Housing**	**Gold**	**Oil**
χ_1	0.0092	-0.0073	-0.2352***	0.0023	-0.0848	0.3338
χ_2	-0.1099	-0.0412	0.1711	-0.0067	0.2119	-0.0613
$\beta_{1,stock}$	0.1504	-0.0140	-0.1854	0.0062	0.0910	-0.1804
$\beta_{2,stock}$	0.1785	0.0880	-0.5010***	-0.0158	-0.0162	-0.8684
$\beta_{1,bond}$	0.0150	-0.0410	0.0566	-0.0022	-0.0319	-0.0228
$\beta_{2,bond}$	0.4364***	0.0689	0.1924	-0.0093	0.2016	-0.9184***
$\beta_{1,forex}$	0.4454	0.4723	0.1025	0.6787***	-1.4923	-6.9487
$\beta_{2,forex}$	-5.2331	2.9129***	1.2814	0.3376	3.8262	0.6120
$\beta_{1,housing}$	-0.0750	0.0073	0.2431***	$-3.55e^{-5}$	-0.1235	-0.2068
$\beta_{2,housing}$	-0.0452	0.0499	0.1349	-0.0073	0.0365	-0.1840
$\beta_{1,gold}$	-0.0621	-0.0174	0.0317	0.0007	-0.0423	-0.0723
$\beta_{2,gold}$	-0.0075	-0.0272	-0.1353	-0.0033	-0.2667***	0.0714
$\beta_{1,oil}$	0.0133***	0.0075***	0.0013	-0.0001	0.0076	0.0036
$\beta_{2,oil}$	-0.0156	0.0105***	0.0193***	0.0005	0.0249	0.0411***
σ_1	0.0014***	0.0003***	0.0010***	$1.20e^{-6}$***	0.0023***	0.0086***
σ_2	0.0035***	0.0007***	0.0012***	$9.44e^{-6}$***	0.0049***	0.0065***
Panel B: Regime properties						
ρ_{11}	0.9074					
ρ_{22}	0.6576					
Dur_1	10.7970					
Dur_2	2.9204					

Source: Author's estimation (2022)

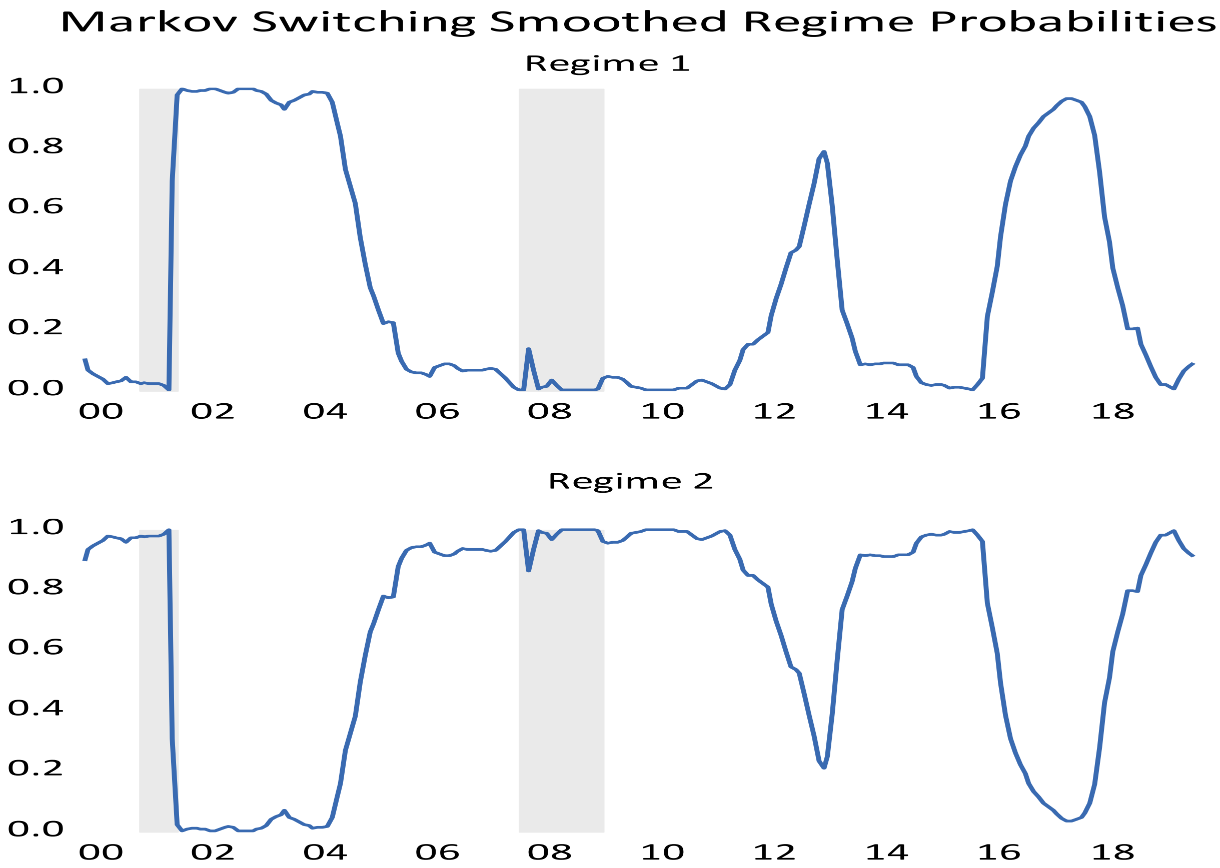

Figure 3.2 Smooth regime probabilities

Source: Author's estimation (2022)

3.4.4 Results for the regime-dependent Impulse response functions

Making economic inferences on the autoregressive coefficients can be misleading because the MSVAR model estimated is a theoretical representation of the relationship between asset markets. The MSVAR allows for the estimation of regime-dependent impulse response functions, which can capture the regime-dependent responses of variables to shocks in another variable. Impulse response functions trace the time path of endogenous variables returning to equilibrium following a shock within a regime (Ehrmann et al., 2003; Chkili and Nguyen, 2014).

Similar to Guidolin and Pedio (2017), this study explored the presence of financial contagion and forms of transmission channels. Flight-to-liquidity is observed in the responsiveness of liquid and less liquid assets to shocks in the system (Guidolin and Pedio, 2017). The presence of flight-to-quality is determined when a shock to the system causes investors to shift liquidity from the risky market to safer assets, thus resulting in the price of risky assets increasing and the price of the safer assets increasing. The risk premium channel is established when a shock in one market causes an increase in investor risk aversion, thus increasing the risk premium of high-risk assets. In other words, risky assets respond positively to a shock in a specific market. The purpose of this analysis is to establish the effects arising from a shift to the crisis regime. Figures 3.1 and 3.2 display the impulse response functions for the different asset market returns. The shocks to the system are equivalent to one standard deviation of the residuals derived from the MSVAR framework and the impulse responses are mapped out for a period of twelve months. Choleski-decomposition ordering is applied to ensure that the correlations in the innovations imposed on the variables in the MSVAR estimation are equivalent to zero (Liu, Zhou and Zhou, 2019). A limitation of Choleski-decomposition ordering is that the ordering of the variables in the MSVAR system influences the magnitude of the contemporaneous correlations of the innovations. Hence, for robustness, the MSVAR model was estimated with different orderings.

The IRFs indicate each asset market's response to its own shocks and from other markets under two regimes, thus providing further justification for estimating regime-dependent IRFs. Figures 3.2 and 3.3 present the impulse response functions (IRFs) for regime 1 and regime 2, respectively. Overall, the results from the impulse response analysis indicate that the asset returns have heterogeneous responses to shocks emanating from another market across the two different regimes, which suggests time-varying linkages between markets.

In the crisis regime, the response of the asset market returns to a 100-basis point shock in other asset markets is higher in magnitude and the effects occur in the latter months (long-run) and are more persistent. In contrast, the effects of innovations in the bull regime are short-lived and market reactions last less than six months before reverting to equilibrium. The reaction to a shock in the second regime is also higher compared to the first regime. This result is similar to Youssef and Mokni (2020) who found that the contagion effects between markets were more significant in the crisis regime compared to the stable regime. The results further show that asset returns were more responsive in the short term to innovations in the bull regime compared to the bear regime.

The effects of own shocks are more significant in the bull regime than in the bear regime, however, the effects are short-term. This result suggests that the assumption of market efficiency does not hold, as previous asset returns can predict current asset returns. The feedback effects from the exchange market to the other asset markets are significant in both regimes. In particular, a one standard deviation shock in the exchange rate has a positive impact on stock, bond and housing returns in the bull regime. In contrast, the exchange rate harms commodities, such as gold and oil. These findings suggest that forex markets are net transmitters of volatility within the other asset markets. The impact of exchange rates on asset prices is explained concerning the flow-oriented model of exchange rates, which emphasises that changes in exchange rates are reflected in international competitiveness and changes in trade balances that are transmitted to the country's output and thus influence stock prices (Dornbusch and Fischer, 1980). Currency depreciation increases the demand for a nation's exports and results in an improvement in the trade balance. Thus, depreciation stimulates aggregate demand and increases the level of economic activity in a nation. Similarly, the stock-oriented model and the arbitrage pricing theory hypothesise a relation between exchange rate movements and stock returns (Gavin, 1989; Mitra, 2017).

In the bear regime, the effects of innovations have a long-run persistence. Bond and currency market innovations have opposite effects on asset markets. This result supports the findings of Mu, Stotsky,and Phelps (2013), and Meyer and Hassan (2020) who showed that the African bond market performance is inversely related to exchange rate volatility. The response of stock returns to bond market shocks is positive and peaks in the latter months. This result suggests contagion effects, which means that bonds cannot act as a hedge or diversifier for stock markets during periods of market turmoil. This result is similar to Flavin and Lagoa-Varela (2021) who found that bond market volatility shocks have a positive impact on stock markets, therefore, resulting in an increase in comovements between stock and bond markets during periods of financial distress.

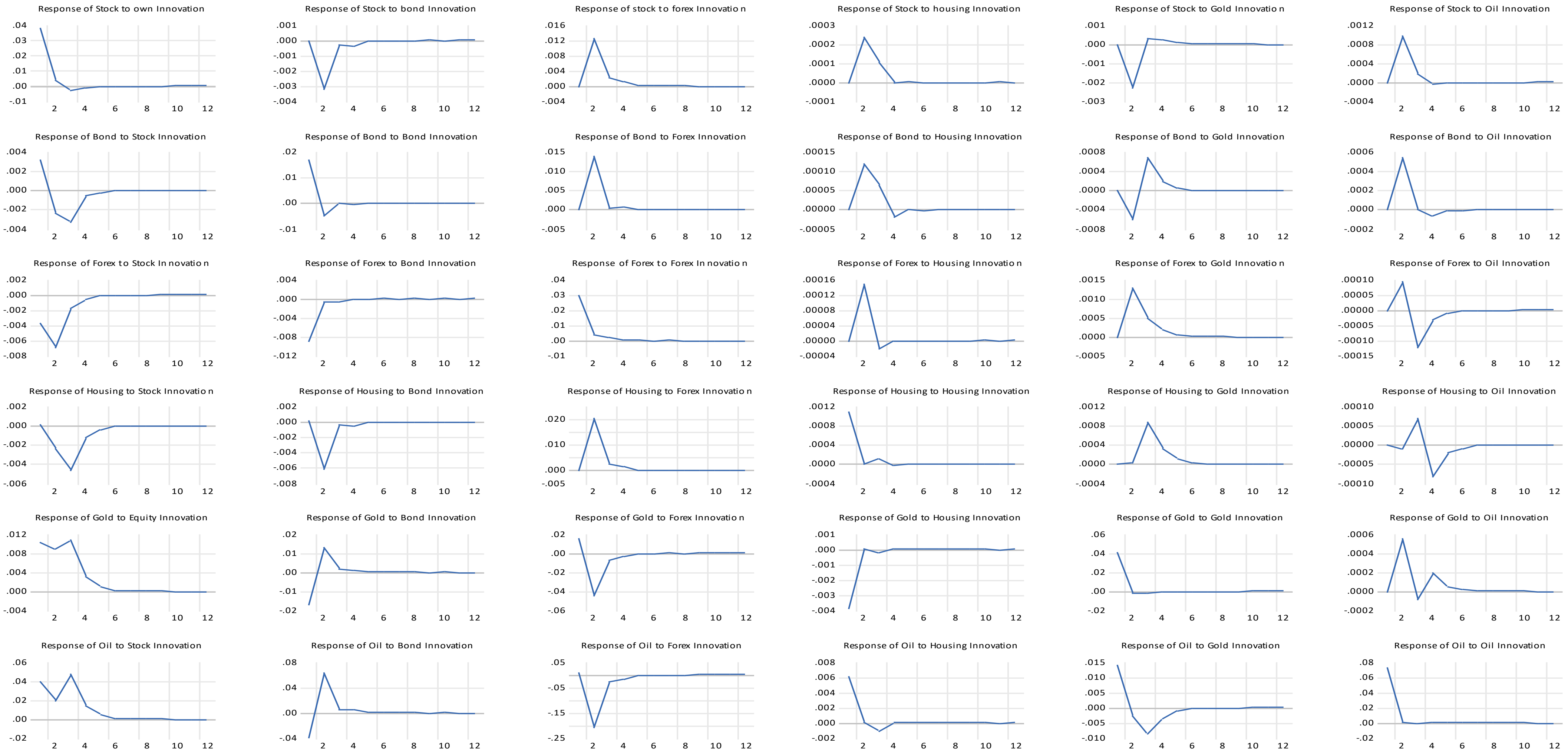

Figure 3.3 Regime 1 impulse response functions

Source: Author’s own depiction (2022)

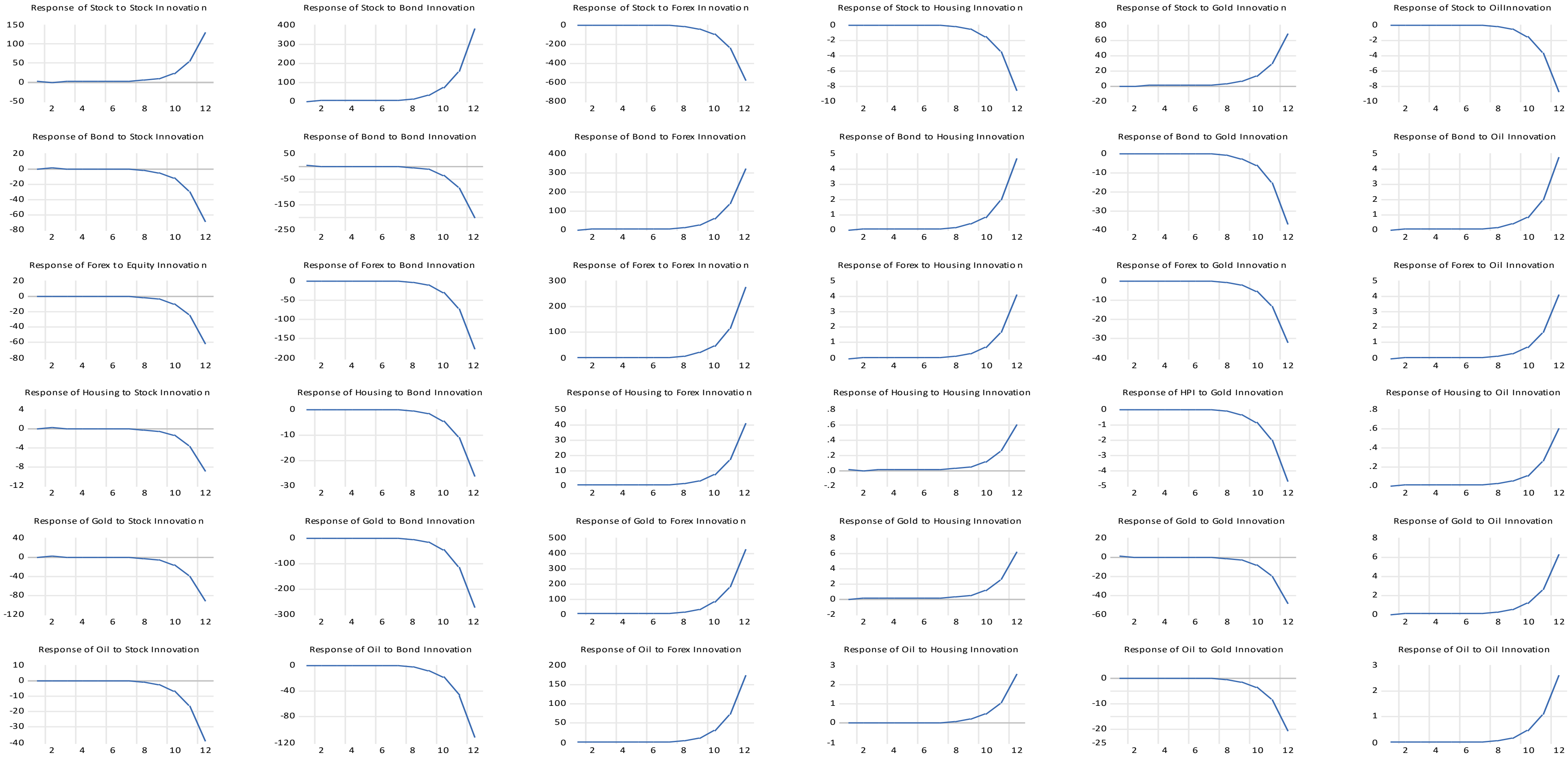

Figure 3.4 Regime 2 impulse response functions

Source: Author’s own depiction (2022)

3.4.5 Results for the variance decomposition

The variance decomposition enables examining how much of the forecast error variance of each variable can be explained by exogenous shocks to other variables. Table 3.5 displays the variance decompositions of the two regimes, 1 and 2, with the lowest forecast horizon being one month and the highest being a twelve-month forecast horizon. From the table, it can be observed that the variance remains qualitatively the same for longer investment horizons. The results are generally consistent with the impulse response functions as discussed in Section 3.4.4. The results indicate that the forecast error variance decompositions in most of the markets, except housing and oil markets, are due to own shocks that took place one month ago in the first regime. Moreover, the results show that shocks in the foreign exchange market are the greatest contributor to forecast error variance in all markets from the second month, of the crisis regime.

When examining the stock returns, the variance in the current period's stock returns is mostly explained by lagged stock returns (previous period's returns) in regimes 1 and 2. In the stable and crisis regime, 100 per cent of the forecast error variance in stock returns is due to own shocks that occurred 1 month ago. The stock market's own shocks account for around 89 per cent of the forecast error variance for the 12-month forecast period, in the stable regime. This result suggests that factors specific to stock markets drive stock price variations rather than shocks emanating from other markets. The remaining forecast error variance is explained by shocks from the forex market, which account for about 9 per cent of the error variance in stock returns. For the crisis regime, stock return error variances are predominantly determined by shocks in the forex market, which account for more than 50 per cent of the variances. This result is consistent with the international trading effect, which is based on the premise that changes in exchange rates will have a positive impact on stock prices through trade balances and international competitiveness (Wei et al., 2019). Stock prices are thus expected to react to changes in exchange rates because they represent the future cash flows of a firm.

For the bond returns, own shocks explain most of the forecast error variance in the stable and crisis regime. Around 60 per cent accounts for the forecast error variance in the stable regime, whilst shocks originating from forex markets are dominant in the crisis regime. For forex returns, its own shocks are the main drivers of error variance across the two regimes. However, the significance of own shocks reduces in the crisis regime, as the bond market shocks account for about 28 per cent of the forecast error variance. Engle and Wu (2018) found that the yield on government bonds had a significant impact on exchange rate movements. For the housing market, one-month lagged own shocks explain 98 per cent of forecast error variance. However, forex shocks for the rest of the forecast period, predominantly determine housing market forecast error variances in both regimes. In the stable regime, forex shocks account for around 85 per cent of the error variance in the 12 months after the initial shock, whilst in the crisis regime, about 28 and 68 per cent of the housing market price variation originate from the bond and forex markets, respectively.

For the commodity markets, the impact of forex market shocks plays a significant role in forecast error variations in the stable regime. The 49 per cent explanatory power of forex for gold price variation is sustained for 12 months after the initial shock. In the second regime, the gold market's own shocks have an insignificant explanatory power. Most of the gold price variation is explained by forex shocks, which explain more than 50 per cent of forecast error variance for the 12-month forecast period. This result is in contrast to Chen, Xu,and Hu (2022) who found an insignificant link between commodity prices –gold and oil-, and South African exchange rates. For the oil market, less than 10 per cent of own shocks explain price variations. In the crisis regime, own shocks are more significant. However, bond market shocks play a significant role in the oil market in the crisis regime and account for around 28 to 50 per cent of oil price variation

Table 3.5 Variance decomposition

Panel A: Regime 1						
Variance decomposition of stock returns:						
Month	STOCK	BOND	FOREX	HPI	GOLD	OIL
1	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	89.4637	0.6251	9.5195	0.0035	0.3309	0.0573
3	89.2351	0.6267	9.7423	0.0041	0.3333	0.0585
12	89.1630	0.6338	9.8044	0.0041	0.3362	0.0586
Variance decomposition of bond returns:						
1	3.4110	96.5890	0.0000	0.0000	0.0000	0.0000
2	2.990	59.9523	36.9302	0.00275	0.0680	0.0569
3	4.8640	58.7321	36.1929	0.0034	0.1517	0.0558
12	4.9200	58.6167	36.2458	0.0035	0.1577	0.0564
Variance decomposition of forex returns:						
1	1.4514	8.1326	90.4159	0.0000	0.000000	0.000000
2	5.8109	7.6832	86.3435	0.0021	0.1595	0.0008
3	6.0797	7.6723	86.0636	0.0021	0.1800	0.0023
12	6.1128	7.6694	86.0306	0.0021	0.1827	0.0024
Variance decomposition of housing returns:						
1	0.9434	0.1925	0.8004	98.0638	0.0000	0.0000
2	1.2015	8.2323	90.3090	0.2571	0.0001	1.75E-05
3	5.5048	7.7809	86.3147	0.2442	0.1543	0.0010
12	5.8129	7.7658	85.9991	0.2422	0.1776	0.0025

Variance decomposition of gold returns:							
1		4.6739	12.8912	10.7500	0.6463	71.0392	0.0000
2		4.0363	10.2528	49.9747	0.3217	35.4078	0.0067
3		6.2968	9.9296	49.2050	0.3113	34.2508	0.0066
12		6.4841	9.9078	49.1857	0.3098	34.1052	0.0074
Variance decomposition of oil returns:							
1		18.4433	17.1209	0.6243	0.4221	2.2129	61.1764
2		3.4148	9.6168	77.2989	0.06387	0.3493	9.2564
3		6.8960	9.1525	74.6669	0.06250	0.4509	8.7712
12		7.1830	9.1246	74.4570	0.0620	0.4702	8.7033
Panel B: Regime 2							
Variance decomposition of stock returns:							
Month	S.E.	Stock	Bond	Forex	Housing	R_GOLD	R_OIL
1	0.0592	100.00	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.1949	11.6131	31.4714	56.9137	2.60E-05	0.0006	0.0012
3	0.2952	19.7052	22.6082	55.4725	0.0294	2.1632	0.0214
12	799.8521	3.3325	27.9445	67.7719	0.0146	0.92180	0.0148
Variance decomposition of bond returns:							
1	0.0271	1.8303	98.1697	0.0000	0.0000	0.0000	0.0000
2	0.1035	6.7745	31.9444	61.2518	0.0007	0.0268	0.00189
3	0.1558	18.3540	21.7416	57.4123	0.0335	2.4349	0.0238
12	432.1347	3.3318	27.9451	67.7721	0.0145	0.9217	0.0148

Variance decomposition of forex returns:							
1	0.0343	4.5763	28.8505	66.5732	0.0000	0.0000	0.0000
2	0.0550	15.4030	20.9696	61.2216	0.0321	2.3513	0.0223
3	0.1543	2.3960	29.5674	67.4060	0.0099	0.6100	0.0106
12	373.4376	3.3462	27.9331	67.7671	0.0145	0.9241	0.0148
Variance decomposition of housing returns:							
1	0.0031	2.5285	0.0002	9.41775	88.0536	0.0000	0.0000
2	0.0119	1.9774	29.3865	62.7248	5.8810	0.0302	0.0003
3	0.0200	12.4033	22.5152	60.9344	2.15457	1.9721	0.0204
12	55.22817	3.3345	27.9428	67.7712	0.01456	0.9221	0.01479
Variance decomposition of gold returns:							
1	0.0697	0.0012	6.4650	13.1099	0.3981	80.0259	0.0000
2	0.1408	3.7563	20.870	54.2481	0.1059	21.0140	0.0056
3	0.2119	15.9576	17.9890	54.9193	0.0735	11.0379	0.0227
12	576.5341	3.3322	27.9447	67.7720	0.0146	0.9217	0.0148
Variance decomposition of oil returns:							
1	0.0805	18.4254	52.9281	0.7455	0.0002	1.98E-05	27.9010
2	0.1010	29.0278	48.9843	4.0286	0.0071	0.1941	17.7580
3	0.1434	15.0004	43.3113	32.6823	0.0047	0.1810	8.8202
12	236.2014	3.3486	27.9312	67.7662	0.0146	0.9246	0.0148

Source: Author’s estimation (2022)

3.5 Summary and conclusion

The purpose of this chapter was to investigate the relationship between asset markets in different market conditions. This chapter fills the gap in knowledge in terms of the scarce literature on the comprehensive asset market linkages within South Africa. The results of the analysis indicate that MSVAR is best suited for modelling the interlinkages between assets markets compared to the linear VAR specification. The MSVAR is able to endogenously identify crisis periods, and identify bull and bear market states. The results of the MSVAR specification indicate that the relationship between asset markets is distinguished by two regimes, namely the crisis regime and the stable regime.

The results showed that the duration of the stable regime is longer than the crisis regime. This result supports the findings of existing studies, which show that economic expansions occur for longer periods compared to economic contractions. The linkages between markets were determined by employing regime-dependent impulse response functions. The impulse response functions showed that all asset markets respond significantly to shocks in the crisis regime. Furthermore, the impact of the shocks occurs in the short run during the stable regime, whilst shocks take longer in the crisis regime. The foreign exchange market causes higher volatility in all markets across both regimes. The impact of housing and commodity market shocks was not significant in both regimes. The impact of bond market shocks is significant in both regimes; however, the effects are more prominent in the crisis regime. Commodity markets have a negative reaction to shocks emanating from the forex markets in the stable regime, whilst housing and bond markets react positively. Interestingly, commodity markets react positively to forex shocks in the crisis regime.

Overall, this study confirms the presence of the flight-from-quality hypothesis, which suggests that during expansionary periods, investors prefer to invest in high-return assets with higher risk such as stock and oil but prefer, during a crisis period, safer investments such as forex and gold. Interestingly, the bond market fails to act as a haven asset in crisis periods; hence, bonds cannot act as a hedge or diversifier for stock markets during periods of market turmoil. This study concludes that the response of markets to shocks takes longer during periods of market instability. Consistent with the flow-oriented model, this study concludes that shocks from the foreign exchange markets have the most significant shock impact on all returns, positively impacting stock, bond and housing returns and negatively impacting commodities such as gold and oil. It is safe to conclude that forex markets are net transmitters of volatility within the other asset markets.

This study is important to investors because correctly identifying the phenomenon facilitates the implementation of better portfolio diversification strategies and helps policymakers because the efficacy of policy interventions highly depends on the nature of shock transmission channels. Future studies could extend this research to explore other transmission mechanisms such as the fundamental channel related to foreign direct investment and the financial channel which explains investor behaviour. It is also important to acknowledge the evolution and development of advanced models. Incorporating wavelet analysis and network-based Markov Chain can provide valuable insight. These are interesting avenues for future research that are beyond the scope of this thesis. Future work could also extend to explore potential determinants of asset market behaviour.

CHAPTER 4: THE IMPACT OF DISAGGREATED COUNTRY RISK ON ASSET MARKET RETURNS

4.1 Introduction

All transactions are associated with a certain level of risk, however, when these transactions occur in global markets, they carry an additional risk which is not present within domestic borders. This type of risk is referred to as country risk. The concept of country risk encompasses various definitions, which makes it challenging to identify a clear, unique and precise definition (Bonatti, Ciacci, & Ivaldi, 2021). Country risk is generally described as the ability and willingness of a country to service its foreign financial obligations (Damodaran, 2021). In the 1960s, the definition of country risk referred to the political risk that could affect multinational companies. During the 1980s, country risk was linked to economic and debt crises, thus a country's inability to payoff its debts (Bekaert, Erb, Harvey and Viskanta, 1998b; Fedderke, 2015). From the 1990s, the definitions of country risk evolved around the financial crises that could cause governments and international institutions to become insolvent (Gaillard, 2020). Since the year 2000, literature expended the definition using various tools and variables (Damodaran, 2021). From that period, the most prominent definition of country risk, which includes, political and economic risk, was provided by Meldrum (2000) stating that country refers to a combination of risks that emerge when an individual or institution invests within a foreign country.

Country risk arises from a country-specific risk and other economic, financial and political factors or uncertainties (Liu et al., 2016). Hence, country risk ratings are determined by a country's economic, financial, social and political landscape (Muzindutsi, Jamile, Zibani and Obalade, 2020). Country risk ratings play a crucial role within global asset markets by improving market effciency through reducing information asymmetries between capital market participants (Ozturk, Namli, & Erdal, 2016). These ratings not only contribute to reducing market uncertainty, but they also play a key role in attracting foreign investments into emerging markets (Bissoondoyal-Bheenick, 2005) by providing signals about the economic, political and financial state of a country. Credit rating adjustments signal shifts in country risk, where downgrades are often associated with a significant decline in investments and asset returns, whilst upgrades have an insignificant impact on asset returns (Ferreira and Gama, 2007; Afonso, Gomes and Taamouti, 2014; Riaz, Shehzad and Umar, 2019). The extent to which ratings adjustments are transmitted to asset markets depends on their efficiency. If the credit ratings reveal new information, then the rating adjustments should have a significant impact on the asset markets (Rusike and Alagidede, 2021). Conversely, the efficient market hypothesis (EMH) posits that investors should not be able to profitably trade based on the new information provided by credit rating agencies. The EMH suggests that if ratings reflect publicly available information then asset prices should not be affected by rating changes (Brooks, Faff, Hillier and Hillier, 2004). However, Andreasen and Valenzuela (2016) present evidence suggesting that the responsiveness of asset markets depend on whether the market is developed or developing. The role of country risk on asset markets may depend on how rapidly each asset market, in both emerging and developed markets, incorporates fluctuations in its prices. Due to South Africa being classified a developing nation, there is an expectation of inefficiency and therefore country risk ratings affect asset returns (Rusike et al., 2021).

Literature has found that country risk plays a critical role in developing countries. Some studies provide strong evidence of differential effects of country risk components (Chen, Chen, Chang and Yang, 2016; Lee, Lee and Ning, 2017; Suleman et al., 2017). Suleman and Berka (2017) found that political risk ratings have a significant role in emerging markets. Thus far, there is no clear understanding of whether the different components of country risk have symmetric effects on asset returns in South Africa. The role of country risk in asset markets is partly justified by the asset pricing theory, particularly for emerging markets with small and volatile asset markets. In addition, traditional asset pricing models such as Capital Asset Pricing Model (CAPM), consumption-based CAPM and single index model merely capture the aggregated country risk component, thereby neglecting the individual effects of components (financial, economic and political) of country risk on the pricing.

The purpose of this chapter is to fill the gap in the literature by examining the factors driving asset market returns in emerging markets such as SA. Based on existing evidence, the study seeks to make the following contributions. The study takes into consideration the decomposed country risk measure to better capture the changes in asset market returns resulting from fluctuations in different risk components. Decomposing country risk will provide a more nuanced understanding of the relationship between country risks and asset returns. Because the influence of changes in country risk ratings varies depending on whether the change is an upgrade or downgrade, the NARDL approach used provides evidence of how asset markets respond to positive and negative shocks in each country's risk component.

In examining the relationship between asset markets and country risk components, the study seeks to provide answers to the following research questions; Does country risk provide new informational value to investors? Do economic, financial and political risk ratings have heterogeneous effects on asset returns? Do positive and negative changes in country risk components have asymmetric effects on asset returns? The chapter is organized as follows; section 4.2 provides an overview of credit rating agencies. Section 4.3 provides a review of the existing empirical literature. Section 4.4 describes the data and methodology of the study. Section 4.5 reports the results and empirical analysis. Finally, section 4.6 concludes the chapter.

4.2 Literature review

4.2.1 Historical overview of credit rating agencies

Sovereign risk and country risk are related but different. The difference between the sovereign and country risk is that the former refers to the country's insolvency or inability to meet its commercial debts obligations whilst the latter includes the pitfall of a country's business environment such as income disparity, corruption levels and legal environment (Heinrichs and Stanoeva, 2013). Literature refers to these interchangeably even though they are conceptually different to a certain extent. Country risk provides a broader perspective compared to sovereign risk, hence this study focuses on country risk. Broadly, the primary role of country risk or sovereign risk ratings is to provide a measure of a country's ability to meet its future financial obligations, i.e. creditworthiness (Hassan, Schreger, Schwedeler and Tahoun, 2021). The risk associated with investing in a country is perceived to be higher when a country has low creditworthiness. Ratings provide important signals to global market participants.

There are various rating agencies, namely Standard and Poor's, Moody's, Political Risk Services (PRS), International Country Risk Guide (ICRG), Euromoney and Institutional Investor (II). In developing those measures, the agencies consider the financial, economic, social and political fundamentals of the country (Damodaran, 2021). Each of these rating agencies uses a combination of various qualitative and quantitative approaches to provide a measure of a country's risk rating (Erb, Harvey and Viskanta, 1996). In addition, each agency uses a different methodology, quantitative and qualitative, and different measures of social, economic, political and financial factors to provide a measure of country risk (Oetzel, Bettis and Zenner, 2001). Therefore, the definitions of country risk by each agency also differ. For example, Standard & Poor's uses subcategories that include projections for economic growth, inflation stability and political risk to determine risk ratings, whereas Moody's uses the probability of government defaulting as one of the determinants (Ozturk, Namli and Erdal, 2016).

ICRG is the only risk rating agency that provides detailed data. The ICRG considers the political, social, economic and financial factors in measuring the country's creditworthiness whilst Moody considers the ability of the central or reserve bank to provide foreign currency for the government and other domestic economic participants to meet their foreign debt obligations (Yalta and Yalta, 2018). Contrary to both Moody and ICRG agencies, the PRS ratings are forward-looking ratings based on measures of political risk and governance factors that influence the business environment (Bekaert, Harvey, Lundblad and Siegel, 2014).

The weighting of country fundamentals also differs for each agency. Hoti (2005) and Yalta and Yalta (2018) found that the weighting of economic, financial and political risk measures was significantly different for all agencies. For example, the weighting of political risk in the composite risk measure is the highest for ICRG, whilst the weight of financial risk is higher in Euromoney risk ratings. Additionally, the notation of ratings also differs among rating agencies (Hoti, 2005). For instance, II, Euromoney and ICRG risk ratings are stated in numerical values ranging between 0 and 100. In contrast, Moody's rating range from AAA to C, S&P from AAA to D and PRS ratings start from A+ to D-, where the former represents the highest rating and the latter is the lowest rating (Hoti, 2005; Yalta & Yalta (2018).

Most of the criticism against rating changes has been around the timing of rating downgrades which have been found to exacerbate asset market downturns (Tran et al., 2019). It has been found that rating agencies are most active in downgrading sovereign nations during periods of increasing market uncertainty, thus prolonging financial crises (Ferri, Liu and Stiglitz, 1999); (Treepongkaruna et al., 2012). Despite the criticism, studies (Arezki, Candelon and Sy, 2011) indicate that ratings have a significant impact on the economic and financial stability of a country in such a way that rating announcements can cause financial instability. The rating announcement affects the costs associated with issuing debt and thus affects the financial stability of an economy (Kiff, Kisser and Schumacher, 2013). Consequently, country risk ratings have significant implications for the performance of asset markets.

Past literature has increasingly evaluated the relationship between country risk ratings and asset markets. For example, Brooks et al. (2014), Treepongkaruna and Wu (2013), Sari, Uzunkaya,and Hammoudeh (2013), Afonso et al. (2014), Mensi, Hammoudeh, Yoon,and Nguyen (2016) and Muzindutsi and Obalade (2020) showed that rating revisions have an asymmetric impact on asset markets. More interestingly, the implications of country risk are more prevalent in emerging markets compared to developed markets (Ferreira et al., 2007; Alsakka and ap Gwilym, 2012a). Other studies show that asset markets have asymmetric reactions to risk rating revisions (Treepongkaruna and Wu, 2013; Afonso et al., 2014). Gande and Parsley (2014) asserted that risk ratings downgrades are statistically significant whilst rating upgrades have no significant effects. Given the dichotomy of the effect of country risk rating and risk components on asset markets, section 4.5 discusses the empirical literature of country risk literature on asset markets focusing on key variables selected for the current study.

4.2.2 Determinants of country risk ratings

Erb, Harvey,and Viskanta (1997) and Damodaran (2021) suggested that publicly available assessments of a country's political risk, financial risk and economic fundmaentals are good proxies for explaining most of the variations in expected returns and volatility of a cross-section of countries. Investors can use these measures to guide them in terms of choosing country weights for globally diversified portfolios. Bilson, Brailsford,and Hooper (2002) and Tuzel and Zhang (2017) further showed that local risk factors take precedence over global factors in driving stock price movements in emerging markets. The authors show that political risk represents a major uncertainty for domestic and foreign investors. In a democratic system, national elections are a major political event that can have significant implications for the future economic and financial course of a country.

Rating agencies do not explicitly outline the methodology used to determine ratings and hence there has been vast literature examining the determinants of country risk ratings assigned by these agencies. One of the early studies, Cantor and Packer (1996), found that macroeconomic determinants such as GDP per capita, level of indebtedness and foreign-currency-denominated debt, determine risk ratings. Over the years, research studying the determinants of country risk has identified several key economic factors contributing to the country's ability to meet future obligations. Among these factors, Ribeiro (2001) identified the following:

- balance of payments,
- exchange rate,
- foreign direct investments and debt,
- exports, imports,
- GDP,
- inflation rate,
- unemployment levels,
- population,
- life expectancy,
- level of education, and
- other social factors.

In a study comparing literature on country risk, Hoti and McAleer (2002) found that aside from the macroeconomic factors identified in existing literature, country risk is also a factor of political risk arising from wars, terrorist attacks, changes in governance structure, and internal and external conflicts. High political risk can lead to a high default rate (Dimic, Orlov and Piljak, 2015). Oetzel et al. (2001)) found that political, social and economic fundamentals significantly determine country-specific risk. Vij and

Kapoor (2007) found that country risk is determined by a range of macroeconomic, financial and political factors. The contribution of certain factors of country risk rating has evolved since the 2008 global financial crisis (Basu, De, Ratha and Timmer, 2013). Following the financial crisis, stakeholders in the financial system placed less emphasis on cyclical variables such as GDP, imports and exports, and placed more emphasis on structural factors concerning the governance of a country such as legislation and government clusters. Structural and cyclical changes are important determinants of country risk adjustments (Hoti, 2005).

Asiri and Hubail (2014) attempt to identify the important macroeconomic and political factors that can forecast country risk ratings of two ratings agencies. Gross domestic product (GDP), gross capital formation, current account balance and a measure for political instability were among the seven factors examined. The study found that GDP had significant explanatory power for future country risk ratings revisions. Furthermore, the study was able to show that economic and political factors explain 85% of the variation in country risk ratings. Political risk, GDP and export growth were able to predict approximately 50% of the variation in risk ratings of high-income countries. Compared to developed markets, political risk was found to be the most significant predictor of country risk ratings in developing and African countries.

Erdem and Varli (2014) investigate the key macroeconomic factors influencing the sovereign credit ratings provided by Standard and Poor’s over ten years. The study found that factors such as GDP per capita, inflation, government intervention, budget balance to GDP and reserves to GDP ratios had a significant influence on credit rating fluctuations. The information conveyed by country credit ratings is a reflection of publically available information and nonpublic information which includes internal reports, budget forecasts, institutional quality and governance (Choy, Gray and Ragunathan, 2006). Therefore, changes in market prices imply that credit rating agencies have access to new private information that is not available to all economic agents.

Karadjova and Trajkov (2022) conducted a comparative analysis on the determinants of country risk for the five Central European Free Trade Agreement (CEFTA) countries. The purpose of the analysis was to determine the reliability of country-specific fundamentals when assessing country risk. The study showed that country risk is determined by various country-specific fundamentals, including a country's sovereign state, foreign debt, technological advancements and industrialization, amongst others.

The major key determinants of country risk and appropriately captured by ICRG are inflation, gross government debt, GDP per capita, political control index of corruption, unemployment and international investment position (Erdem et al., 2014). These variables are included in this study analysis to assess their effect on the South African assets markets.

4.2.3 Review of empirical literature

Over the years, the role of country credit ratings has been of interest to investors and researchers. Attracting external sources of funding is critical for African countries as most of these countries are dependent on external funding and concessional loans to finance their capital spending and current account deficits (Hayakawa, Kimura and Lee, 2013). Theory suggests that as markets become more liberalized, the increased participation of global investors in capital markets should increase domestic asset prices and thus reduce the cost of capital, which would result in increased investment and greater economic growth. Karolyi et al. (2003) argued that asset markets are influenced by two categories of information; local information and global information. Local information affects local markets, whereas global information affects local and global markets.

However, the risk of engaging in cross-border financial transactions increases during periods of high uncertainty (Alagidede, 2008). Investors interested in emerging market securities are often cautious and sensitive to new information because of transactional lags combined with information asymmetries and a lack of transparency (Odra, 2012). Hence, changes in credit ratings are expected to provide new information about a country and may fuel asset price booms and downturns.

4.2.3.1 The impact of country risk on asset markets

Ratings have been criticised for their lagged effects and the role they played in the 2008 global financial crisis (Kaminsky and Schmukler, 2002). Reisen, Von

Maltzan,and Larraín (1998) point out that the effects of the 1997 Asian financial crisis were prolonged as rating agencies adjusted their ratings after the crisis had taken place. Finance proponents have argued that credit rating agencies exhibit procyclical behaviour; upgrading in good financial market conditions and downgrading during periods of high market turbulence, may contribute to further exacerbating boom-bust cycles in global asset markets (Ferri et al., 1999; Riaz et al., 2019). Reinhart (2002) studies the prediction probabilities of ratings for emerging markets. The study finds that the probability of an economy experiencing a crisis is reduced following a rating upgrade. However, rating adjustments fail to predict the probability of a crisis. This shortcoming has implications for the performance of asset markets. For example, a sovereign downgrade is interpreted by investors as a signal of negative future market prospects, as such has the potential to induce market panic as investors long their risky positions (Gande et al., 2014; Mutize et al., 2019).

Due to the implications of sovereign ratings on asset markets, there is a continuous debate that arises in the literature regarding the informational value of credit ratings. One of the reasons ratings are found to lag crisis periods is because they rely heavily on the release of macroeconomic information which is released annually or quarterly. One side of the debate argues that credit rating agencies use publicly available information and hence, ratings assigned to sovereign nations lag asset markets in processing information (Treepongkaruna et al., 2012; Abad, Alsakka and ap Gwilym, 2018). Gropp and Richards (2001) argued that the frequency of rating revisions is low and therefore contributes to rating agencies being too slow to generate new information for the market. Another point of view proposes that a significant market reaction may not be observed in response to rating changes because the rating changes might be anticipated by market participants and hence reflected in the prices before the actual rating changes even take place (Goh and Ederington, 1993; Reisen et al., 1998). Therefore, in response to rating adjustments, investors would rebalance their portfolios for risk and liquidity management in response to the new information.

Ratings affect asset markets through various transmission mechanisms (Ismailescu and Kazemi, 2010). The transmission effect depends on the efficiency of markets in incorporating information from rating agencies (Brooks, Faff, Treepongkaruna and Wu, 2012). Therefore, creating a debate around the efficiency of these markets. The impact of credit rating changes can be asymmetric (Ferreira and Gama, 2007; Sari et al., 2013). Furthermore, Kaminsky and Schmukler, (2002); Brooks et al. (2004); Sy (2004), Gande and Parsley (2005); Ferreira and Gama (2007); Afonso et al. (2011) are among the earlier studies to highlight the asymmetric effects of sovereign credit risk ratings changes. The studies found that credit risk ratings downward revisions had a significant impact on stock and bond market performance, while ratings upward revisions had insignificant or minimal impact on these markets. Taking into consideration the asymmetric impact of positive and negative fluctuations in credit ratings is important as investors' responses to good or bad news can lead to heterogeneous effects in different markets. Moreover, in response to bad news or downgrades, investors may shift capital from risky asset markets to safer markets causing larger effects in the short run than in the long run (Gande and Parsley, 2014). Thus, the distinction between positive and negative movements in risk ratings and investment horizon is important for emerging markets that are characterized by information asymmetries and liquidity constraints.

Brooks et al. (2004) examined the impact of sovereign ratings on stock market returns and found that compared to upgrades, rating downgrades have a significant and negative impact on domestic stock markets and the dollar value of the country's currency. Chiang et al. (2007) used a sample of nine Asian countries for the period 1990 to 2003 to examine how stock market correlation values adjust to new information. Chiang et al. (2007) found that sovereign rating changes had a significant impact on cross-country correlations, particularly during the 1997 Asian crisis period. They found that correlation across countries was influenced by changes in domestic and global markets and foreign-currency sovereign credit ratings. Christopher et al. (2012) showed that rating announcements in Latin American countries had a more significant negative influence on countries with higher foreign currency debt ratings.

Alsakka and ap Gwilym (2012b) investigated the impact of sovereign credit rating changes on the foreign exchange market before and after the crisis. They show that the effects of rating changes were more pronounced following a crisis. Furthermore, the study shows that countries with high credit ratings are the most vulnerable to negative credit rating changes during crisis periods. The impact of negative credit rating changes is greater for higher-rated countries during crisis periods. Thus findings of Alsakka et al. (2012b) are supported by those of Christopher et al. (2012) as both studies highlight the negative effect of credit rating fluctuations during periods of crisis.

In contrast, Bissoondoyal-Bheenick (2005) arguedd that rating changes do not have an impact on asset markets because the information included in ratings is already known by the market. Sensoy et al. (2016) found a similar result when analysing the effects of sovereign ratings on stock market correlations, showing that emerging markets are insensitive to sovereign rating announcements in developed markets. Additionally, they found no spillover effects of credit risk rating shock in one market on other markets within the same region, thus implying that credit risk can be managed by diversifying into other markets within a region. Briefly, despite the importance of rating agencies to the financial and equity markets, these agencies are sometimes slow in providing information and consequently, markets might react to outdated information. Markets might also anticipate rating information and adjust their prices before the publication of rating information from rating agencies. Consequently, some investors make their investment decisions generally based on financial market information. Besides, rating information has an asymmetric effect, especially within emerging markets where bad or downgrade information cause the shift of investment towards developed markets. Further, rating adjustments do not provide the likelihood of a crisis. Consequently, countries with high credit ratings are mostly affected by negative changes in credit ratings when a crisis hits markets (Alsakka and A.P. Gwilym, 2012). Given the importance of knowledge about country credit rating, it is imperative to discuss the effects of country risk on stock markets.

4.2.3.1 The impact of country risk on stock markets

In recent years, a few studies have investigated the relationship between country risk and stock markets (Sari et al., 2013; Nasr Ben, Cunado, Demirer and Gupta, 2018; Nhlapho and Muzindutsi, 2020). Erb, Harvey,and Viskanta (1995) conducted one of the early studies to explore the link between country credit ratings and stock markets. Using a country's credit rating from institutional investors' semi-annual survey of bankers as a proxy for country risk, the study found that expected stock returns were higher for countries with higher credit risk ratings. Moreover, the study shows that country credit ratings can be used by investors to distinguish between stocks with a high expected return and stocks with a low expected return. Country risk has a significant effect on stock market performance. A country that is perceived to be riskier for investment growth is less likely to attract investors. Harvey (2004) investigated the relevance of political risk, financial risk and economic risk in portfolio and direct investment decisions. The findings of the study revealed that equity returns are closely related to country risk rationing. Thus stock market improvement can be achieved through the reduction of risk associated with a specific country.

Several studies show that country risk ratings have an important role to play in emerging country stock markets ((Hassan, Maroney, El-Sady and Telfah, 2003; Sari et al., 2013; Mensi, Hammoudeh, Yoon, et al., 2016; Lee et al., 2017; Nasr Ben et al., 2018; Nhlapho et al., 2020). For example, Hassan *et al.* (2003) studied the impact of political, economic and financial risk on stock market volatility in ten Middle East countries and five African markets, including South Africa. Although the study did not specify the effect of economic, financial and political risk on the stock market separately, the result of the study indicated a significant impact of country risk -political economic and financial risk- on stock market volatility. Additionally, the study conducted by Montes and Tiberto (2012) to assess the linkage between country risk and stock market performance in Brazil suggested that the lower is the risk associated with the country the better is the performance of equity markets. Similarly, Sari et al. (2013) examined the relationship between disaggregated country risk ratings and stock market movements in Turkey in the long and short run using the autoregressive lag (ARDL) approach. The study found evidence of a long-run relationship between disaggregated risk ratings and stock market movements. Furthermore, the study found a long-run relationship between all three country risk components and stock market movements. However, found that only political and financial risk ratings had a positive and significant impact on stock market movements.

Certain studies have examined the impact of country risk in leading emerging markets such as BRICS (Hammoudeh, Sari, Uzunkaya and Liu, 2013; Liu, Hammoudeh and Thompson, 2013; Nasr Ben et al., 2018) found that within the BRICS grouping, China was the only stock market to respond to changes in country risk ratings and global factors.

Analogous to the aforementioned findings, the study by Liu et al. (2013) showed that the impact of the three risk components of country risk on BRICS stock markets is determined by the direction of the shocks; that is country with low economic, financial and political risk, experiences attractive and profitable stock market. Using a dynamic panel smooth threshold regression model to investigate the nonlinear relationship between stock returns and country risk ratings of BRICS countries, Mensi et al. (2016) found an asymmetric relationship between BRICS countries' stock markets and the three country risk components. Additionally, the effects of economic, financial and political risk ratings were highly dependent on the degree of volatility in the stock market. Mensi, Hammoudeh, Yoon,and Balcilar (2017) investigated the non-linear relationship between stock markets in GCC countries and their country risk ratings. They show that a high financial risk rating improves the performance of stock markets.

However, the approach used in the above-mentioned studies does not take into account the asymmetric impact of positive and negative changes in risk ratings. In this context, Nasr et al. (2018) conducted a study in BRICS markets using a nonlinear autoregressive distributed lagged approach and found that economic, financial and political risk have asymmetric effects on stock market returns of individual BRICS stock markets and commodity prices. The study also revealed that the most detrimental components of country risk on BRICS stock returns are financial and political risks. The main outcome of the above-mentioned studies is the asymmetric relationship between country risk rating components and asset markets. The objective and analysis for this chapter extend this line of research by adding bond market returns, household price, exchange rate and commodity markets-gold and oil- to the empirical setting to assess the impact of economic, financial and political risk on asset markets.

Out of the various components of country risk, existing literature highlights the important role of political risk in explaining stock returns. An anomaly in this relationship is the violation of the basic risk-return tradeoff, which has been dubbed the political risk sign paradox. Investigations have found that a decline in political risk is often associated with rising stock returns (Lehkonen and Heimonen, 2015). Dimic, Orlov and Piljak (2015) examined the effects of political risk on the stock returns of developed, emerging and frontier markets. The study found that political risk is priced in all markets, such that an increase in political risk results in a decline in stock returns. The study shows that political risk has a more significant impact on stock returns in emerging markets as compared to its impact in developed and frontier markets.

Although there have been few studies comparing the impact of country risk or political risk on various South African asset markets, there has been some research that has explored the response of domestic asset markets to changing economic, financial and political fundamentals. For example, Gkillas et al. (2019) examined the effects of economic news releases on South African equity and foreign exchange markets. The study applies a Vector autoregressive (VAR) approach to examine the effects on return, volatility and jumps in the asset series. Economic news announcements were segmented into three categories with a focus on news relating to monetary policy, trade integration, GDP, CPI, inflation and interest rates. The results show that macroeconomic fundamentals are significant determinants of stock and foreign exchange market returns, volatilities and jumps. The results also show that stock markets have a higher sensitivity to economic news releases compared to foreign exchange markets.

4.2.3.2 The impact of country risk on bond markets

Several studies have investigated the impact of country risk on bond markets. Cantor et al. (1996), Reisen and Von Maltzan (1999) and Nair (2019) studied the effects of sovereign rating changes on bond yields. Cantor and Packer (1996) and Nair (2020) investigated the relationship between sovereign credit ratings and bond yield spreads. These studies found that sovereign credit rating announcements had heterogeneous effects on bond yield changes. Their evidence suggests that bond yield fluctuations lag sovereign rating changes and rating upgrades have a more significant impact on government bonds than downgrades. On the other hand, studies including, Reisen and von Maltzan (1999) and El-Shagi and von Schweinitz (2018) examined the directional causality of fluctuations in sovereign credit ratings and emerging bond yield spreads. The results of these studies demonstrated that country risk ratings encompass a significant effect on government bond yield spreads being more pronounced for downgrades.

In a similar study, Mutize and Nkhalamba (2020) compared the impact of sovereign credit ratings provided by the various rating agencies on sovereign bond yield spreads. The study found that a one-notch upgrade in sovereign credit ratings decreased the bond yield spread. Similarly, when examining the impact of risk ratings across stocks and bonds within various markets, Kenourgios, Umar,and Lemonidi (2020) concluded that ratings provide new information to asset markets, and therefore, affect bond and stock markets. However, the information provided by the different rating agencies created symmetric behaviours amongst the assets. Positive information improved market performance while negative information caused negative shocks within the markets. Furthermore, the findings of the study indicated that markets are more sensitive towards negative information relative to positive information. Thus, the study of Kenourgios, Umar and Lemonidi (2020) corroborated the finding from Afonso et al. (2011) who found a strong linkage between government bond yield spreads, and changes in credit ratings and rating outlook.

Afonso et al. (2012) used an event study method to examine the response of sovereign yield spreads to sovereign credit ratings news. They found that bond yields react more to negative rating events and have no reaction to positive events. Consistent with the evidence of asymmetric effects of rating adjustments, Afonso et al. (2014) demonstrated that sovereign ratings downgrades significantly increased stock and bond market volatility, while upgrades had no significant effect. These studies were conducted for developed markets. Similarly, Böninghausen and Zabel (2015) examined the cross-border bond market spillovers following a rating announcement for 73 developed and emerging countries for the period 1994-2011. They found significant spillovers due to sovereign rating downgrades and insignificant sensitivity to ratings upgrades. They also found that cross-border spillovers were more significant for countries in the same region.

Duyvesteyn et al. (2016) found that bond markets had a delayed response to changes in political risk in developed and emerging economies. They show that political risk had significant predictive power for future bond market returns, particularly during crisis periods. High political risk (low-risk rating) was associated with high bond yields, thus a higher bond risk premium. Based on the evidence of asymmetric effects of risk ratings, Chow, Gupta, Suleman,and Wong (2019) employed linear and nonlinear causality techniques to examine the relationship between economic, financial and political risk on government bond spreads for BRICS and PIIG countries. Their analysis found a strong long-run relationship between the various risks and bond spreads for both BRICS and PIIGS. However, not all risks strongly predict bond spread for both BRICS and PIIGS. For example, the study found a nonlinear and statistically significant causal relationship between political risk and BRICS bond spreads, but causality for economic and financial risk. Further, using Granger causality tests and Dynamic Conditional Correlation Generalised Autoregression Conditional Heteroskedasticity (DCCGARCH) to study the impact of sovereign rating announcements on the stock and bond markets of 19 African countries, Mutize and Gossel (2019) found unidirectional causality running from credit ratings to bonds and a weak link between stock markets and sovereign credit ratings. Furthermore, the study found that a sovereign rating downgrade resulted in negative stock and bond returns.

4.2.3.3 The impact of country risk on housing markets

The housing market is another component of the equity market and it is influenced by various factors be it economic, financial and political changes. However, the literature does not provide enough direct information about the empirical relationship between the housing market and country risk. Nonetheless, some researchers such as Tsatsaronis and Zhu (2004) made a distinction between factors that affect housing prices in the long term compared to those that affect housing markets in the short term. The study considers GDP growth rate, inflation rate, real short-term interest rates and government bond yield spread as determinants of house prices. The results show a strong long-term relationship between inflation, interest rates and housing prices.

Another study was conducted by Adams and Füss (2010) to evaluate the long-run and short-run dynamics between macroeconomic variables and international housing prices using panel dynamic ordinary least squares estimator. House prices have a slow adjustment to changing macroeconomic factors due to homeowners being reluctant to sell their properties during periods of financial turmoil. The study shows that house prices react significantly to changes in macroeconomic fundamentals. Particularly, house prices are positively affected by an increase in economic activities, whilst an increase in long-term interest rates significantly reduces future house prices. Further, Antonakakis and Kizys (2015) studied the linkages between economic policy uncertainty and housing market returns. The study applies the DCC GARCH approach for a sample period between 1987 and 2014. The study revealed that the high losses in housing markets are associated with growing uncertainty or risks associated with the market.

Bahmani-Oskooee and Ghodsi (2016) examined the effects of economic factors on house prices. The study finds that fundamentals have asymmetric effects on house prices. The study uses a non-linear ARDL to decompose the negative and positive partial sums of interest rate and income and find that income and interest rates have differential effects in the long and short run. Besides, economic factors, housing markets are also impacted by changes in financial conditions. Analysis, of the effect of systemic financial crises on the housing market cycle, Agnello, Castro,and Sousa (2019) concluded that financial crises significantly impede the housing market's preformation as the latter depends on the financial stability of a given country. Taking all country risk components into account, Muzindutsi, Jamile, et al. (2020) examined the effects of economic, financial and political risk on housing prices in South Africa. The results of the study show a long-run relationship between the housing price index and country risk ratings. In particular, the results show a positive long-run impact of economic and political risk ratings in the long-run. Whereas financial risk ratings were found to harm housing prices in the long run.

4.2.3.4 The impact of country risk on currency markets

When considering whether rating changes have an impact on the relationship between stock and exchange rate returns, Subaşı (2008) found that rating downgrades have a negligible negative impact on stock and exchange rate returns, which implies that the information provided by the rating agencies has been incorporated in the prices already. Alsakka and A.P. Gwilym (2012) compared the impact of credit signals provided by three different rating agencies on the foreign exchange market for the period between 1994 and 2010. The study finds a significant impact of credit risk ratings on emerging markets compared to developed markets. An explanation for this finding is that ratings revisions in emerging markets happen more frequently and economic changes are less predictable. The study also shows that the foreign exchange market reacts to rating changes emanating from all three rating agencies. The study shows that foreign exchange markets in developed and emerging economies have differential responses to changes in credit ratings. For instance, the study finds that rating information provided by Fitch has a fast transmission to developed foreign exchange markets, while S&P ratings negative outlook have informational value for emerging countries. Similar to existing literature, the results also show that markets overreact to negative rating news compared to positive/upgrade news. The study further finds that credit risk ratings in one country have cross-country effects.

Tran et al. (2019) evaluate the informational value of credit ratings on equity and foreign exchange rate markets. Credit ratings lead to investor herd behaviour. Ratings news has the same effect on stock and foreign exchange markets. The reaction of investors is explained as stemming from how investors perceive the information. Investors respond to rating information when information is expected. And the response of the markets is less significant if rating news confirms existing/ known information.

4.2.3.5 The relationship between country risk and commodity markets

The commodity market plays a significant role in a country's economic and financial development. Nonetheless, the performance of the commodity market is significantly influenced by country risk. In other words, changes in political financial and economic may enhance or destabilize the commodity market of any given country. However, the effect of country risk on the commodity market may differ from country to country as producers of commodities may not be affected by buyers of commodities. Numerous studies, including Pastor and Veronesi (2013), Liu, Shu and Wei (2017) and Brogaard, Dai, Ngo and Zhang (2020), indicated that political risk or political uncertainty negatively impacts commodities prices, thus impeding the commodity market performance. Additional to the effect of political risk on commodity price and market, the stud of Lee et al. (2017) proposed that higher oil prices can lead to a decline in economic activity, which puts pressure on policy choice and hence brings about increased economic policy uncertainty. As a result, changes in country risk are closely linked with increases in uncertainty and economic instabilities.

Khan (2015) investigated the interaction between economic growth in Pakistan and major commodities, oil price and gold price. The findings of the study suggested that a positive correlation exists between commodity prices and economic stability and GDP growth. A similar study was conducted by Koseoglu, Khan and Ifat (2019), using the asymmetric causality test, to analyse the relationship between oil prices and economic growth in Gulf Cooperation Council (GCC) countries. The result of the study indicated that asymmetric shocks (positive or negative) in oil price influence each country's economic growth.

The linkages between country risk and commodity market is not an isolated case, as discussed in section 4.5.4, the impact of country risk on stock markets has the potential to spill over to commodity markets. This was justified in the study of Nasr et al. (2018) where findings revealed that fluctuations in country risk ratings have implications for the stock market and the effects spillover to commodity markets. In summary, all equity markets are interdependent. Changes in one market, as a result of a country's risk rating, stimulates changes or fluctuations in other markets. Consequently, solving country risk issues can be a solution to various challenges faced by the discussed markets.

4.2.4 Summary and conclusion

The review of related literature has highlighted the following issues. First, the studies have shown that the information content of country credit ratings has significant implications on asset pricing. Most studies focus solely on the long-run relationship or the short-run relationship. This study employed an econometric technique that allows for empirically examining the short-run and long-run relationship. This study provides additional evidence of the effects of country risk by empirically investigating this relationship in the context of South Africa. Studies reported differential impacts of country risk on emerging market assets. However, these studies concentrated on one or two asset markets. It would be of interest to compare whether the different asset markets have heterogeneous responses to country risk.

4.3 Data and methodology

This section describes the method of analysis followed to investigate the relationship between asset returns and country risk components. The country risk components are described, followed by a description of the method of analysis, the non-linear autoregressive distributed lag (NARDL) model.

4.3.1 Sample and data description

This section provides a brief overview of the asset market and country risk data used. The asset market indices used for the analysis were provided in Chapter 3, section 3.4.1. Hence, this section focused on describing the three country risk components, namely economic risk, financial risk and political risk.

4.3.1.1 Asset markets

To examine the impact of country risk on asset market returns, the study employed market index data on stock, bond, currency, housing, gold and oil markets. The description and sources of these indices were provided in Chapter 3, section 3.4.1. The sample period used in chapters 3 and 4 is the same. The monthly returns for each asset market index were calculated as described in Chapter 3, section 3.3.1. The descriptive analysis and data properties of the calculated asset returns were discussed in Chapter 3, section 3.4.1.

4.3.1.2 Country risk ratings

Ratings provide important signals to global market participants. Integration of asset markets results in financial crises which have contagion effects. There are various ratings agencies, namely; Institutional Investor International Country Risk Guide (ICRG), Economic Intelligence Unit, Euromoney, Political Risk Services, Moody's, Fitch and Standard and Poor's. Each of these rating agencies uses a combination of various qualitative and quantitative approaches to provide a measure of a country's risk rating. For example, Standard & Poor's uses subcategories which include projections for economic growth, inflation stability and political risk to determine risk ratings, whereas Moody's uses the probability of government defaulting as one of the determinants. This study uses the ICRG measure of country risk as it provides detailed data on country risk components as displayed in Table 4.1.

Table 4.1 ICRG Country risk components

Political Risk	Economic Risk	Financial Risk
Government Stability (12) Socioeconomic Conditions (12) Investment Profile (12) Internal Conflict (12) External Conflict (12) Corruption (6) Military in Politics (6) Religious Tensions (6) Law and Order (6) Ethnic Tensions (6) Democratic Accountability (6) Bureaucracy Quality (4).	GDP per Head of Population (5) Real Annual GDP Growth (10) Annual Inflation Rate (10) Budget Balance as a Percentage of GDP (10). Current Account Balance as a Percentage of GDP (15).	Foreign Debt as a Percentage of GDP (10) Foreign Debt Service as a Percentage of Export in Goods and Services (10) Current Account as a Percentage of Export in Goods and Services (15) Net Liquidity as Months of Import Cover (5) Exchange Rate Stability (10).

Note: The range of risk points for each variable is indicated in parentheses ().

Source: ICRG (2019)

The country risk data used is derived from the International Country Risk Guide (ICRG) of Political Risk Services (PRS) and comprises of 22 indicators under each of the three risk subcategories; political risk, financial risk and economic risk (ICRG, 2019). Various financial practitioners in internationally recognized organisations such as the International Monetary Fund (IMF) and World Bank rely on the ratings provided by ICRG risk ratings as a benchmark against which to compare other risk ratings. Empirical evidence, further shows that ICRG indices provide reliable measures, and when compared to credit risk ratings supplied by other agencies, provide a superior measure of political risk (Bekaert, Harvey, et al., 2014). Hoti and McAleer (2004) showed that ICRG indices perform better when forecasting the economic, financial and political risk of a country. The ICRG provides these ratings monthly with numerical scales on which higher numbers indicate lower risk and lower numbers indicate higher risk. The ratings provided by the ICRG are different from those provided by other accredited credit rating institutions. The ICRG provides a more comprehensive and more frequent numerical measure of risk ratings monthly. For ratings to be effective as an assessment tool, they need to be released more frequently (Erb et al., 1996). Moreover, the distinction between economic, financial and political risk ratings provides a comprehensive measure for market participants to make investment decisions (Sari et al., 2013). A rating score ranging from 50% to 60% indicates high risk, moderate risk score is between 60-70% and a score between 70 and 100% indicates low risk.

Economic and financial risk ratings are related to the sovereign nation's ability to repay its debt obligations in full and on time, whereas political risk relates to the sovereign's willingness to fulfil its obligations (Butler and Fauver, 2006). The economic and financial risk components have a weighting of 50 points each, whilst the political risk rating has a weighting of 100 points. Political risk identifies 12 risk indicators, while financial risk and economic risk each identify five risk indicators (ICRG, 2019). Each risk indicator is ranked on a scale starting from zero to a maximum value. Political risk is a measure of the transparency and integrity of the leadership in a country.

Amongst the three measures of country risk, political risk is the most difficult to quantify due to its subjective nature. In most studies, political risk is proxied by factors such as corruption, institutional quality, quality of governance and other economic factors. In Africa, South Africa has the lowest political risk rating (Essel and Mostert, 2013; Filippou, Gozluklu and Taylor, 2018). This lower rating is attributed to its well-established political system. However, the country is characterized by a high rate of corruption and ongoing civil unrest (Barnard and Croucamp, 2015). The political risk indicators encompass 12 indicators including; labour freedom, civil unrest, property rights, government stability, internal conflict, external conflict, corruption, law and order, ethnic tensions, democratic accountability, bureaucracy quality, and military expenditure as a percentage of GDP. These indicators are related to each other and have similar characteristics. Economic risk indicators provide a measure of the country's economic strengths and weaknesses (Howell, 2013).

4.3.2 Method for analysing the relation between asset returns and country risk

This section describes the method of analysis used to achieve the second objective. The literature reviewed in section 4.4 suggests that country risk exhibits non-linear behaviour. Therefore, the relationship between asset returns and economic, financial and political risk was determined by employing the Autoregressive Distributed Lag (ARDL) model originated by Pesaran and Shin (1998) and the nonlinear Autoregressive Distributed Lag (NARDL) model introduced by Shin et al. (2014), which is a non-linear specification of the linear ARDL approach. Section 4.3.2.1 and section 4.3.2.2 discusses the ARDL and NARDL, respectively.

4.3.2.1 Autoregressive distributed lag (ARDL) model

The ARDL is an error correction model that can establish a short-run and long-run relationship between the dependent and independent variables by applying cointegration techniques. "This approach uses lags of the dependent variable and the lagged and contemporaneous values of the independent variables such that the short-run effects can be directly estimated and the long-run equilibrium relationship indirectly inferred (Bouchoucha, 2015)." A distinguishing feature of the ARDL compared to other symmetric estimation techniques is its ability to test for cointegration irrespective of the order of integration of the regressors (provided the variables are not I(2)) (Pal and Mitra, 2019). The model is also able to simultaneously estimate short-run and long-run parameters (Pesaran, Shin and Smith, 2001). The ARDL can combine variables with different numbers of optimal lags (Habanakize and Muzindutsi, 2016). In addition, choosing the appropriate number of lags in the ARDL model corrects for residual correlation and endogenous regressors (Pesaran and Shin, 1999).

The standard ARDL approach follows two steps. In the first step, the presence of a cointegrating relationship between asset returns and country risk components is investigated. In the second step, the parameters of the long-run relationships are estimated and the short-run parameters are determined using the error correction model (ECM). The speed of adjustment to equilibrium is derived from the ECM of the estimated ARDL model. In addition, choosing the appropriate number of lags in the ARDL model corrects for residual correlation and endogenous regressors (Pesaran and Shin, 1999).

The standard ARDL(p, q) model can be specified as follows:

$$\Delta\varphi_t = c + \rho_1\, \varphi_{t-1} + \rho_2\, ER_{t-1} + \rho_3\, FR_{t-1} + \rho_4 PR_{t-1} + \sum_{i=1}^{p} \beta_i\, \Delta\varphi_{t-i} + \sum_{i=0}^{q}. \theta_i\, \Delta ER_{t-i} + \sum_{i=0}^{q} \delta_i\, \Delta FR_{t-i} + \sum_{i=0}^{q} \sigma_i\, \Delta PR_{t-i} + \epsilon_t \quad (4.1)$$

φ is the dependent variable measuring the asset returns (stock, bond, forex, housing, gold and oil). ER, FR and PR refer to economic risk, financial risk and political risk, respectively. The asset returns are regressed on their lags, and current and lagged values of the country risk variables. p and q represent the optimal lag lengths of the model. The optimal lag combination for the ARDL model is determined based on the minimization of the Schwartz Information Criterion (SIC). The ARDL model selected is used to test for the long-run relationship between country risk and asset market returns using the bounds test. Equation 4.1 can be specified into an error correction model that includes an error correction term (ECT). The re-specified equation is as follows:

$$\Delta\varphi_t = \omega\vartheta_{t-1} + \sum_{i=1}^{p} \beta_i\, \Delta\varphi_{t-i} + \sum_{i=0}^{q}. \theta_i\, \Delta ER_{t-i} + \sum_{i=0}^{q} \delta_i\, \Delta FR_{t-i} + \sum_{i=0}^{q} \sigma_i\, \Delta PR_{t-i} + \epsilon_t \quad (4.2)$$

Where $\omega\vartheta_{t-1} = \varphi_{t-1} - \alpha_0 - \alpha_1 ERV_{t-1}$ represents the linear ECT and ω is the parameter for the speed of adjustment to equilibrium. The long-run parameters are defined as:

$\alpha_0 = -\ \rho_1 / \rho_0$ and $\alpha_0 = -\ \rho_2 / \rho_0$

To account for structural breaks, studies (Erdoğan, Ceylan and Abdul-Rahman, 2022; Sharaf, 2022) have opted to separate their sample into two periods. A limitation of this approach is that the dates are 'subjective' and tend to be different for all studies. This study employs the Bai-Perron test to examine the effects of structural breaks. The ARDL framework was extended to include dummy variables for structural breaks and the ARDL (p, q) was specified as follows:

$$\Delta\varphi_t = c + \rho_1\, \varphi_{t-1} + \rho_2\, ER_{t-1} + \rho_3\, FR_{t-1} + \rho_4 PR_{t-1} + \sum_{i=1}^{p} \beta_i\, \Delta\Upsilon_{t-i} + \sum_{i=0}^{q}. \theta_i\, \Delta ER_{t-i} + \sum_{i=0}^{q} \delta_i\, \Delta FR_{t-i} + \sum_{i=0}^{q} \sigma_i\, \Delta PR_{t-i} + \sum_{m=1}^{n} D_m B_{mt} + \epsilon_t \quad (4.3)$$

Where $\sum_{m=1}^{z} D_m B_{mt}$ captures the structural breaks identified using the Bai-Perron test. D_m is the parameter for the dummy variable for each break, B_{mt} is the dummy variable for each break identified and it is defined as:

$B_{mt} = 1$ for $t > T_B$, and $B_{mt} = 0$ otherwise, where T_B is the structural break dates for m=1,2…..n.

The standard ARDL models the short- and long-run relationships between country risk components and asset returns but fails to account for the possibility of nonlinear effects which is the case in recent literature (see Liu et al., 2013; Mensi et al., 2016; Nasr et al., 2018).

4.3.2.1 Nonlinear autoregressive distributed lag (ARDL) model

The study followed the non-linear ARDL (NARDL) methodology of Shin, Yu,and Greenwood-Nimmo (2014) to investigate the nonlinear effect of country risk components on asset market returns. The NARDL can capture the dynamic cointegration between variables and also provide estimations for the long- and short-run impact of independent variables on the dependent variable (Pal and Mitra, 2016). The study captures the symmetric and asymmetric behaviour of each of the country risk components; economic risk (ER_t), financial risk (FR_t) and political risk(PR_t), by decomposing them into their positive and negative partial sums, as follows:

$$x_t = x_0 + x_t^+ + x_t^-. \qquad (4.4)$$

The general forms for the positive and negative partial sums of x_t are expressed in the following way:

$$x_t^+ \sum_{k=1}^{t} \Delta x_k^+ = \sum_{k=1}^{t} \max(\Delta x_k, 0) \text{ and } x_t^- \sum_{k=1}^{t} \Delta x_k^- = \sum_{k=1}^{t} \min(\Delta x_k, 0) \qquad (4.5)$$

Where x_t is a $m \times 1$vector of explanatory variables (ER, FR and PR) and $\Delta x_k = x_k - x_{k-1}$. Decomposing the explanatory variable into positive and negative partial sums allows us to examine the effects of a decrease and increase of country risk on the asset returns. To model the short- and long-run nonlinearity, the NARDL model is expressed as follows:

$$\Delta\varphi_{it} = c + \theta\,\varphi_{it-1} + \rho_1^+ ER_{t-1}^+ + \rho_2^- ER_{t-1}^- + \rho_3^+ FR_{t-1}^+ + \rho_4^- FR_{t-1}^- + \rho_5^+ PR_{t-1}^+ + \rho_6^- PR_{t-1}^- + \sum_{k=1}^{p-1} \nu_i\, \Delta\varphi_{it-k} + \sum_{i=0}^{q-1} (\beta_{2k}^+ \Delta ER_{t-k}^+ + \beta_{3k}^- \Delta ER_{t-k}^-) + \sum_{k=0}^{q-1} (\beta_{4k}^+ \Delta FR_{t-k}^+ + \beta_{5k}^- \Delta FR_{t-k}^-) + \sum_{k=0}^{q-1} (\beta_{6k}^+ \Delta PR_{t-k}^+ + \beta_{7k}^- \Delta PR_{t-k}^-) + \epsilon_t \qquad (4.6)$$

where p and q are the lag orders, θ is the symmetric long-run parameter and ρ_k^+ and $\rho_k^-$are the long-run asymmetric parameters. ν is the short-run parameter and the short run adjustment to positive and negative shocks are captured by parameter estimates β_k^+ and β_k^-.

The error correction model is specified as follows:

$$\Delta\varphi_{it} = \lambda\,\eta_{it-1} + \sum_{k=1}^{p-1}\nu_i\,\Delta\,\varphi_{it-k} + \sum_{i=0}^{q-1}(\beta_{2k}^+\,\Delta ER_{t-k}^+ + \beta_{3k}^-\Delta ER_{t-k}^-) + \sum_{k=0}^{q-1}(\beta_{4k}^+\,\Delta FR_{t-k}^+ + \beta_{5k}^-\Delta FR_{t-k}^-) + \sum_{k=0}^{q-1}(\beta_{6k}^+\,\Delta PR_{t-k}^+ + \beta_{7k}^-\Delta PR_{t-k}^-) + \epsilon_t \qquad (4.7)$$

where η_{it-1} is the ECT that captures the long-run equilibrium and λ is the parameter that captures the speed of adjustment to long-run equilibrium.

The long-run impact of positive and negative shocks of financial, economic and political risk factors on the asset returns are equal to $\varphi^+ = -\rho_k^+/\rho_\Upsilon$ and $\varphi^- = -\rho_k^-/\rho_\Upsilon$. The short run impact of positive and negative changes in economic risk, political risk and financial risk components is indicated by $\sum_{k=0}^{q-1}\beta_k^+$ and $\sum_{k=0}^{q-1}\beta_k^-$.

The NARDL framework including structural breaks is as follows:

$$\Delta\varphi_{it} = c + \theta\,\varphi_{it-1} + \rho_1^+ER_{t-1}^+ + \rho_2^-ER_{t-1}^- + \rho_3^+FR_{t-1}^+ + \rho_4^-FR_{t-1}^- + \rho_5^+PR_{t-1}^+ + \rho_6^-PR_{t-1}^- + \sum_{k=1}^{p-1}\nu_i\,\Delta\,\varphi_{it-k} + \sum_{i=0}^{q-1}(\beta_{2k}^+\,\Delta ER_{t-k}^+ + \beta_{3k}^-\Delta ER_{t-k}^-) + \sum_{k=0}^{q-1}(\beta_{4k}^+\,\Delta FR_{t-k}^+ + \beta_{5k}^-\Delta FR_{t-k}^-) + \sum_{k=0}^{q-1}(\beta_{6k}^+\,\Delta PR_{t-k}^+ + \beta_{7k}^-\Delta PR_{t-k}^-) + \sum_{m=1}^{n}D_mB_{mt} + \epsilon_t \qquad (4.8)$$

The study estimated the NARDL equation and used the bounds test proposed by Pesaran *et al.* (2001) to determine cointegration among the variables. The null hypothesis for the bounds test is where $\rho = \rho_i^+ = \rho_i^- = 0$, for i=0, 1, 2….8. The null hypothesis of the standard Wald test used to test the long-term symmetry hypothesis is as follows: $\rho_i^+ = \rho_i^-$ and short-run symmetries will be tested on the following null hypotheses: $\sum_{i=0}^{q-1}\beta_i^+ = \sum_{i=0}^{q-1}\beta_i^-$, for i=0, 1,2 ….q. This study applies the error correction model (ECM) based on the NARDL to evaluate the short-run asymmetric effects. A statistically significant country risk component will indicate a short-run relationship between country risk and asset return correlations.

The long-run cointegrating relationship is tested using the bounds test. The test entails estimating the ARDL (p, q) model and analysing whether the coefficient values for one period lagged variables are jointly zero. The F-test is based on the following hypothesis:

H_0: $\rho_1 = \rho_2 = \rho_3 = \rho_4 = \rho_5 = \rho_6 = 0$

H_1: $\rho_1 \neq \rho_2 \neq \rho_3 \neq \rho_4 \neq \rho_5 \neq \rho_6 \neq 0$

The null hypothesis of no long-run relationship is tested against the alternative hypothesis of co-integration. To test the hypothesis, the computed F-statistic is tested against the upper and lower bounds of critical values (Pesaran et al., 2001). The null hypothesis is rejected when the F-statistic is greater than the critical value of the upper bound and thus the conclusion of a long-run relationship between variables is reached. When the null hypothesis is not rejected, they conclude that there is no cointegration when the F-statistic falls below the lower bound. Lastly, in cases where the F-statistic falls between the upper and lower bound, the result is inconclusive and the relationship between variables would need further probing (Pesaran et al., 2001). A long-run cointegrating relationship can also be confirmed by assessing the significance and sign of the error correction term can be used to support cointegration test results (Banerjee et al., 1998). For example, a significant and negative error correction term would suggest a long-run, cointegrating relationship (Bahmani-Oskooee and Nasir, 2004).

According to Enders (2004), econometric analysis should be preceded by tests that ensure that the dataset or variables to be analysed are free of unit roots and stationary. In this regard, various unit roots tests and stationarity tests were performed before ARDL and NARDL model estimation. The subsequent sections discuss both unit root and stationarity tests.

4.4 Results and discussion

4.4.1 Descriptive statistics and preliminary testing

When analysing logged financial asset returns, many data properties have been found to hold in different securities and different markets. Therefore, it is important that when applying a chosen statistical model those properties are adjusted to ensure that the model is correctly specified. The stylized facts include; leverage effects (asymmetry in gains and losses), heavy-tailedness, serial correlation and volatility clustering (Cont, 2001). The descriptive statistics measures, such as the mean, median, maximum and minimum, standard deviation, skewness, kurtosis and Jarque-Bera statistics were computed for each of the return series and country risk components.

The descriptive statistics for the monthly returns of equity, bond, housing and foreign exchange market were presented and discussed in Chapter 3, section 3.3.1, Table 4.2 panel A displays the results for the descriptive analysis pertaining to the logged values of economic, financial and political risk in South Africa. It was noted in section 3.3.1 that the mean of historical monthly returns of the stock, bond, housing, exchange market and commodities markets were positive. The mean returns of gold were the highest at 1%, whilst the returns for the foreign exchange market were the lowest, 0.04%. This evidence indicated a bullish market trend throughout the sample period. Consistent with literature findings (Morales et al., 2014) the return series indicates a high standard deviation in monthly stock returns which indicates that the market was the most volatile during the sample period. Whilst the foreign exchange market exhibits less volatility in comparison to the bond markets. In line with the empirical properties of financial returns series, the asset return series exhibit skewness and leptokurtosis. This result also confirmed the results of the Jarque-Bera test which rejects the null hypothesis of a normal distribution of asset returns at the 5% level of significance.

Concerning the properties of the country risk series presented in table 4.2, ER and PR are platykurtic, with a kurtosis value below 3 and FR is leptokurtotic, with a kurtosis value of more than three. Moreover, the Jarque-Bera test statistics are significant for FR and PR which suggests that the risk series are not normally distributed. This result justifies the application of a non-linear modelling approach to assess market behaviour.

Figure 4.1 shows the plots of logged economic, financial and political risk ratings, respectively. The plots indicate that financial risk ratings and political risk ratings were highly volatile over the sample period. Economic risk ratings were more stagnant over the sample, with changes in these ratings occurring over the medium term. The economic risk rating is based on macroeconomic data published at a low frequency, quarterly or annually. It is also noted that economic and financial risk ratings were revised downwards in the period coinciding with the 2008 global financial crisis which would imply the crisis affected economic and financial stability in South Africa (Boako and Alagidede, 2018). However, political risk ratings were less sensitive to global risk and most of the decrease in political risk ratings occurred around 2017, a period of significant political instability in South Africa (Ngwakwe and Sebola, 2019).

4.4.2 Unit root tests and multicollinearity tests

As mentioned in section 4.3.2.1, identifying whether the series has a unit root is an important step before determining the long-run relationship between asset markets. The Augmented Dickey-Fuller, Phillips-Perron and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests are implemented at levels including a constant only, and a constant and a trend. The null hypothesis of the ADF and PP is that the series contains a unit root, whilst the KPSS null hypothesis is the series is stationary or has no unit roots. The unit root test results for the asset return series presented in Table 3.1 panel A indicated that the ADF and KPSS statistics found that all asset return series were stationary at levels except for the housing price index returns, which were found to be stationary at first difference.

The presence of structural breaks in a series can lead to results indicating unit roots (Perron, 1989). The ZA structural breaks test confirmed that the housing return series is not I(2). The results from the ADF, KPSS and PP unit root tests in Table 4.2 find that all the country risk components are stationary at the first level and none of the variables are integrated in the second order. Overall, the results from all four unit root tests employed indicate that variables of interest are either I(0) or I(1) none of them is not I (2). Therefore, the ARDL or NARDL is the appropriate model to estimate both long-run and short run relationships among variables.

Table 4.3 presents the correlation matrix. The absolute value of the unconditional correlations displayed in the table shows that ER, FR and PR are weakly correlated. Notably, the highest correlation value is 0.4690, observed between ER and PR. Due to all the correlation values being less than 0.8, the potential issue of multicollinearity may not significantly affect the analysis (Gujarati, 2022). The variance inflation factor displayed in Appendix B2 is lower than 9, providing further evidence that there is no multicollinearity.

4.4.3 Structural breaks tests, cointegration and asymmetry tests

Asset markets and country risks are often influenced by various events such as financial and economic crises, regimes shift and policy changes, and changes within institution arrangements. These changes might have significant implications for the variables under consideration. Therefore, it is indispensable to consider structural changes for better findings.

This study used the Bai-Perron (2003) test which allows for detecting up to five structural breaks endogenously. The estimation is conducted using the Bai-Perron Global L breaks vs none approach, where the unweighted-max F (UDMax) test represents the number of breaks and sets a Trimming percentage of 15. The results of the Bai-Perron (2003) test are presented in Table 4.4, panel A. The tests were conducted on individual regression estimations of asset returns that are estimated assuming Newey-West standard residuals.

Table 4.4 shows the results of the break dates for the housing returns. No structural breaks were identified for the stock, bond, gold, oil and forex returns. However, two break dates were identified in the housing market in 2003 and 2007. These breaks occur around the time of the 2002 US Dotcom crisis and the 2007/2008 financial crisis which caused significant fluctuation within the financial and economic data. The global financial crisis, triggered by a credit and housing boom, had adverse effects on macroeconomic stability and an increase in capital outflows which subsequently resulted in a decline in consumption and investments (Roy and Kemme, 2020). In addition, the Chow breakpoint test (panel B) was conducted and the test concluded there exist structural changes in housing returns in August 2007 at all conventional levels of significance. As a result, an endogenously determined dummy variable, to capture the break date, was included in the estimation of the ARDL and NARDL models. A comparison was drawn on whether the consideration of break dates altered the results of the model.

The step that follows after conducting unit root tests is to determine whether a long-run relationship exists between the asset return series. The long-run relationship between variables is explained as the state at which variables converge to a long-run equilibrium such that there is no tendency for variable values to change (Brooks, 2019).

Table 4.2 Descriptive analysis for country risk components

Variable	LER	LFR	LPR
Mean	3.5459	3.6406	4.1932
Median	3.5264	3.6507	4.1972
Maximum	3.6507	3.7377	4.2767
Minimum	3.3673	3.4500	4.1190
Std. Dev.	0.0629	0.0504	0.0395
Skewness	-0.1392	-0.7347	0.1601
Kurtosis	2.4054	3.5092	2.1218
Jarque-Bera	4.2749	23.9842***	8.6651**
PP	-14.8899#	-4.5739***	-13.9056#
ADF	-13.9056#	-4.4827***	-13.9538#
KPSS	0.0538#	0.2041	0.0611#

Notes: (*) Significant at 10%; (**) Significant at 5%; (***) Significant at 1%. # denotes series that are I(1). LER, LFR and LPR are the logged values for economic, financial and political risk ratings, respectively.

Source: Author's own estimation (2022)

Table 4.3 Correlation matrix

Variables	LER	LFR	LPR
LER	1.0000		
LFR	-0.0641	1.0000	
LPR	0.4690	0.3555	1.0000

Source: Author’s own estimation (2022)

Table 4.4 Bai-Perron structural breaks test and Chow Breakpoint test

Panel A: Bai-Perron Structural Breaks test		
Asset Returns	No. of Breaks	Dates
Stock	0	
Bond	0	
HPI	4	2007M08; 2003M02; 2011M02; 2015M06
Forex	0	
Gold	0	
Oil	0	
Panel B: Chow breakpoint test (Housing market returns)		
Break date	**F-stat**	**Conclusion**
2003M02	0.2852 [0.5938]	No Break
2007M08	149.9927 [0.0000]	Structural break

Source: Author’s own estimation (2022)

Figure 4.1 Logged economic risk ratings, logged financial risk ratings and logged political risk ratings

Source: Author's own depiction (2022)

Cointegration analysis is conducted for the linear ARDL and non-linear ARDL because the two models allow the use of a mixture of I(1) and I(0) variables. Additionally, NARDL allows research to determine both the positive and negative effect of independent on the dependent variable simultaneously. Nonetheless, it is important to choose the optimal lag order before running the bounds test. The specification of each model used a maximum of four lags with the Akaike Information Criteria (AIC) to determine the optimal lag structure of each model where asset returns are the dependent variables and the country risk components are the explanatory variables. After determining the optimal lag structure, the bounds test is conducted.

The bounds test results for the ARDL and NARDL approach, in panel A and B, reveals that the null hypothesis of no cointegration is rejected in favour of the alternative hypothesis of cointegration. The outcome of the ARDL bounds test demonstrates that the F-statistic exceeds the upper bounds critical value of 4.66 at a 1% significant level, thus confirming the presence of a long-run relationship between asset returns and country risk components. The linear ARDL approach does not account for the possibility of an asymmetric relationship between country risk and asset returns (see Mensi et al., 2016, Li et al., 2019). Thus, the NARDL bounds test for cointegration was conducted. The NARDL bounds test results indicated that F-statistics exceeded the upper bounds critical value of 3.99 at the 1% level of significance. This implies that country risk components - economic, financial and political risk- contain information that can predict changes in asset returns in the long run.

Table 4.5 Bounds test results

Panel A: ARDL model			
Market	Model specification	F-stat	Conclusion
Stock	ARDL(1,0,1,0)	57.9091***	Cointegration
Bond	ARDL(1,0,2,4)	43.6709***	Cointegration
Forex	ARDL(3,0,1,1)	17.4526***	Cointegration
Housing	ARDL(4,0,0,3)	4.0839***	Cointegration
Gold	ARDL(1,0,3,2)	67.0537***	Cointegration
Oil	ARDL(1,0,0,0)	48.4877***	Cointegration
	Critical values		
Significance level	I(0)	I(1)	
10%	2.37	3.2	
5%	2.79	3.67	
2.5%	3.15	4.08	
1%	3.65	4.66	
Panel B: NARDL Model			
Market	Model specification	F-stat	Conclusion
Stock	ARDL(1, 0, 0, 1, 3, 4, 2)	37.7291***	Cointegration
Bond	ARDL(1, 0, 3, 0, 2, 0, 2)	27.3146***	Cointegration
Forex	ARDL(2, 0, 0, 3, 1, 1, 1)	22.9621***	Cointegration
Housing	ARDL(4, 2, 0, 0, 4, 2, 4)	3.6717***	Cointegration
Gold	ARDL(1, 0, 0, 3, 0, 0, 2)	43.2260***	Cointegration
Oil	ARDL(1, 0, 0, 0, 0, 0, 1)	30.0744***	Cointegration
	Critical values		
Signif.	**I(0)**	**I(1)**	
10%	1.99	2.94	
5%	2.27	3.28	
2.5%	2.55	3.61	
1%	2.88	3.99	

Notes: *** denotes the level of significance at the 1% level. Model specification is based on the AIC. The critical values are taken from Pesaran et al (2001). I(0) is the lower bound and I(1) is the upper bound.

Source: Author’s own estimation (2022)

4.4.4 ARDL estimation results

4.4.4.1 Long-run analysis and results

The ARDL examines the long-run and short run linear relationship between country risk components and asset returns. The results of the long-run estimation are presented in equations 4.1.1 to 4.1.6.

$$Stock = -0.8144 + 0.0580LER + 0.0577LFR - 0.2965LPR \quad (4.1.1)$$

$$Bond = -0.2149 - 0.0059LER + 0.0253LFR + 0.0322LPR \quad (4.1.2)$$

$$Forex = 0.0330 - 0.0035LER + 0.0473LFR - 0.0463LPR \quad (4.1.3)$$

$$Housing = -0.2810 + 0.0621LER + 0.1074LFR - 0.0823LPR \quad (4.1.4)$$

$$Gold = 0.7868 - 0.0129LER + 0.0147LFR - 0.1916LPR \quad (4.1.5)$$

$$Oil = 1.4079 + 0.0045LER - 0.2191LFR - 0.1511LPR \quad (4.1.6)$$

The sign of the long-run parameters in equations 4.1.1 to 4.1.6 show the direction of the impact of economic risk, political risk and financial risk on the different asset markets. The magnitude of the parameter values demonstrates that financial and political risk have higher explanatory power for asset market returns compared to economic risk. An increase in economic risk was associated with a decrease in bond, forex and gold returns. A 1% increase in financial risk lead to an increase in stock, bond, housing and gold returns, whilst the impact on oil returns was negative. Political risk ratings were generally associated with declines in all asset returns except for the bond market which exhibited a positive relation with political risk ratings in the long run.

4.4.4.2 Short run analysis and results

The results for the short run error correction model are displayed in Table 4.6. The error correction terms in all the models are negative and statistically significant at all levels. The error correction term coefficient value of 0.051 in the housing model suggests that it takes 5.1% of the deviations from equilibrium are eliminated each month. Therefore it takes longer for long-run equilibrium to be restored. Economic risk has no short run impact on any of the asset markets, however financial and political risk play a prominent role in determining domestic asset market returns. Financial and political risk do not have a short run linear relationship with stock returns. However, it is found that global risk, the financial crisis, had a negative and significant impact on stock returns. This finding corroborates the evidence which shows that South African stock markets are integrated with global markets (Atenga and Mougoué, 2021).

Similar to the long-run estimations, the coefficient for current political risk and its lags were statistically significant and positive. A 1% increase in political risk ratings, increases bond returns in the short run. Political risk also had explanatory power for exchange rates and housing market returns. A 1% increase in political risk increased housing returns by 0.02%, whereas exchange rates decreased by 0.63%. Housing return's one-, two- and three-month lags explained the variation of housing prices in the current period. This means that housing prices can be forecast using past prices. Only financial risk had an impact on gold returns. An increase in financial risk ratings was negatively related to gold returns. The impact of South African risk ratings had no significant impact on oil markets. Contrary to Shehzad et al. (2021) who showed that the global financial crisis had a significant and positive impact on oil returns.

Table 4.6 Short run error correction model

Stock		Bond		Forex		Housing		Gold		Oil	
Variable	Coefficient	Variable	Coefficient	Variable	Coefficient	Variable	Coefficient	Variable	Coefficient	Variable	Coefficient
ΔFR	0.0616	ΔFR	0.0081	$\Delta Forex_{t-1}$	0.0413	ΔHPI_{t-1}	0.7301***	ΔFR	-0.3822**	Crisis	-0.0184
Crisis	-0.0340***	ΔFR_{t-1}	-0.1219**	$\Delta Forex_{t-2}$	-0.0852	ΔHPI_{t-2}	-0.1675***	ΔFR_{t-1}	-0.1969	ECT	-1.0189***
ECT	-1.1112***	ΔPR	0.2414**	ΔER	0.2116	ΔHPI_{t-3}	-0.1808***	ΔFR_{t-2}	-0.2356*		
		ΔPR_{t-1}	0.2335**	ΔFR	-0.4432***	ΔPR	0.0163**	ΔPR	-0.2209		
		ΔPR_{t-2}	0.2047*	ΔPR	-0.6363***	Crisis	-0.0004	ΔPR_{t-1}	-0.4713		
		ΔPR_{t-3}	0.2160*	Crisis	0.0118*	Crisis2	-0.0003**	Crisis	0.0118		
		Crisis	0.0015	ECT	-0.8167***	Crisis3	-0.0002	ECT	-1.2008***		
		ECT	-0.9711***			ECT	-0.0511***				

Note: (*) Significant at 10%; (**) Significant at 5%; (***) Significant at 1%. Crisis 2 represents the break date and

Source: Author’s own estimations (2022)

4.4.5 NARDL estimation results

In line with the recommendation[1] of Shin et al. (2014), the study opted to estimate the NARDL specification by using a maximum of four lags on each lagged variable. The relationship between country risk ratings and financial market returns is complex in nature (Nasr et al., 2018) as such a linear specification may not be the most appropriate functional form. The NARDL specification is determined by applying the Akaike Information criterion. After confirming the cointegration among variables, the study proceeds to interpret the findings of the long-run and short-run asymmetric impacts of economic, financial and political risk on the asset returns. The long-run coefficients are displayed in equations 4.2.1 to 4.2.6 showing the long-run coefficients for economic, political and financial risks that capture the long-run dynamic relationship between country risk and asset markets. Table 7 reports the short-run coefficients and the error correction terms.

4.4.5.1 Wald test results

After establishing a cointegration relationship for all asset markets, the next step is to test for asymmetry in the long-run and short-run relationships. The Wald test is conducted to establish if there are asymmetric effects of country risk components in the long- and short-run. The null hypothesis of the Wald test implies that the relationship between asset returns and country risk components is symmetric in the long- and short-run. Whereas the alternative hypothesis is an asymmetric relationship between the dependent and independent variables. The test establishes whether the partial sums of the decomposition of country risk components are necessary.

Table 4.6 presents the results for the Wald statistics for long- and short-run asymmetry between country risk ratings and asset markets. The evidence indicates strong evidence of asymmetric effects of financial and political risk on stock returns in the long- and short-run as indicated by significant coefficients of their Wald F-statistic as

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[1] Shin et al. (2014) argues the cointegration components of positive and negative effect of independent variable on the dependent variable can be estimated using the nonlinear autoregressive distributed (NARDL).

displayed in Table 4.6; 3.3938 for financial risk and 3.2836 for political risk. Furthermore, the evidence shows a non-rejection of the null hypothesis of symmetric effects of political risk in the long-run and short-run for the commodities market as the p-value is 0.6180 for gold and 0.3360 for oil is greater than 0.05 at a 0.10 significant level. The resents displayed in equations (4.1.1) to (4.1.6) suggest that the partial sums decomposition of economic risk in the long run is important for determining forex returns, however, has symmetric effects on the stock, bond, gold and oil returns. In contrast, the decomposition of financial risk, in the short run, is only important for gold returns and has symmetric effects on the other asset returns.

The asymmetries may be due to the complexity of asset markets in which various economic agents with different preferences, risk tolerances and investment objectives interact. For instance, some assets carry less risk as an investment option and therefore their reaction to country risk changes may take longer than other markets (Hammoudeh et al., 2013). Overall, it can be concluded that the NARDL approach allowing for long- and short-run asymmetries is the appropriate model for examining the dynamic interaction of asset markets and the three components of country risk.

Table 4.7 Asymmetry Wald test

	W_{LR}			W_{SR}		
	LER	LFR	LPR	LER	LFR	LPR
Stock	1.7245	3.3938*	3.2836*	No SR	0.0203	3.5545*
Bond	0.8091	0.1385	0.0106	5.4869**	0.7944	6.3730**
Housing	0.01697	1.0938	0.6111	3.7432*	2.3421	0.0045
Forex	2.4029	0.3209	5.4387**	No SR	1.8116	4.9717**
Gold	0.8391	0.0122	0.2494	No SR	9.3336***	6.0904**
Oil	0.0299	0.1272	0.9296	No SR	No SR	1.3024

Note: * represents significance at 10%, ** significance at 5% and *** at 1% significance. P-values are presented in parentheses ().W_{LR}: long-run Wald, W_{LR}: short run Wald, SR: Short run

Source: Author's own estimation (2022)

4.4.5.2 Long-run analysis and results

The NARDL was employed to assess the long-run relationship between the dependent variables and the results are reported in equations 4.2.1 to 4.2.6 below.

$$RSTOCK = 0.1582LER^{+} + 0.0106LER^{-} - 0.0873LFR^{+} + 0.0049LFR^{-} + 0.2647LPR^{+} + 0.04983LPR^{-} - 0.0213 \quad (4.2.1)$$

$$RBOND = 0.1282LER^{+} + 0.0745LER^{-} + 0.0334LFR^{+} + 0.0430LFR^{-} + 0.0055LPR^{+} - 0.125LPR^{-} - 0.0229 \quad (4.2.2)$$

$$RHPI = 0.0686LER^{+} + 0.0768LER^{-} + 0.0438LFR^{+} + 0.0177LFR^{-} + 0.0067LPR^{+} + 0.0592LPR^{-} - 0..0130 \quad (4.2.3)$$

$$RFOREX = 0.1853LER^{+} + 0.0655LER^{-} - 0.0152LFR^{+} - 0.0340FR^{-} + 0.0624LPR^{+} + 0.2579LPR^{-} - 0.0097 \quad (4.2.4)$$

$$RGOLD = -0.1724LER^{+} - 0.0441LER^{-} + 0.1169LFR^{+} + 0.1107FR^{-} - 0.2678LPR^{+} - 0.3356LPR^{-} - 0.0035 \quad (4.2.5)$$

$$R0IL = -0.0096LER^{+} + 0.0454LER^{-} - 0.2534LFR^{+} - 0.2135FR^{-} - 0.1590LPR^{+} - 0.4246LPR^{-} - 0.0297 \quad (4.2.6)$$

Given that a long-run relationship exists between the country risk component and selected variables, it is important to discuss the magnitude effect of each of the country risk components on the variables under consideration. LER^{+}, LER^{-}, LFR^{+}, LFR^{-}, LPR^{+} , and LPR^{-} are the positive and negative partial sums of economic risk, financial risk and political risk components, respectively. The sign and magnitude of the risk rating parameters were interpreted. Positive partial sums reflect an increase in the risk ratings, meaning a decrease in risk. In contrast, negative partial sums represent a decrease in risk ratings, which implies an increase in risk.

4.4.5.2.1 Effect of country risk components on the stock market

The results presented in equation 4.2.1 show that the effects of economic risk changes on stock market returns were symmetric, differing only in magnitude. The magnitude of positive innovations in economic risk is higher than the negative shocks. These results suggest that economic improvement and deterioration generate higher equity returns. Thus, any policy or strategy that enhances economic condition favours the equity market. Contrary to economic risk, positive shocks in financial risk cause negative changes in the equity market whilst negative changes in financial risk cause an increase in the equity market. The effects on stock returns are asymmetric, such that positive shocks have a negative effect, whilst negative shocks have a positive effect. A decrease in financial risk decreases stock returns, whilst an increase in financial risk is positively related to stock returns. This result is in contrast to Nasr et al. (2018) who found that shocks in financial risk have negative effects on stock markets regardless of the direction of the effect.

Lastly, as expected, positive changes in political risk ratings result in the growth of the equity market. This implies that political stability in South Africa is associated with an increase in stock returns. This result is consistent with the political risk sign paradox which holds that stock returns and political risk are inversely related (Lehkonen and Heimonen, 2015). Conversely, negative shocks in political risk adversely impact on equity market, reflecting a negative risk-return relationship. Comparing the magnitude of positive and negative changes in political risk on the equity market, it is important to note that the South African stock market is highly influenced by negative changes in political risk. Related empirical research often finds that political uncertainty has explanatory power for stock market returns (Dimic et al., 2015; Lehkonen, 2015; Ben Ghozzi and Chaibi, 2022).

4.4.5.2.2 Effect of country risk components on the bond market

Similar to stock returns, both positive and negative changes in economic risk positively impact the bond market yet at a different magnitude. Positive changes in economic risk rating possess an important effect on the bond market compared to negative changes in economic risk. This result is in contrast to Alsakka and ap Gwilym (2012) who showed that the impact of credit ratings downgrades on emerging stock markets was more significant compared to ratings upgrades. Additionally, the bond market is positively influenced by negative and positive shocks in financial risk. Negative changes in financial risk have more influence on the bond market level compared to positive changes in financial risk. The results in equation 4.2.2 also indicate that positive changes and negative changes in political risk harm the bond market. While political stability is associated with a decline in bond returns, political instability was related to declining bond returns As observed in the case of financial risk, the magnitude effect of negative shocks of political risk is high compared to the effect of the positive shock. This result is corroborated by Duyvesteyn et al. (2016) who found that political risk has long-term effects on bond returns.

4.4.5.2.3 Effect of country risk components on housing market

Equation 4.2.3 displays the effect of country risk components of the housing market in South Africa. In the long run, economic risk rating changes are positively associated with long-term growth in the housing market, however, at differing magnitudes. The impact of economic risk is positive regardless of the direction of the shock. An increase in economic risk ratings results in a 6.86% increase in housing market returns, and a decrease in economic risk ratings causes a 7.68% increase in housing market returns. Comparing the magnitude of positive and negative shocks of economic uncertainty on the housing market, the impact of negative changes in economic risk was higher compared to positive changes. Similarly, both financial risk and political risk have symmetric and positive effects on housing returns. In other words, positive or negative shocks in financial and political risk ratings, coincide with increasing housing market returns. Housing markets are indicators of future economic performance (Aye, Balcilar, Bosch and Gupta, 2014). Muellbauer and Murphy (2008) emphasised the key role of housing wealth in maintaining macroeconomic stability. The South African housing markets exhibit safe-haven properties during periods of increasing country risk and investors can rely on investments in housing markets to hedge against country risk.

4.4.5.2.4 Effect of country risk components on the currency market

The direction of impact of country risk components on exchange rates is symmetric. Specifically, the impact of economic and political risk rating shocks on currency returns is symmetric and positive. An increase or decrease in economic and political risk ratings increased the exchange rate, thus causing the domestic currency to depreciate. In contrast, positive and negative shocks in financial risk ratings harm the exchange rates. An increase in financial risk caused the domestic currency to appreciate. Exchange rate stability is one of the sub-components of financial risk, thus it is expected that an increase in financial risk is associated with exchange rate volatility. Similar to the other markets, negative changes in country risk components were found to have a higher impact on exchange rate returns relative to positive changes.

4.4.5.2.5 Effect of country risk components on gold price

The results on the effect of country risk components on gold in the asset market are shown in Equation 4.2.5 above. As displayed in the equation, either positive or negative changes in economic risk result in a decline in gold price. In contrast, both positive and negative changes in the components of financial risk are associated with an increase in the price of gold. Cai et al. (2001) found that financial and economic fundamentals determine the return volatility of gold futures. Thus, a 1% increase in positive components of financial risk leads to a 0.1169% increase in the price of gold while the latter will grow 0.1107 in response to a 1 % increase in negative components of political risk.

4.4.5.2.6 Effect of country risk components on oil prices

As displayed by country risk components in equation 4.2.6, the impact of economic risk ratings is asymmetric. Positive shocks in economic risk are negatively associated with oil prices and negative changes in economic risk ratings are associated with positive changes in oil price. In other words, one can say that a long-run nonlinear relationship exists between economic risk and oil price. Nonetheless, positive and negative changes in both financial and political cause a decline in the price of oil. This result also indicates that negative shocks of country risk components on oil prices dominate over positive shocks. This result is consistent with the findings of Lee, Lee and Lien (2018) who found that country risk and financial distress do not explain energy commodity returns.

4.4.5.3 Short-run analysis

The results for the short run error correction models for each asset market are presented in Table 4.7. The error correction term (ECT), in Table 4.7, shows the speed of adjustment and it is negative and statistically significant in all the markets indicating that there is a short-run relationship between country risk and financial market returns, and there is cointegration between these variables. The negative and significant error correction terms at the 5% level convey the speed of adjustment towards long-run equilibrium. The parameter value of the error correction term reflects the adjustment speed. For instance, the coefficient value of 0.97 in the bond equation means that 97% of the disequilibrium in bond returns is corrected in one month. Moreover, the disequilibrium in bond returns due to changes in country risk components take approximately one month (1/0.97) to correct. The disequilibrium in housing market returns takes longer to correct, taking approximately 15 months (1/0.066) to correct. In contrast, the speed of adjustment to equilibrium is much faster for equity, exchange rate and commodity returns. These returns take less than one month to adjust to long-run equilibrium following a shock in country risk components. This result is to be expected because these markets incorporate ratings change information more rapidly.

Considering the significant level at 5 per cent and 10 per cent, the results show that there is no short run relationship between economic risk and asset returns except for the bond market returns. This result is similar to Nasr et al (2018) who also found no short run effect of economic risk in BRICS stock markets. Interestingly, economic risk rating changes have a positive effect on bond returns in the long run and the short run. Economic risk rating upgrades increase bond returns in the short run, which implies that bonds can be used to hedge against adverse changes in economic risk. This result is similar to Muzindutsi and Obalade (2020) who showed that bond returns respond positively to shocks in economic risk.

According to the study findings, only negative shocks in financial risk ratings have a significant impact on domestic asset markets. This means that holding domestic assets in the same portfolio has no diversification benefits in the short run. In the short run, negative shocks to financial risk ratings have a positive and negative effect depending on the number of lags. A decrease in financial risk ratings, in the current period, has a diminishing effect on stock returns, whilst three months lag financial risk decrease increases stock returns. The impact of financial risk rating changes is immediate in the stock market, as current changes in risk have an immediate effect on stock returns. The positive shocks in financial risk ratings were statistically significant for the currency and gold returns, having negative effects on gold returns. The long-run effect of positive and negative shocks in financial risk on bond returns is positive, whereas negative shocks in financial risk ratings have a negative effect in the short-run. This means that, in the short run, a 1% increase in financial risk causes a 0.22% decrease in bond returns. The impact of financial risk has the opposite effect on foreign exchange in the short run. In the short run, financial risk has a positive effect on currency returns compared to negative effects in the long run.

The US crisis dummy variable is significant and the coefficient is negative, which implies that South African stock markets were adversely impacted by the global financial crisis. There was a consensus that developing and emerging markets would be resilient to external global shocks (Lin et al., 2013). However, due to integration with global markets, the South African market was not sparsed for the consequences of the crisis. Agyei-Ampomah (2013) and Boako and Alagidede (2018) reported that among the African economies, South African stock markets are the most sensitive to global market shocks.

Political risk has asymmetric short run effects on all markets except for forex returns. Political risk has a symmetric and positive effect on bond and housing markets. The Wald test shows that it is important to distinguish between positive and negative shocks in political risk ratings as these have different effects on asset returns. The effects of increases in political risk ratings are stronger in the stock market. The results show that current increases in political risk ratings (lower risk) had a positive impact on stock returns such that a 1% increase in political risk rating causes a 1.08% increase in stock returns. Ratings upgrades are generally anticipated and therefore stock returns are fast in responding to changes in ratings (Gande and Parsley, 2004). Brooks, Faff, Treepongkaruna and Wu, (2013) study the reaction of stock and currency markets to sovereign rating announcements in 75 countries around the world and found that stock markets had a more significant reaction to rating downgrades when compared to currency markets. The medium-term -three-month lag- effects of political risk ratings increase are however negative. This contradicts the results in the long-run equation which shows that stock returns increase as a response to negative shocks in political risk ratings. The effect of negative shocks on political risk is significantly higher for the exchange market and gold returns.

The effect of political risk rating downgrade has a positive effect on bond returns. Noteworthy is that political risk downgrades have the opposite effect on stock and bond returns, which suggests possible flight-to-quality effects. This result could be due to investors making decisions to shift capital from high-risk markets, such as stock markets, to safer markets, such as bond markets (Christopher et al. 2012). Political risk upgrades and downgrades have similar effects on forex returns. The results show that the foreign exchange market is fast to respond to political risk ratings downgrades as the current period's political risk change has an immediate and positive effect on foreign exchange.

All three country risk components have no statistically significant effect on the oil futures market in the short run. (Kristoufek and Vosvrda, 2014) examined the efficiency of 25 commodity futures and find that WTI crude oil ranks amongst the most efficient commodities. The efficiency of the market determines whether it reacts to adjustments to risk ratings (Mutize and Gossel, 2020). On the other hand, this result can be interpreted as domestic country risk ratings not affecting oil prices because South Africa is a net-oil importer and therefore country fundamentals are exogenous to the oil future market (Chiweza and Aye, 2018). The expectation is that news concerning OPEC economies is more significant for crude oil markets (Mensi, Hammoudeh and Yoon, 2014).

Table 4.8 NARDL Short run ECM

Stock		Bond		Forex		Housing		Gold		Oil	
Variable	Coeff.	Variable	Coeff.	Variable	Coeff.	Variable	Coeff.	Variable	Coeff.	Variable	Coeff.
ΔFR^{+}_{t}	-0.1715	ΔER^{-}_{t}	-0.0970	$\Delta Forex_{t-1}$	0.1785***	ΔHPI_{t-1}	0.7512***	ΔFR^{+}_{t}	-0.4747**	ΔPR^{-}_{t}	-1.2168
ΔFR^{-}_{t}	0.4987***	ΔER^{-}_{t-1}	0.2872***	ΔFR^{+}_{t}	0.3693***	ΔHPI_{t-2}	-0.1795*	ΔFR^{+}_{t-1}	-0.1510	Crisis	-0.0243
ΔFR^{-}_{t-1}	-0.1145	ΔER^{-}_{t-2}	0.3119***	ΔFR^{+}_{t-1}	0.1445	ΔHPI_{t-3}	-0.1706***	ΔFR^{+}_{t-2}	-0.4811**	ECT	-1.0251***
ΔFR^{-}_{t21}	-0.4923***	ΔFR^{-}_{t}	0.1170	ΔFR^{+}_{t-2}	0.2200**	ΔER^{+}_{t}	-0.0037	ΔPR^{-}_{t}	-0.8562		
ΔPR^{+}_{t}	1.0839***	ΔFR^{-}_{t-1}	-0.2242***	ΔFR^{-}_{t}	0.3798***	ΔER^{+}_{t-1}	-0.0181**	ΔPR^{-}_{t-1}	-1.1228*		
ΔPR^{+}_{t-1}	0.2295	ΔPR^{-}_{t}	0.2651	ΔPR^{+}_{t}	0.2812	ΔFR^{+}_{t}	-0.0044	Crisis	0.0065		
ΔPR^{+}_{t-2}	-0.2524	ΔPR^{-}_{t-1}	0.4921**	ΔPR^{-}_{t}	1.2601***	ΔFR^{-}_{t-1}	-0.0070	ECT	-1.2036***		
ΔPR^{+}_{t-3}	-1.1108***	Crisis	0.0042	Crisis	-0.0038	ΔFR^{-}_{t-3}	-0.0123***				
ΔPR^{-}_{t}	-0.8763*	ECT	-0.9654***	ECT	-1.1217***	ΔPR^{+}_{t}	0.0215**				
ΔPR^{-}_{t-1}	-0.9671**					ΔPR^{+}_{t-1}	0.0264***				
Crisis	-0.0436***					ΔPR^{-}_{t-2}	0.0457***				
ECT	-1.1345***					Crisis	-0.0004				
						Crisis 2	-0.0003**				
						ECT	-0.0657***				

Note: ER, PR and FR represent economic risk, political risk and financial risk. Variables suffixed with ‘+’ and ‘-’ represent the positive and negative partial sums, respectively.

Source: Author’s own estimations (2022)

4.4.5.4 NARDL residual testing

Diagnostic tests are conducted to ensure the robustness of results estimated by the model. The diagnostic tests for serial correlation, normality and heteroscedasticity are presented in Table 4.8. Diagnostic test results show satisfactory results as the null hypotheses for serial correlation and heteroscedasticity are rejected, hence it can be concluded that the NARDL models are correctly specified.

A serial correlation test assesses whether different lags of residuals are correlated. The null hypothesis of no serial correlation in the residuals is tested against the alternative hypothesis of the presence of serial correlation in the residuals. Results from both the Breusch-Godfrey serial correlation LM test and the Ljung-Box Q statistic indicate a non-rejection of the null hypothesis of no serial correlation. Therefore, the specified and employed models are free of serial correlation.

The Breusch-Pagan-Godfrey Heteroscedasticity test examines the null hypothesis that the residuals have a constant variance (homoscedastic) against the alternative hypothesis of non-constant variance (heteroscedastic). Heteroscedasticity is observed in standard errors of all asset markets. Because the residuals in all ARDL and NARDL models exhibit heteroscedasticity, the Newey-West (HAC) process is used to correct for heteroscedasticity in residuals.

Normality (Jarque-Bera) has the null hypothesis of normally distributed residuals tested against the alternative hypothesis of non-normally distributed residuals. The null hypothesis of normality is rejected for all markets except the oil equation. Overall, results from the diagnostic checks suggest that the NARDL models estimated are unbiased.

The Cumulative sum of recursive residuals (CUSUM) and the cumulative sum of recursive residuals (CUSUMSQ) test introduced by (Brown, Durbin and Evans, 1975) are used to investigate the stability of the long-run and short-run coefficients obtained from the ARDL framework. The results of this test are a graphical representation where the residuals are plotted against breakpoints for the 5% significance level (upper and lower 95% confidence bounds). Figure 4.2 plots of the CUSUM and CUSUMSQ are within the 95% confidence bands.

Table 4.9 Model diagnostic tests

	Stock	Bond	Housing	Forex	Gold	Oil
Q(12)	15.092	12.283	11.281	8.5610	18.143	16.738
Q^2(12)	9.7936	6.1009	8.8851	14.837	18.174	17.370
Q(36)	32.997	29.617	34.985	38.319	47.243*	36.305
Q^2(36)	34.978	32.652	19.468	44.873	43.997	29.739
LM (2)	0.8701	0.3451	2.3859*	0.5187	0.5687	0.7389
B-G	2.8953***	1.6639*	1.8779**	2.2149***	2.4973***	4.4850***
ARCH	0.8442	0.0722	2.3481	0.4644	0.0132	5.8354**
Normality	4.7274*	6.9281**	164.2703***	39.1955***	7.3627**	1.6835

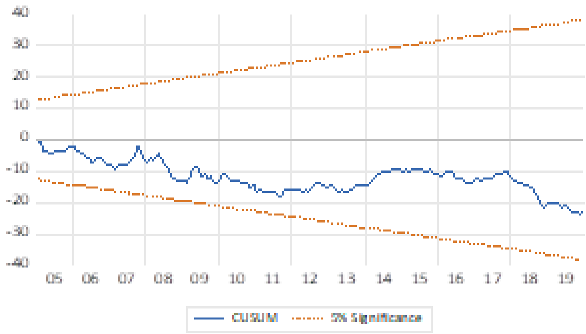
Note: * represents significance at 10%, ** significance at 5% and *** at 1% significance.

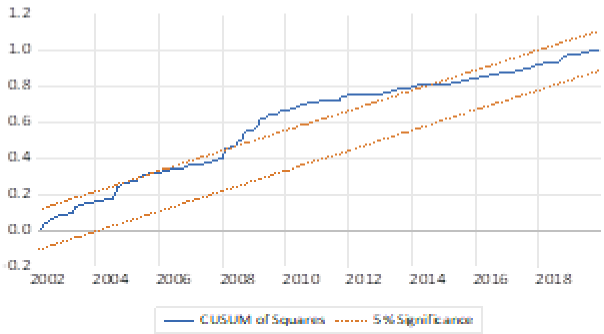
Source: Author's own estimations (2022)

Figure 4.2 displays the results from the CUSUM and CUSUMSQ tests. The graph indicates that the long-run and short-run coefficients estimated in the stock, bond, gold and oil models are stable. In contrast, the CUSUM test for the forex and housing market models indicates stability while the CUSUMSQ indicates there is instability, for the period between 2008 and 2016, which falls within the period of the global financial crisis. The models are stabilized by including a dummy variable for the period January 2008 and January 2017 for the housing market model and a dummy variable for the period between September 2009 and June 2012 for the equity market. The dummy variable is insignificant in the forex market equation which means that the instability is due to the sample size. The dummy variable in the housing market model is negative and significant. Including the dummy variable does not affect the cointegration results (Brooks, 2014).

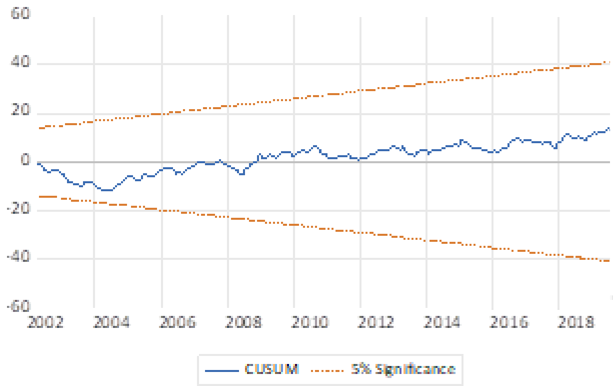
CUSUM | CUSUMSQ

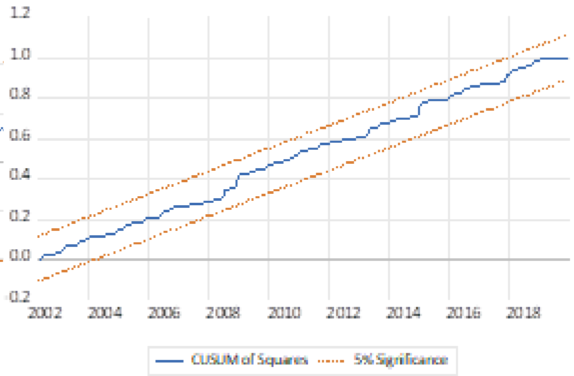
Stock



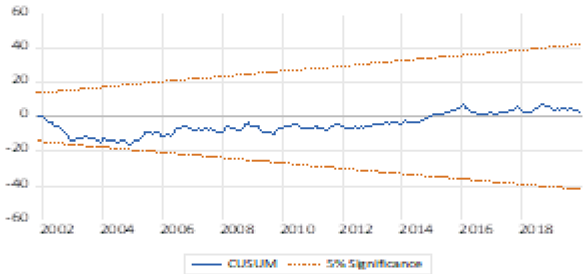


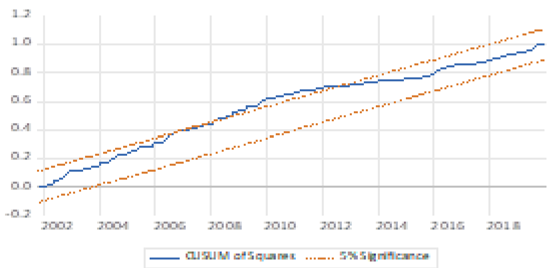
Bond





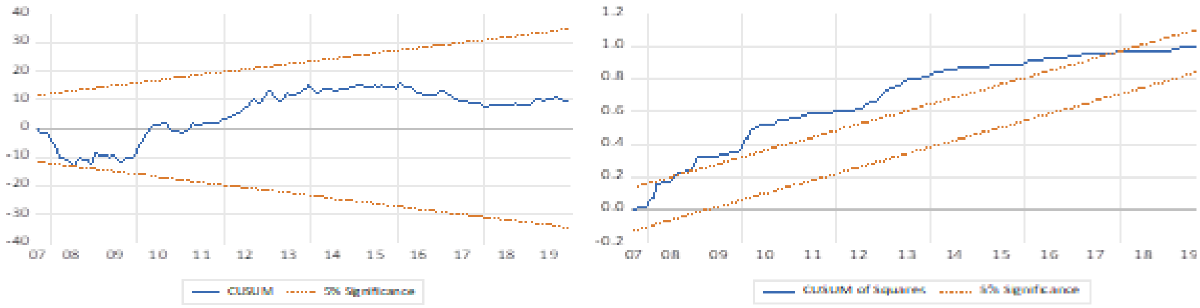
Foreign exchange



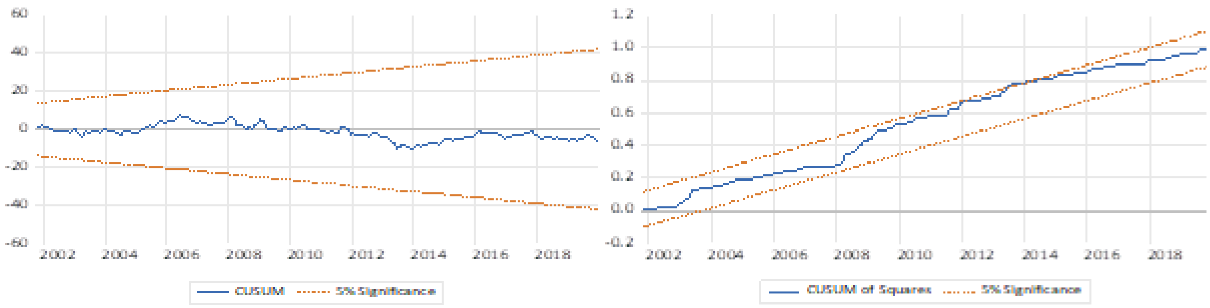


CUSUM CUSUMSQ

Housing



Gold



Oil

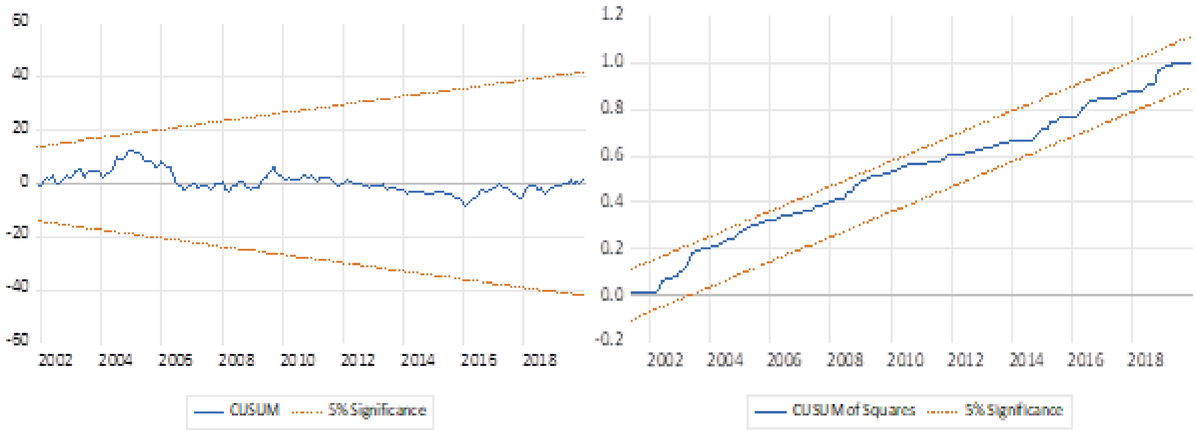


Figure 4.2 CUSUM and CUSUMSQ

Source: Author's estimation (2022)

4.5 Summary and conclusion

The chapter aimed to evaluate the impact of changes in economic, financial and political risk ratings on asset returns using the NARDL approach. The main finding is that country risk components have heterogeneous effects on asset markets thus suggesting that country risk rating adjustments provide investors with new tradable information, therefore have the potential to cause instability in asset markets. If markets were efficient, asset markets should not respond to changes in country risk components. If the risk components were based on publicly available information, then asset prices would already reflect this information. If assets are priced efficiently, then country risk rating information should already be incorporated in asset prices. The assumption of market efficiency is static and is not reflective of the current market dynamics. Asset markets are implied to have differentiated responses to their determinants based on cash flow determinants and risk determinants (Campbell & Ammer, 1993; Li, 2002).

The results show that the effect of country risk components on asset returns is not the same and that it is important to decompose the risk components into their partial sums. Overall, the results are consistent with those of Afonso et al. (2014) and Muzindutsi et al (2020) and Muzindutsi and Obalade (2020), who found that country risk components have heterogeneous effects on asset returns. Unlike most extant literature, applying nonlinear analysis to evaluate the asymmetric relationship between country risk and asset returns facilitates a better understanding. Specifically, the results of this study show that financial and political risk ratings have significant implications for asset returns. This evidence is consistent with the empirical findings of Sari et al (2013) and Mensi et al (2016) who found that political and financial risk have significant implications for emerging market asset returns. The results show that the effects of decreasing financial and political risk ratings are much more significant in the short run. The decrease in these ratings signals worsening financial and political fundamentals which has implications for investment decisions. Wu (2014) hypothesizes that when there is an increase in political risk, domestic investors move capital from domestic markets to foreign assets. The allocation to foreign assets increases when there are unanticipated shocks in political risk (Liu et al. 2003).

The magnitude of negative shocks associated with political risk ratings is significantly higher in the long and short run. Bekaert and Harvey (1997) and Bilson et al. (2002) argue that political risk is an important determinant of asset market returns in emerging markets. Generally, the effects of political risk are negative, thus implying that a decrease in political risk ratings increases asset returns. This could be due to market inefficiencies which cause economic agents to overact to bad news (Nasr et al., 2018). Ratings downgrades are often associated with market downturns and ratings upgrades are associated with market booms. Negative shocks in political risk mean a rating downgrade which is an unfavourable outcome for emerging economies (Dimic et al., 2016). Political risk ratings have the most significant impact on asset returns in the long and short run. This result is consistent with the Wald test which also confirms that decomposing the political risk series into positive and negative partial sums is important and that the effects are asymmetric. Government has more incentive to release reports reflecting good news about the economy hence prices fully reflect publicly available information. In contrast, there is more reluctance to release bad news which is why rating downgrades have a significant effect on asset prices. In periods of political uncertainty, this study finds that the only safe-haven/ hedge assets are bonds, housing, forex and oil markets. The returns in these markets are either unaffected or positively affected by political risk ratings downgrades.

The absolute value for coefficients of country risk in the short run was higher than the long-run coefficients. Moreover, in all cases, the magnitude of negative shocks in the long-run and short run is generally higher than the positive shocks. Heterogeneous beliefs of investors (risk-averse investors) dictate how investors react to rating changes. Thus, beliefs can lead to mispricing and increased market uncertainty in the long and short run (Tran et al., 2019). The results show that economic risk has long-run effects but little or no significant short run effects on asset returns. The reason is that these asset markets are based on investors' expectations of the future (Du, 2019) and factors composing the economic risk indicator are coincident indicators (Nasr et al., 2018). Returns of stock, bond, housing and exchange markets respond positively to increases and decreases in economic risk in the long run.

Stock returns are the most sensitive to country risk changes as the coefficient values in the long-run and short run models are higher in most cases. The response of the stock market to shocks to country risk components is generally higher when compared to the magnitude of coefficients for the other markets. Prior literature has found that stock markets generally have a faster and stronger reaction to rating changes (Li et al., 2007; Treepongkaruna and Wu, 2013; Afonso et al., 2014; Nasr et al., 2018). Brooks, Faff, Treepongkaruna and Wu, (2013) found that stock markets had a stronger response to rating downgrades when compared to foreign exchange markets. When considering the traditional asset pair of stock and bond returns, the results show that these markets have asymmetric responses to shocks in country risk components. This result is similar to Afonso et al (2014) who show that stock and bond markets have asymmetric reactions to shocks in risk ratings. Furthermore, the result is consistent with the output of all the markets, the housing market is the least responsive to domestic country risk changes.

The results for commodity markets indicate a contrasting result. As would be expected, domestic country fundamentals do not influence oil futures returns(Lee, Lee and Lien, 2019), however, gold returns are somewhat affected by financial risk in the short run. South Africa is a gold producer and exporter, therefore it is expected that financial risk would affect gold prices. The effects of political risk downgrade harm stock and gold returns which limits the hedge effectiveness of gold during periods of high political uncertainty (Morema et al., 2020). Economic agents interested in investing in South African asset markets should be cautious of changes in financial and political risk when investing. Policymakers should focus on strategies to reduce risk to improve asset market performance.

CHAPTER 5: ASSET MARKET COMOVEMENTS AND THE IMPACT OF COUNTRY RISK COMPONENTS

5.1 Introduction

Due to increasing market integration, asset market linkages in emerging markets have gained considerable interest from global investors. This interest stems from the growing demand for emerging market assets as investors seek diversification opportunities (Bossman, Adam, Junior and Agyei, 2022). The nature and direction of asset market correlations becomes more relevant as they can be an indicator of investor sentiment concerning the future outlook for the economy. During normal or stable market conditions, asset correlations are expected to be positive due to optimistic investors choosing to increase their position in stock, bond, housing, currency and commodities in a diversified portfolio. During periods of crisis and instability, equity investors may shift their positions in favour of less volatile assets such as bonds and commodities, resulting in a negative correlation between stock, bond, housing and commodity markets (Ciner et al., 2013). In some cases, high financial market uncertainty increases investor risk aversion which may result in them liquidating their position in emerging market assets, thus resulting in a positive correlation between stock, bond and housing markets. The synchronized sell-offs in domestic asset markets can have detrimental effects on investment flows and the stability of the economy. Thus, it is important to examine and understand the key drivers of asset return correlations as they not only assist with the price discovery process but also act as an indicator of investor sentiment and risk aversion.

Establishing the extent of comovement between asset markets is a key tool that investors can utilise to diversify additional risk exposure, such as country risk (Ni, 2017). Financial liberalisation exposes international investors to external risk factors related to the economic, political, financial and social stability of individual countries. These risks are more prevalent across emerging markets in Africa, the Middle East and Asia (Sarwar and Khan, 2019). Assessing and pricing the risk associated with international diversification poses a challenge to portfolio managers, financial analysts and policymakers. Hence, the issue of how best to measure the risk exposure of asset markets is still being debated. Empirical tests have examined beta, standard deviation or value at risk (Elsas, El-Shaer and Theissen, 2003; Bi and Zhu, 2020; Ali, Badshah and Demirer, 2022). Asset pricing theory provides a framework to identify and measure risk and determine the risk premium for bearing the risk. Theory can explain why the expected returns vary amongst different asset markets. The underlying premise of asset pricing theory is that investors are risk averse, prefer higher returns, dislike variance and hold well-diversified portfolios. The theory, therefore, establishes an important framework for portfolio construction and asset allocation decisions.

The foundational theories on asset pricing originated from the introduction of the capital asset pricing model (CAPM) by Sharpe (1964) and Lintner (1965). The CAPM explains that the expected returns on securities may be different because of their covariance with a well-diversified portfolio. Merton (1973) introduced the intertemporal CAPM (ICAPM) framework designed to examine the effects of time-varying factors on expected returns. The ICAPM is based on the premise that investors will attempt to hedge their positions against current and future risk exposures. Therefore, investors' asset allocation decisions are based on risk perceptions in the investment opportunity set. The model therefore shows that the time-varying expected market returns and expected market volatilities have an impact on the changes in the investment opportunity set (Campbell, 1992, 1996; Chen, 2002). Bali and Engle (2010) examined whether changes in macroeconomic variables have an impact on the investment opportunity set and examine whether covariation of stock portfolios produces an additional risk premia on stock portfolios. Harvey (2004), Almahmoud (2014) and Nhlapho and Muzindutsi (2020) found that economic, financial and political risks provided by ratings agencies contained information about expected emerging stock market returns.

Credit rating agencies play a pivotal role in solving the issue of information asymmetry between corporate issuers and investors (Ferri and Liu, 2005). The ratings provided by these agencies are based on publicly available information, such as economic, political and social fundamentals (Chen et al., 2016). According to the EMH, the information provided by rating agencies should not affect asset prices. Therefore, if asset markets are found to react to rating changes, this would provide evidence against semi-strong efficiency or imply that rating agencies have access to private information that is not available publically (Pacheco, 2012). Notwithstanding, credit ratings have been found to have an impact on asset markets (Le and Zak, 2006; Afonso et al., 2014; Mensi, Hammoudeh, Yoon, et al., 2016; Muzindutsi and Obalade, 2020). Specifically, some of the main outcomes from this research are the asymmetric effects of rating upgrades and downgrades (Pukthuanthong-Le et al., 2007; Subasi, 2008; Böninghausen et al., 2015; Li et al., 2019).

Existing studies have found that rating downgrades have a significant impact on market returns, whilst the implications of rating upgrades were insignificant (Gande and Parsley, 2005; Ferreira et al., 2007; Williams, Alsakka and Ap Gwilym, 2013). However, these studies employ event study methodologies that are only able to capture the short-run dynamics of credit ratings. Other studies have considered the short-run and long-run effects (Christopher et al., 2012; Li et al., 2019). Christopher et al. (2012) demonstrated that changes in ratings had asymmetric effects on the comovement between stock and bond markets. Moreover, they found that the effects were more significant in the long-run relative to the effects in the short-run. Motivated by the evidence provided in these studies, the analysis of this chapter considered dynamic and nonlinear frameworks to examine the effects of country risk on asset market comovements.

Against this background, this chapter examined the dynamic correlations of stock, bond, housing and oil markets and investigated their relation with the evolution of country risk ratings over the short run and long run. Thus, this study aimed to contribute to the growing strand of literature which seeks to establish whether country risk changes affect asset market returns and whether these changes affect how domestic asset market returns relate to each other. Chapter 5 extends the study of the impact of country risk on asset markets in Chapter 4 by examining the symmetric and asymmetric effect of country risk components on asset market linkages.

5.2 Literature review

Country risk is often considered an additional risk of investing in an emerging market compared to a developed market (Lessard, 1996). The extent of the impact of country risk has been debated over the years. One of the concerns raised by scholars is the lack of traditional asset pricing models that can be used to describe the cross-section of returns of emerging markets (Bekaert, Erb, Harvey and Viskanta, 1998a; Fama and

French, 2012). The central argument and underlying assumption in financial theory and asset pricing models is that riskier investments require higher expected returns compared to safe investments (Sharpe, 1964; Lintner, 1965; Fama & French, 1992).

However, these models fail to explain the risk-return concept in emerging markets, thus leading researchers such as Erb et al. (1995) to conclude that country risk is a relevant and priced risk in global equity markets. Most of the empirical literature that followed, proved that emerging stock markets are significantly influenced by country-specific factors (Bekaert, Harvey and Lundblad, 2001; Nishiotis, 2004; Carrieri, Chaieb and Errunza, 2008). The central view is that the risk and return of asset markets are strongly influenced by the macroeconomic fundamentals that determine a country's expected real growth, inflation and economic policies.

5.2.1 Empirical literature on the determinants of asset market linkages

Most of the existing empirical literature has focused on equity market comovements across developed economies or developed and emerging economies (Pukthuanthong-Le et al., 2007; Dimic et al., 2015; Lehkonen, 2015). Other studies have focused on stock-bond market comovements within a country or across regions (Connolly, Stivers and Sun, 2005; Cappiello et al., 2006; Dimic et al., 2016; Lin, Yang, Marsh and Chen, 2018). For the literature on the drivers of asset return comovements, studies have examined the impact of macroeconomic factors on stock market integration (Walti, 2005; Eiling and Gerard, 2015; Gkillas et al., 2019) and stock-bond comovements (Baele et al., 2010; Piljak, 2013; Perego et al., 2016; Skintzi, 2019). The studies on the impact of political risk factors on asset return comovements are relatively limited (Kollias, Papadamou and Arvanitis, 2013; Pagliardi and Poncet, 2019).

5.2.2 Macroeconomic and market risk determinants of asset market linkages

The determinants of asset market correlations are a widely explored area in finance research. Despite the extensive literature, there is no consensus on the key determinants of this relationship. The early studies examining determinants of asset market correlation concluded that inflation, interest rates and economic cycles impact asset market correlations (Li, 2002; Ilmanen, 2003a). Li (2002) developed a theoretical framework to examine the dynamic relationship between stock and bond markets. The study argues that the correlation between stock and bond markets is largely determined by expected inflation and real interest rates.

Several studies have since explored the explanatory power of various macroeconomic and financial variables, particularly examining the role of inflation, economic policy uncertainty, monetary policy stance and business cycle fluctuations (Ilmanen, 2003b; Andersson, Krylova and Vähämaa, 2008; Aslanidis and Christiansen, 2014; Chiang, Li and Yang, 2015; Skintzi, 2019; Mokni, Hammoudeh, Ajmi and Youssef, 2020). According to Illmanen (2003), during periods of high inflationary pressure, changes in common discount rates outweigh changes in cash flow expectations, thus the correlation between stock and bond returns will be positive. Aslandis and Christiansen (2014), when examining the explanatory power of macroeconomic factors on stock-bond correlations found that macroeconomic factors explained negative correlation between the markets. Stock and bond markets are expected to comove because future cash flows and discount rates are determined by the same economic fundamentals (Skintzi, 2019). Therefore, stock-bond comovements are expected to be positive over the long term (Lin et al., 2018).

In contrast, some studies have shown that macroeconomic fundamentals play an insignificant or minor role in explaining cross-asset market integration (Campbell et al., 1993; Baele et al., 2010). Baele et al. (2010) examined the impact of macroeconomic variables and other non-macroeconomic factors on stock-bond market comovements. The study found that macroeconomic factors have little significance in explaining stock-bond correlations, instead, liquidity-related factors hold significant predictive power.

Another strand of literature has explored the explanatory power of market risk or stock market uncertainty for stock and bond market comovements. Connolly et al. (2005), Connolly et al. (2007) and Baur (2010) found evidence of flight-to-safety during periods of high stock market volatility. Employing the MIDAS approach, Asgharian, Christiansen,and Hou (2015) found evidence of flight-to-quality during periods of increasing macroeconomic uncertainty.

Dimic et al. (2016) employ wavelet analysis to investigate the impact of global financial market uncertainty and domestic macroeconomic factors on stock-bond correlations in emerging markets. They foundcorrelation is negative in the short run, but stays positive in the long run. Long-run correlations were determined by inflation and stock market uncertainty, and short-run correlations were determined by monetary policy stance.

Kocaarslan, Sari, Gormus,and Soytas (2017) examined whether volatility expectations in oil, gold, currency and US stock markets can explain the dynamic correlation between US and BRIC stock markets. The study employed a combination of the ADCC-GARCH framework with quantile regression analysis which allowed for determining the asymmetric and non-linear impact of volatility expectations. The results demonstrated that volatility in commodities markets and financial markets plays a pivotal role in determining the interactions between US and BRIC stock markets. The impact of volatility expectations was found to be non-linear and vary with the degree of correlation, thus having implications on diversification benefits for international investors.

Lin et al. (2018) applied continuous wavelet analysis to examine the impact of key economic fundamentals and stock market uncertainty on stock-bond comovements over different time frequencies. The study found that stock and bond market dependencies vary over the short- and long-term. The impact of economic factors was found to be symmetric and did not vary across the different frequencies. However, the impact of crises was asymmetric across the frequencies, resulting in positive stock-bond comovements in the short-term period and negative comovements in the long-term.

Skintzi (2019) employed a Bayesian selection model to investigate the impact of macroeconomic and financial variables on stock-bond comovements in eleven Eurozone countries. The results found that time-varying comovements of bond and stock markets were affected by domestic bond market uncertainty, global stock market uncertainty, inflation and interest rates. The most influential determinant of stock-bond comovements was bond market uncertainty. The impact of bond market uncertainty is more significant during crisis periods and high uncertainty increases the comovement between the markets. The study also found evidence of the flight-to-quality phenomenon during periods of high stock market uncertainty.

Various studies have examined the impact of financial crises on asset market comovements (Tamakoshi and Hamori, 2014; Karfakis and Panagiotidis, 2015; Bedoui, Braeik, Goutte and Guesmi, 2018; Tronzano, 2020). Tamakoshi and Hamori (2014) found that the 2008 global financial crisis and the Eurozone debt crisis had a significant impact on most pairwise exchange rate correlations examined. While Karfakis and Panagiotidis (2015) found significant effects of the Greek debt crisis on the correlation between exchange rate pairs. In contrast, Kang et al (2016) found that the effects of crises such as the global financial crisis and the Eurozone sovereign debt crisis had little to no significant effects on correlations between BRICS stock markets, and commodity futures markets.

Some studies have explored the drivers of bond market integration (Barr and Priestley, 2004; Bunda, Hamann and Lall, 2009; Abad, Chuliá and Gómez-Puig, 2010; Piljak, 2013; Böninghausen et al., 2015). Bunda et al. (2009) examined the extent to which local and global factors can be used to explain the correlation between emerging market bonds. Piljak (2013) examined the comovement between ten emerging government bond markets and four frontier government bond markets with the US market. The study examines whether domestic and global macroeconomic factors and global bond market uncertainty can explain time-varying comovements between bond markets. The study analyses the time-varying comovement between bond markets by applying the DCC GARCH approach and the ordinary least squares (OLS) regressions to examine the drivers of the comovements. The study shows that domestic macroeconomic factors have more explanatory power for bond market comovements compared to global factors. In particular, domestic monetary policy and the inflationary environment had a significant impact on this relationship. However, the study focuses on the linear effects of macro fundamentals.

Fewer studies have examined the drivers of comovements between safe-haven assets such as commodities markets and currencies markets (Zhang & Ding, 2021; Tronzano, 2020; Antonakakis & Kizys, 2015; Karali & Ramirez, 2014). Silvennoinnen & Thorp (2013) examined the impact of financial variables on the comovements of commodity markets and traditional asset markets (stock and bond markets). The study found an increase in correlation between stock, bond and commodity futures markets during periods of high stock market uncertainty. This result implied diminishing safe-haven and hedge properties of commodities markets during crisis periods. Büyükşahin and Robe (2014) examined the role of financialisation on the comovements between stock and commodity markets. The study shows that the stock-commodities correlation is determined by the speculative activity of hedge funds actively trading in the stock and commodity markets.

Poshakwale et al. (2016) employ a time-varying copula model to investigate the impact of macroeconomic and non-macroeconomic factors on asset return comovements between stock, bond, commodities and real estate. The study found that amongst the macroeconomic factors, inflation and interest rates had a significant impact on return comovements during periods of market turmoil. Moreover, non-macroeconomic factors, including stock and bond market illiquidity, explained asset return comovements. Behmiri et al 2019 use a combination of the DCC GARCH and ARDL approach to investigate the effects of macroeconomic and financial variables on energy and non-energy commodity futures markets. They show that economic and financial variables explained the agriculture-energy and metals-energy correlations. The correlation between energy and agricultural commodities was explained by speculative activity in energy markets.

Tronzano (2020) examined the impact of financial crises and a few key macroeconomic variables on return comovements of safe haven assets- gold, oil and the Swiss Franc. The study demonstrates that there was an increase in the conditional correlation between the asset markets during the crisis periods, which suggested a shift in portfolio allocation choices of investors from conventional assets such as stocks and bonds in preference for safe-haven assets. From the macroeconomic factors, the world equity risk premium and indicators of economic policy uncertainty had a significant impact on return comovements.

Yousaf, Bouri, Ali,and Azoury (2021) determine the hedge effectiveness and safe-haven properties of gold for thirteen Asian stock markets during the COVID-19 pandemic. The study applied the DCC GARCH framework to determine time-varying correlations of gold and thirteen stock markets and quantile regression analysis to examine the safe-haven and hedge properties of gold against negative stock market movements. The results found gold played a significant role as a safe haven asset for stock investors during the COVID-19 period. The results further show that gold-implied volatility and inflation expectations have a significant impact on the hedge portfolio returns pre- and post-COVID-19 periods.

5.2.3 Political risk as a determinant of asset market linkages

Existing literature has reported a significant impact of political risk on stock markets (Pástor and Veronesi, 2012). According to Białkowski, Gottschalk,and Wisniewski (2008), major political events can directly impact market risk premia and investor sentiment. The general equilibrium model proposed by (Pástor et al., 2012, 2013) suggests that there is a risk premium attached to increasing political uncertainty. Furthermore, political uncertainty reduces stock prices, increases return volatility and exacerbates the effects of systematic risk by making stock returns more correlated. Therefore, major political events can give rise to changes in asset market returns, their interactions with other markets and portfolio allocation decisions. These events have led investors to perceive assets from emerging markets, particularly African markets, as high risk and thus investors are moving capital out of these economies to safer markets, such as commodities. Bekaert and Harvey (2003a) showed that political risk plays a more significant role in emerging markets than in developed markets.

Lensink, Hermes,and Murinde (2000) examined the relationship between six political risks and three different measures of capital flight for a group of developing countries. They found all six political risk variables to be positively related to capital flight. The domestic investment environment drives the choice between investing domestically or investing in offshore markets. Le and Zak (2006) examined the effects of economic and political factors on capital flight. They model capital flight as a portfolio choice depending on return differentials, economic risk and various sources of political risk. The study found that political instability, economic risk and policy uncertainty have an impact on capital flight.

Frijns, Tourani-Rad,and Indriawan (2012), Sriananthakumar and Narayan (2015), Chen, Hope, Li,and Wang (2018) and Narayan, Le,and Sriananthakumar (2018) examined linkages between political uncertainty and stock market performance and integration. Chen, Hope, Li, and Wang (2018) investigate whether political uncertainty can be used to explain fund managers' investment decisions. The proxy for political uncertainty included national elections. The study found that flight-to-quality occurs during periods of high political uncertainty and fund managers rebalance their equity holdings towards stocks with higher financial reporting quality. The outcome of this action resulted in higher fund returns and mitigated systematic risk of fund portfolios.

Pagliardi & Poncet (2019) investigated whether politics-related factors can be used to explain the time-varying comovements in international stock markets. They considered two politics-related factors; level of government instability and institutional frictions, and economic policy risk which captures the quality of government's economic reforms and their effect on the economic environment. The results showed that political risk had significant explanatory power for abnormal returns in international stock market comovements.

The relationship between political risk and bond markets has been explored in several studies (Huang et al., 2015; Duyvesteyn et al., 2016; Chow et al., 2019; Sonenshine and Kumari, 2022). However, unlike stock markets, there is sparse research on the impact of political uncertainty on the comovements of bond markets (Kollias, Papadamou, et al., 2013) and commodity markets (Kollias, Kyrtsou and Papadamou, 2013; Karali and Ramirez, 2014; Chiang, 2021). (Kollias, Kyrtsou, et al., 2013) examined the effects of political events -war and terrorism- on oil and stock markets in four stock markets- the US, Germany, the UK and France. Using a non-linear BEKK-GARCH approach, the study found that the covariance between stock and oil is affected by war, effects are long-term. Found impact of terrorism had an impact on the comovements between oil and French and German stock markets. Karali and Ramirez (2014) investigated the role of macroeconomic factors, and political and weather-related events on time-varying volatility and spillover effects in three energy markets- crude oil, heating oil and natural gas. The study demonstrated that volatility changes significantly in response to major events. Because crude oil prices are highly sensitive major events, a change in its prices affected other energy markets through spillover effects. Major events such as the September 2001 terrorist attacks, had more pronounced and long-term impact on crude oil price volatility.

Chiang (2021) examined the effects of changes in geopolitical risk and economic policy uncertainty on the comovement of stock, bond and gold markets. The study employed a DCC framework and a rolling correlation approach to determine the time-varying linkages between the markets and their drivers. The study found evidence of flight-to-quality between stock and bond markets during periods of high policy uncertainty, while the correlation between stock and gold markets was proven to increase with geopolitical uncertainty. The comovement between bonds and gold was found to be negatively related to both risk factors, which implied that gold may be a haven asset for bond markets during periods of increased geopolitical risk and economic policy uncertainty. Gong and Xu (2022) examined the effects of geopolitical risk on the dynamic connectedness of commodity markets. Using the GARCH-MIDAS approach the study found that geopolitical risk changes have a significant impact on commodity market connectedness.

Studies which explored economic policy uncertainty (EPU) can explain asset market comovements (Antonakakis, Chatziantoniou and Filis, 2013; Li and Peng, 2017; Fang, Chen, Yu and Xiong, 2018; Chiang, 2020). Government policymakers can give rise to uncertainty through fiscal, monetary or regulatory policies they implement (Brogaard and Detzel, 2015). Fang et al. (2018) when examining the explanatory power of economic policy uncertainty on stock-oil correlation, found that EPU has a positive effect on the correlation between oil and US stock markets in the long run. This implies that during crisis periods, the haven properties of crude oil futures are minimised. Chiang (2020) determined the responsiveness of stock-bond correlations to changes in financial risk measures, including the US implied stock market volatility index (VIX), Merrill Lynch Option Volatility Estimate of bond volatility (MOVE), and economic policy uncertainty measures, such as fiscal policy uncertainty and monetary policy uncertainty.

5.2.4 Country credit risk ratings as a determinant of asset market comovements

There has also been significant literature investigating the role of credit rating agencies and rating announcements on asset markets. Existing literature has established a link between country credit ratings and asset market co-movements (Christopher et al., 2012; Mensi et al. 2016; Eraslan, 2017; Mutize and Gossel, 2019).

Among the existing literature, Kaminsky and Schumkler (2002) reveal that stock and bond markets react to sovereign rating outlooks and watch announcements, and the reaction is stronger for negative news than positive news. However, this study did not consider the time-variance of correlations between asset markets. Gande and Parsley (2005) showed that the correlation between the different stock markets decreases significantly during downgrade event days compared to none-event days.

In contrast, Ferreira et al. (2007) found evidence suggesting increased correlations for rating downgrade event days. Christopher et al. (2012) applied a DCC modelling approach to establish the long-run and short-run effect of sovereign credit ratings on stock and bond markets in various emerging markets. The results revealed that rating changes have asymmetric effects on stock and bond markets, particularly in the long run.

Sensoy et al. (2016) examined the implications of sovereign rating announcements on the dynamic correlation between eleven Latin American stock markets. Sensoy (2016) employ a DCC-APARCH model and then regress the dynamic correlations on lagged correlations and rating changes. The study shows that general credit rating announcements do not influence stock return co-movements. In contrast, Ni (2017) use an Error Correction model to measure the short and long-run effects of sovereign credit ratings on financial markets. The results show that the common information effect dominates when ratings are upgraded, thus resulting in boosted investment in the upgraded country and neighbouring countries. In contrast, downgrades are regarded as country-specific thereby reducing the co-movement of the country's stocks with the regional stock index. Furthermore, the study found that the effects of sovereign credit ratings on stock market correlations were significant in the long run.

5.2.5 Empirical literature in african economies

The literature examining the dynamic relationship between three country risk components and financial markets in developing economies is rather scant, particularly in African markets. Concerning studies conducted in the African context, Hassan et al. (2003) showed that economic, financial and political risk are significant determinants of stock market volatility and predictability for ten stock markets across the Middle East and African countries. However, the study only considered aggregated country risk and did not examine whether country risk can explain stock market volatility spillovers or comovements.

Related literature has explored return and volatility spillovers pre- and post-financial crises (Sugimoto, Matsuki and Yoshida, 2014; Boako et al., 2018; Gourène, Mendy and Ake, 2019; Atenga et al., 2021). Duncan and Kabundi (2013) investigated the global and local sources of volatility transmission between South African asset markets – stock, bonds, currencies and commodities- over the period between 1996 and 2010. The analysis was conducted based on variance decomposition derived from VAR estimations. The study found time-varying spillovers between asset markets during foreign and domestic crisis periods. Domestic sources were more relevant for explaining the spillovers in asset markets relative to global factors. El Ghini and Saidi (2017) examined the magnitude and direction of return and volatility spillovers among Moroccan stock markets and US and Europe markets, pre- and post-financial crisis. Using a bivariate VAR-BEKK GARCH approach, the study found unidirectional spillover transmission from developed stock markets to Moroccan stock markets in the period before and after the 2008 global financial crisis. Stock market integration between Morrocan and US and UK stock markets increased following the global financial crisis.

Atenga et al. (2021) assessed the determinants of African stock market integration with global markets. The magnitude of volatility spillovers was found to be more significant compared to return spillovers. The return variation in South African and Egyptian equity markets was found to be explained mostly by external shocks rather than own-market shocks. This result implies that these markets are more integrated with global markets compared to other African countries. Volatility spillovers were higher during the global financial crisis and the European debt crisis. The study also showed that shocks emanating from the exchange rate and commodity markets explained stock market integration between African and global stock markets. Commodity market crashes significantly reduced return and volatility spillover effects in different African stock markets.

Bossman, Adam, Junior,and Agyei (2022) examined the interdependence of stock returns and bond yields for Sub-Saharan African countries- Kenya, Zambia, Nigeria and South Africa- and examine whether Covid-19 has any implications on how the markets interact. Applying the wavelet framework, the study found Covid-19 cases had an insignificant impact on the comovement between the stock and bond markets over all frequencies. This suggests that African assets can be relied upon as safe-haven assets during global events. Further to this, the study found a weak relationship between Kenya, Nigerian and Zambian stock and bond markets during normal periods. However, the relationship between South African stock and bond markets was found to be more significant. For all the countries examined, the results demonstrated a weak relationship between stock returns and bond yields. The study concludes that government bonds of all countries provide diversification benefits in normal market conditions over the short and medium term.

5.2.1 Summary and conclusion

The following are highlighted in the literature above; the determinants of asset market comovements have been explored in developed markets. The general consensus is that credit ratings have asymmetric effects on asset market co-movements. However, the evidence is inconsistent in emerging markets. Most of the research has not been conducted in African markets, particularly using country risk data. There is no recognised study on the effect of disaggregated risk rating on domestic asset market co-movements. This study contributes to the literature in the following manner. First, most of the existing empirical research on asset market comovements has focused on macroeconomic factors and market uncertainty as key drivers of asset market comovements. A novel contribution of this study is by examining the influence of economic, financial and political risk on time-varying asset market comovements. Existing empirical literature (Hassan et al., 2003, Sari et al., 2013, Hammoudeh et al., 2013; Nasr et al., 2018) has examined the reaction of stock returns to country risk shocks. However, the interaction between country risk and time-varying asset market linkages has not been explored. Hence, the study extends the burgeoning literature on the impact of country risk components by examining the linkages between country risk and comovement dynamics of asset markets. Moreover, empirical evidence suggests heterogeneous effects of country risk components on financial markets (Sari et al., 2013; Mensi et al., 2017; Nasr et al., 2018; Nhlapho & Muzindutsi, 2020). This study is similar to Mensi et al (2016) who showed that country risk components have asymmetric effects on asset market returns. This study differs from Mensi et al (2016) by focusing on the impact of country risk components on cross-asset comovements, especially in the context of African markets.

The study contributes by examining the drivers of safe haven assets such as currencies and commodities markets, thus this study contributes to the scanty literature on the drivers of comovements between conventional asset markets and safe-haven asset markets. There is little research on African markets. African markets have attracted attention among international investors in recent years due to higher rates of returns in the 1990s. Literature has also identified several diversification benefits of investing in African markets (Bossman et al., 2022). However, increasing financial integration, financialisation of commodity markets and the contagion effects of financial crises on African markets has renewed interest in examining the dynamic comovements of asset markets. Thus, this study aimed to provide fresh insights into the area of research on African market dynamics.

Few studies have explored the determinants over different frequencies. Examining asset return comovements over different investment horizons is important for asset allocation due to market participants having different investment horizons due to varying consumption patterns. The fact that macroeconomic and non-macroeconomic fundamentals have nonlinear and asymmetric impacts on asset return correlations implies that a non-linear model would be best suited for examining the drivers of comovements. This study aims to contribute to the theoretical literature on asset pricing models and literature that seeks to incorporate country risk into the capital asset pricing models.

5.3 Data and methods

This section comprises of three main parts. This section begins with a description of the sample data and data sources, and the statistical methods used to analyse the data. This is followed by a discussion of the descriptive characteristics of the time series data and the results derived from the estimation techniques.

5.3.1 Data and sample properties

The study uses asset market and country risk data as described in Chapter 3, Section 3.3, and Chapter 4, Section 4.3, respectively. The sample period is from February 2000 to December 2019. As mentioned in the previous chapters, the sample period takes into consideration the major crisis, such as the 2007-2008 global financial crisis and the 2012 European sovereign debt crisis. The study uses monthly frequency data due to country risk data only being available in monthly frequencies. The asset returns were calculated as presented in equation 3.1 in Chapter 3. The country risk components were used as logged values. To ensure that the models used were correctly applied, diagnostics tests were conducted on asset return series and country risk components. The detailed results of these tests can be found in Chapter 3, under Section 3.4, and Chapter 4, under Section 4.4.

5.3.2 Methods for analysing the determinants of asset market correlations

The analysis for this chapter was conducted using a hybrid approach. In the first step, the Dynamic conditional correlation generalized autoregressive conditional heteroskedasticity (DCC GARCH) model is used to estimate the time-varying correlation of the asset returns. The second step entailed examining the effects of economic, financial and political risk on the asset market correlations. The model estimated in the second step is the non-linear autoregressive distributed lag (NARDL) model and is discussed in section 5.3.2.2.

5.3.2.1 Univariate GARCH Model with Asymmetric Specifications

GARCH models were estimated to determine asset return correlations. Specifically, the study used the DCC model of Engle (2002) because it performs better than the constant correlation GARCH model introduced by Bollerslev (1990).

The GARCH process comprises of two equations: the mean equation and the variance equation. The initial step of a GARCH process is to estimate a mean equation. For this study, the autoregressive moving average, ARMA(k, m)-GARCH (p,q) process was adopted to derive the standardized residuals, where k is the order of the autoregressive process, and p and q are the orders for the GARCH noise process. The mean equation was expressed as follows:

$$r_{it} = \mu + \phi r_{i,t-1} + \upsilon \varepsilon_{i,t-1} + \zeta \sigma^2_{i,t-1} + \varepsilon_{i,t}, \quad \varepsilon_{i,t} \sim N(0, \sigma^2_t) \qquad (5.1)$$

Where r_{it} is the return series of asset i depends on past returns, $r_{i,t-1}$ and ϕ captures the effects of past returns. The effects of past shocks are measured by υ and $\varepsilon_{i,t}$ is the random error term that follows a normal distribution with a zero mean and constant conditional variance. ζ is a parameter for the risk premium which measures the risk-return relationship. If the value is positive and statistically significant, it would suggest that an increase in risk, as measured by the conditional variance $\sigma^2_{i,t-1}$, would cause an increase in return (Brooks, 2019).

The variance equation models the conditional variance's error terms from the mean, where the variance is a function of the lagged errors and past conditional variance. The univariate GARCH(1,1) of Bollerslev (1986) was used to model the conditional variance for each asset return, $\sigma_{i,t}$ for the $i = 1,2, \ldots, n$,set out as follows:

$$\sigma^2_{i,t} = \varphi + \omega_i \varepsilon^2_{i,t-1} + \vartheta_i \sigma^2_{i,t-1} \qquad (5.2)$$

where is φ the constant, σ^2_t is the conditional variance, β measures the effects of the past conditional volatility. ε^2_{t-1} is the lagged squared standard errors and ϑ measures the effects of the previous month's conditional variance on the current month's conditional variance. The sum of ω_i and ϑ_i should be close to one. A sum close to one indicates a higher degree of conditional variance persistence. ω_i and ϑ_i should be non-negative and φ is a positive constant for the GARCH model to meet the stability and stationarity conditions of a GARCH model (Brook, 2019). A GARCH (1,1) model was estimated for each asset market. One lag for past volatility and squared errors was deemed appropriate when examining financial time series data (Bollerslev, Engle and Nelson, 1994).

A limitation of the GARCH model is that the conditional variance is a function of lagged residuals and the model imposes a symmetric response of current volatility to positive and negative shocks. Empirical research shows that financial time series data has properties of leptokurtotis, volatility clustering and exhibits leverage effects (Cont, 2010). The traditional symmetric GARCH process of Bollerslev (1986) is limited in its ability to capture the heterogeneous effects of past positive and negative shocks on the future conditional second moments (covariance and correlation) (Cappiello et al., 2006). These models imply that the conditional variance of squared residuals is determined by the magnitude and ignores the direction of the lagged innovations. As such, the study considered two other univariate volatility models. The study estimated three univariate volatility models such as the; traditional GARCH model developed by Bollerslev (1986), the exponential GARCH (EGARCH) introduced by Nelson (1991) and the GJR-GARCH/TGARCH of Glosten et al. (1993). The best fitted model is selected based on the minimization of SIC and AIC, and the highest log-likelihood values. The mean equation for the three GARCH models is similar, and each equation differs in the specification of the variance equation. The EGARCH model introduced by Nelson (1991) accounts for the leverage effects, which implies that downturns have a more significant influence on volatility predictability than upturns. The EGARCH uses the generalized exponential distribution represented by the following mathematical expression:

$$\ln(\sigma_{i,t}^2) = \varphi + \omega_i \ln(\sigma_{i,t-1}^2) + \vartheta_i \, {\varepsilon_{i,t-1}}\Big/{\sqrt{\sigma_{i,t-1}^2}} + \gamma \left[{|\varepsilon_{i,t-1}|}\Big/{\sqrt{\sigma_{i,t-1}^2}} - \sqrt{2/\pi} \right] \quad (5.3)$$

The parameter value of γ_i is the leverage term and this term is generally negative. The impact of negative values of ε_t have heterogeneous effects on volatility.

The GJR-GARCH model introduced by Glosten et al. (1993) takes into account asymmetry by including a term for asymmetry. The variance equation is defined as follows:

$$\sigma_{i,t}^2 = \varphi + \omega_i \varepsilon_{i,t-1}^2 + \vartheta_i \sigma_{i,t-1}^2 + \gamma_i \varepsilon_{i,t-1}^2 I_{i,t-1} \quad (5.4)$$

Where $I_{i,t-1}$ is a dummy variable. $I_{i,t-1} = 1$ if $\varepsilon_{i,t-1} < 0$ and zero otherwise. γ represents the leverage effects, i.e. the asymmetric response of asset returns to positive and negative shocks. The model is admissible if the following non-negativity conditions are met: $\varphi > 0$, $\omega_i > 0$, $\vartheta_i > 0$ and $\omega_i + \gamma_i \geq 0$ even when γ_i is negative.

Good news has an impact of ω, and bad news has an impact of $(\omega + \gamma)$. The good news ($\varepsilon_t^2 > 0$) and bad news ($\varepsilon_t^2 < 0$) have heterogeneous effects on the conditional variance. The presence of leverage effects and asymmetry are indicated by a positive and statistically significant value for the leverage term (Brooks, 2019).

5.3.2.2 DCC-GARCH Model

To examine the impact of country risk on asset market correlation, first, the study will generate measures of asset market correlation using the dynamic conditional correlation GARCH (DCC-GARCH) and the asymmetric GARCH (ADCC-GARCH). This approach has been used in existing empirical research to examine the dynamic time-varying relation of asset markets(Asgharian et al., 2016; Kocaarslan et al., 2017; Marozva, 2017; Seth et al., 2020). To this effect, this study will also employ this method as it is most suitable for directly estimating the conditional correlation across asset pairs. Furthermore, the DCC approach appears to be the only approach to provide a measure of time-varying correlation which can then be used to study the impact of country risk components on asset market correlation. The DCC model of Engle (2002) is a generalized extension of the constant conditional correlation GARCH (CCC-GARCH) model (Bollerslev, 1990). However, unlike assuming a constant correlation matrix, the DCC model allows for the correlation matrix to vary over time.

The estimation of the DCC GARCH follows a two-step process to simplify the estimation of time-varying correlations, where volatilities and correlations are a function of past returns. The initial step entails estimating the univariate volatility parameters using different specifications of univariate GARCH models for each asset market as presented in equations 5.2 to 5.4. In the second step, the estimated standardized residuals are used to determine the conditional correlations and the persistence parameters.

The DCC-GARCH is an extension of Engle (2002) constant conditional correlation (CCC) GARCH, which allows for time variation in the correlation matrix. According to Engle (2002), the variance-covariance matrix of the DCC model can be defined as:

$$H_t = D_t F_t D_t \quad \text{such that } D_t = \begin{bmatrix} \left(h_{i,t}^2\right)^{1/2} & 0 \\ 0 & \left(h_{i,t}^2\right)^{1/2} \end{bmatrix} \tag{5.5}$$

Such that, $D_t$defines a diagonal matrix of time-varying standard deviations derived from the univariate GARCH model with $\left(h_{i,t}^2\right)^{1/2}$. F_t represents a time-varying N x N correlation matrix of asset returns where the diagonal elements are equal to one and specified as:

$$F_t = (Q_t^*)^{-1} Q_t (Q_t^*)^{-1} \tag{5.6}$$

Where $Q_t^* = diag(Q_t)^{\frac{1}{2}}$, a diagonal matrix where Q_t is the $(N \times N)$ symmetric positive definite matrix. When Q_t is positive, Q_t^* ensures that F_t represents a dynamic correlation matrix with elements equal to one and all other elements in the matrix have an absolute value of less than 1 (Kocaarslan et al., 2017). Where $Q_t = \{q_{ij,t}\}$ is a covariance matrix.

The evolution of the dynamic correlations in the DCC-GARCH is expressed by the following equation:

$$Q_t = (1 - \theta_1 - \theta_2)\bar{Q} + \theta_1 v_{t-1} v_{t-1}' + \theta_2 Q_{t-1}$$

$$v_{i,t} = \frac{v_{i,t}}{\sqrt{h_{i,t}}} \tag{5.7}$$

Where Q_t is the unconditional variance, $\bar{Q} = E[v_t v_t']$ is the unconditional covariance of standard residuals, $v_{i,t}$. The scalar parameters, θ_1 and θ_2, capture short-run and long-run persistence, respectively. The DCC model is considered to have a mean-reverting process when $\theta_1 + \theta_2 < 1$ (Cappiello et al., 2006). A value closer to one indicates a slower mean reverting process.

The conditional correlation coefficients for a pair of markets i and j at time t can be defined as:

$$\rho_{ij,t} = \frac{q_{ij,t}}{\sqrt{q_{ii,t} q_{jj,t}}} \quad i,j = 1,2 \ldots., n \text{ and } i \neq j \tag{5.8}$$

Where $\rho_{ij,t}$ is the dynamic conditional correlation for each asset pair. For the analysis, the sign and magnitude of the correlation coefficients are important. A positive correlation coefficient suggests that the standardized residuals of the two asset markets react move in the same direction and thus react similarly to new information. A low (close to zero) or negative correlation indicates that the asset markets react differently to new information and hence the residuals will move in opposite directions.

The DCC model indicated does not take into consideration the possibility of asymmetries in conditional variances, covariances and correlations which can result in misspecification of the conditional variance-covariance matrix (see Cappiello et al., 2006). The asymmetric DCC (ADCC) GARCH proposed by Cappiello et al. (2006) allows for leverage effects to have an impact on the conditional correlations of asset returns. The ADCC GARCH is presented as follows:

$$h_{i,t} = \omega_i + \alpha_i \varepsilon_{i,t-n}^2 + \beta_i h_{i,t-n} + d_i \varepsilon_{i,t-n}^2 I(\varepsilon_{i,t-n}) \quad (5.9)$$

Where, the indicator function $I(\varepsilon_{i,t-n}) = 1$ if $\varepsilon_{i,t-n} < 0$. d is an indicator of leverage effects where a positive value would suggest that negative residuals increase more than positive residuals following a shock of equal magnitude in the model.

The asymmetric effects are represented as follows in the DCC-GARCH (1,1) model:

$$Q_t = (\bar{\delta} - A'\bar{Q}A - B'\bar{Q}B - G'\bar{N}G) + A'v_{t-1}v'_{t-1}A + G'\eta_{t-1}\eta'_{t-1}G + B'Q_{t-1}B \quad (5.10)$$

where A, B and G are NxN parameter matrices and $\bar{Q}$ and $\bar{N}$ are unconditional covariance matrices of v_t and η_t. $\eta_t = I[v_t < 0] \circ v_t$ ($\circ$ indicates the Hadamard product) and $\overline{N = [\eta_t \eta'_t]}$. A parameters indicate the impact of past standardized shocks on the current dynamics and B parameters indicate the impact of past dynamics on current dynamics and G indicates the asymmetric parameter which represents the episodes of bad shocks for global markets. Q_t becomes positive definite with probability 1 if $(\bar{\delta} - A'\bar{Q}A - B'\bar{Q}B - G'\bar{N}G)$ is positive definite. The GARCH estimation was conducted following the Quasi maximum likelihood (QML) method based on the BHHH optimization algorithm.

Using a model that takes into account the non-linearity in asset markets can help investors optimise their portfolios. The DCC GARCH model will assist with determining the direction and magnitude of comovements between asset markets, thus providing a robust analysis of asset market linkages as presented for objective 1. Furthermore, this approach will assist in deriving a time series of correlation coefficients for asset pairs, which will be applied to examine the impact of economic, financial and political risk factors on asset market correlations as per objective three of this thesis.

5.3.2.3 Method of analysis for the impact of Country Risk Components on the Dynamic conditional Correlations

After generating the correlation series for asset pairs, the study investigated how the components of country risk affect the estimated correlation between the asset markets. As mentioned in section 5.2.5, several studies have explored the determinants of asset market comovements (Sensoy et al., 2016; Chai et al., 2019), however, a few studies have investigated this relationship across a broader subset of asset markets. The autoregressive distributed lag (ARDL) model of Pesaran et al. (2001) and the non-linear autoregressive distributed lag (NARDL) model of Shin et al. (2014) were employed. This approach distinguishes this study from existing literature which has used the DCC-MIDAS (Asgharian et al., 2016), cointegration analysis (Song, Huang, Paramati and Zakari, 2021) and Granger causality (Balli, Hasan, Ozer-Balli and Gregory-Allen, 2021) to investigate the determinants of asset market correlations. Section 5.3.2.3.1 discusses the ARDL approach used to empirically assess the symmetric impact of economic, financial and political risk on asset return correlations. Section 5.3.2.3.2 discusses the NARDL approach used to investigate the asymmetric impact of country risk components on asset return correlations.

5.3.2.3.1 Autoregressive distributed lag model

The objective of this study was analysed using the standard ARDL specified as follows:

$$\Delta \Upsilon_{it} = c + \rho_1 \Upsilon_{t-1} + \rho_2 ER_{t-1} + \rho_3 FR_{t-1} + \rho_{PR} PR_{t-1} + \sum_{i=1}^{p} \beta_i \Delta \Upsilon_{t-i} + \sum_{i=0}^{q} \varphi_1 \Delta ER_{t-i} + \sum_{i=0}^{q} \varphi_2 \Delta FR_{t-i} + \sum_{i=0}^{q} \varphi_3 \Delta PR_{t-i} + \beta_8 D_{1,t-i} + \epsilon_t \quad (5.11)$$

ϒ is the dependent variable measuring the time-varying conditional correlation series between two asset markets estimated from the DCC model in equation 5.8. ER, FR and PR refer to economic risk, financial risk and political risk, respectively. The standard ARDL models the short- and long-run relationships between country risk components and asset market co-movements but fails to account for the possibility of nonlinear effects which is the case in recent literature (see Liu et al., 2013; Mensi et al., 2016; Nasr et al., 2018). The long-run cointegrating relationship between asset correlations and country risk is examined using the F-bounds cointegration test. The following null hypothesis is tested:

$$H_0: \varphi_1 = \varphi_2 = \varphi_3 = 0$$

$$H_1: \varphi_1 \neq \varphi_2 \neq \varphi_3 \neq 0$$

The null hypothesis of no long-run relationship is tested against the alternative hypothesis that a long-run relationship exists. The ARDL short-run error correction model is specified as follows:

$$\Delta \Upsilon_{it} = c + \sum_{i=1}^{p} \beta_i \, \Delta\varphi_{t-i} + \sum_{i=0}^{q} . \theta_i \, \Delta ER_{t-i} + \sum_{i=0}^{q} \delta_i \, \Delta FR_{t-i} + \sum_{i=0}^{q} \sigma_i \, \Delta PR_{t-i} + \omega\vartheta_{t-1} + \epsilon_t \quad (5.12)$$

Where $\omega\vartheta_{t-1}$ represents the linear ECT and ω is the parameter for the speed of adjustment to equilibrium.

5.3.2.3.2 Nonlinear autoregressive distributed lag model

This study will follow the NARDL methodology of Shin *et al.* (2014) to investigate the nonlinear effect of country risk components on asset market correlations. The study will capture the asymmetric behaviour of each of the country's risk components; economic risk (ER_t), financial risk (FR_t) and political risk(PR_t), by decomposing them into their positive and negative partial sums, as follows: $x_t = x_0 + x_t^{+} + x_t^{-}$.

The general forms for the positive and negative partial sums of x_t are expressed in the following way:

$x_t^{+} \sum_{k=1}^{t} \Delta x_k^{+} = \sum_{k=1}^{t} \max(\Delta x_k, 0)$ and $x_t^{-} \sum_{k=1}^{t} \Delta x_k^{-} = \sum_{k=1}^{t} \min(\Delta x_k, 0)$

Where x_t is a $m \times 1$vector of explanatory variables and $\Delta x_k = x_k - x_{k-1}$.

Decomposing the explanatory variable into positive and negative partial sums allows us to examine the effects of a decrease and increase on the correlation between asset markets. To model the short- and long-run nonlinearity, the NARDL model is expressed as follows:

$$\Delta\Upsilon_t = c + \theta\,\Upsilon_{t-1} + \rho_1^+ ER_{t-1}^+ + \rho_2^- ER_{t-1}^- + \rho_3^+ FR_{t-1}^+ + \rho_4^- FR_{t-1}^- + \rho_5^+ PR_{t-1}^+ + \rho_6^- PR_{t-1}^- + \sum_{k=1}^{p-1} \nu\,\Delta\,\Upsilon_{t-k} + \sum_{i=0}^{q-1} (\beta_{2k}^+\,\Delta ER_{t-k}^+ + \beta_{3k}^- \Delta ER_{t-k}^-) + \sum_{k=0}^{q-1} (\beta_{4k}^+\,\Delta FR_{t-k}^+ + \beta_{5k}^- \Delta FR_{t-k}^-) + \sum_{k=0}^{q-1} (\beta_{6k}^+\,\Delta PR_{t-k}^+ + \beta_{7k}^- \Delta PR_{t-k}^-) + \omega\vartheta_{t-1} + \beta_8 D_{1,t-i} + \epsilon_t \quad (5.13)$$

Where p and q are the lag orders, θ is the symmetric long-run parameter and ρ_k^+ and $\rho_k^-$are the long-run asymmetric parameters. ν is the short-run parameter and the short run adjustment to positive and negative shocks are captured by parameter estimates β_k^+ and β_k^-. The long-run impact of positive and negative shocks of financial, economic and political risk factors on the correlation between asset returns is equal to $\varphi^+ = -\rho_k^+/\rho_\Upsilon$ and $\varphi^- = -\rho_k^-/\rho_\Upsilon$.

The error correction model for the NARDL is specified in the following manner:

$$\Delta\Upsilon_t = c + \theta\,\Upsilon_{t-1} + \rho_1^+ ER_{t-1}^+ + \rho_2^- ER_{t-1}^- + \rho_3^+ FR_{t-1}^+ + \rho_4^- FR_{t-1}^- + \rho_5^+ PR_{t-1}^+ + \rho_6^- PR_{t-1}^- + \sum_{k=1}^{p-1} \nu\,\Delta\,\Upsilon_{t-k} + \sum_{i=0}^{q-1} (\beta_{2k}^+\,\Delta ER_{t-k}^+ + \beta_{3k}^- \Delta ER_{t-k}^-) + \sum_{k=0}^{q-1} (\beta_{4k}^+\,\Delta FR_{t-k}^+ + \beta_{5k}^- \Delta FR_{t-k}^-) + \sum_{k=0}^{q-1} (\beta_{6k}^+\,\Delta PR_{t-k}^+ + \beta_{7k}^- \Delta PR_{t-k}^-) + \beta_8 D_{1,t-i} + \epsilon_t \quad (5.14)$$

The short run impact of positive and negative changes in country risk components is indicated by $\sum_{k=0}^{q-1} \beta_k^+$ and $\sum_{k=0}^{q-1} \beta_k^-$.

The study will estimate the NARDL equation and use the bounds test proposed by Pesaran *et al.* (2001) to determine cointegration amongst the variables. The null hypothesis for the bounds test is where $\rho = \rho_i^+ = \rho_i^- = 0$, for i=0, 1, 2….8. The null hypothesis of The standard Wald test will be used to test the long-term symmetry hypothesis as follows: $\rho_i^+ = \rho_i^-$ and short-run symmetries will be tested on the following null hypotheses: $\sum_{i=0}^{q-1} \beta_i^+ = \sum_{i=0}^{q-1} \beta_i^-$, for i=0, 1,2 ….q.

The null hypothesis is not rejected when the F-statistic is below the lower bound critical values and greater than the upper bound critical values (Peseran et al., 2001). Equation (24) represents a model specification where both the hypothesis for long- and short-term symmetry are rejected. This study will apply the error correction model (ECM) based on the NARDL to evaluate the short-run asymmetric effects. A statistically significant country risk component will indicate a short-run relationship between country risk and asset return correlations.

5.4 Results

This section presents the analysis for objective three. First, a summary of the descriptive statistics is provided. The data characteristics and preliminary tests for the asset returns and country risk components were discussed in detail in Chapter 3, in Section 3.3 and Chapter 4, Section 4.4, respectively. This is followed by an analysis of the time-varying correlation between asset markets among South African asset classes and global commodities. This is followed by a discussion of the results of the impact of economic, financial and political risk on asset market correlations.

5.4.1 Data characteristics and statistical Properties

The descriptive statistics for asset returns were presented in Table 3.1. It is noted, in Table 3.1, that all markets examined have positive mean returns over the sample period, which indicates a bull market over the sample period. The average returns range from 1.0249% to 0.6250%. The stock, bond and gold returns are found to have the highest average monthly returns. The table also shows that oil markets are the most volatile compared to the other markets. The results for the skewness, kurtosis and Jarque-Bera tests suggest that the asset return series are not normally distributed. Moreover, the return series for the various markets exhibits volatility clustering and heteroskedasticity, thus further justifying employing the GARCH process to model the relationship amongst the asset market returns.

The results from the ADF, KPSS and PP unit root tests, in Table 3.1 find that all asset returns are stationary at levels, except for the housing market return which contains a unit root. The test results indicate a rejection of the null hypothesis of a unit root, thus concluding that housing market returns are stationary at first difference. Perron (1989) suggests that structural breaks in the series can lead to the conclusion of the presence of a unit root when there is none. The standard unit root tests tend to be biased in rejecting the null hypothesis in the presence of structural breaks in the series, ignoring the effects of structural breaks may result in bias in the model estimation (Aggarwal, Inclan and Leal, 1999). Hence, the Zivot et al. (2002) unit root test is conducted and the results indicate the presence of a structural break in the housing price index occurring in May 2007. The conditional mean of the housing price index is estimated to account for structural breaks. The aim is to determine the number of structural breaks and the break dates in the sample period.

Leaving structural breaks unidentified may result in the GARCH model overestimating the level of volatility persistence (Hwang and Valls Pereira, 2008). The endogenous structural breaks in the series are identified using the Bai and Perron (1998) test and the Zivot and Andrews (2002) (ZA) breakpoint unit root test). These breaks are associated with major social, economic, political and financial events that took place in a domestic and international market (Ewing and Malik, 2010). The aim is to determine the number of structural breaks and the break dates in the sample period. Table 3.1 and Table 4.3 present the results for the ZA unit root tests. Table 3.1 finds that there are no unit roots in the stock, bond, housing, gold and oil returns. The results of the test show that the null hypothesis was rejected at the 5% level of significance. This result further supports those of the ADF, KPSS and PP unit root tests.

5.4.2 Diagnostic tests for serial correlation and heteroscedasticity

The financial series are tested for the presence of ARCH effects before specifying a GARCH model. The results of the ARCH test presented in Table 3.1 show a failure to reject the null hypothesis of no ARCH effects for exchange rate and gold return series. The results indicate significant ARCH effects at the 1% level of significance, particularly for the stock, housing and oil market series and the presence of ARCH effects exists in the bond returns series at the 10% level of significance. However, the results of the ARCH test presented in Table 3.1 show a failure to reject the null hypothesis of no ARCH effects for exchange rate and gold return series. Henceforth, the GARCH model was fitted to analyse the dynamic nature of the stock, bond, forex and oil market.

5.4.3 Results for asset return comovements

The results of the DCC-GARCH model estimations are presented in this section. The estimations will culminate in a time series of correlations between the asset markets.

5.4.3.1 The evolution of correlations between asset markets

The initial step entailed fitting univariate GARCH models for each of the six markets and choosing the best-fit model based on the information criteria. The GARCH models were estimated assuming three distributions: normal distribution, student's t and the generalized error distribution (GED). Table 5.1 presents the SIC values for the three univariate GARCH specifications for three error distributions. Based on the minimization of the SIC, the GJR-GARCH(1,1) modelled estimated with GED performed better for the bond and housing market returns, and the GJR- GARCH (1,1) estimated with GED distribution was selected for modelling the dynamic nature of the South African stock market return.

The EGARCH with normal distribution was the optimal specification for the oil market. The EGARCH can capture the serial correlation, heteroscedasticity and asymmetric marginal distribution, and statistical properties associated with asset returns (Do, Powell, Yong and Singh, 2020). The optimal model specification for all asset returns, except the housing markets, was estimated under the assumptions of normally distributed standard errors. This result is consistent with Krishna and Yelamanchili (2021) who found that normal distribution was a more appropriate assumption for low-frequency data, such as monthly asset returns. This result was in contrast to the Jarque-Bera test which indicates that asset returns were not normally distributed.

The results of the estimated GARCH model for the stock, bond, housing and forex markets are displayed in Table 5.2. In the mean equation, the risk premium parameter was found to be insignificant for the stock, housing and oil market returns, suggesting there is no link between the conditional variance and the mean returns of these markets (Brooks, 2019).

Table 5.1 Model selection

	GARCH			GJR GARCH			EGARCH		
Asset	Normal	GED	Student T	Normal	GED	Student T	Normal	GED	Student T
Stock	-3.2896	-3.2744	-3.2666	-3.2924	**-3.3059**	-3.2693	-3.3022	-3.2883	-3.2722
Bond	**-4.8196**	-4.8100	-4.3991	-4.7966	-4.7987	-4.7942	-4.7988	-4.8029	-4.7978
Housing	-10.3523	**-10.3696**	-10.3577	-10.3440	-10.3565	-10.3482	-10.3624	-10.3700	-10.3643
Oil	-1.7687	-1.7458	-1.7461	-1.7458	-1.7664	-1.7668	**-1.7957**	-1.7590	-1.7816

Note: Bold values indicate the superior model specifications based on SIC

Source: Author’s own estimation (2022)

Table 5.2 Results Univariate GARCH

	Stock	Bond	Housing	Oil
Model	**GJR-GARCH-M GED**	**GARCH-M Normal**	**GARCH-M GED**	**EGARCH-M Normal**
	Mean equation			
μ	0.0080*	0.0058	2.28E-06	0.031591
ϕ	-0.9730***	-0.8470*	0.382218***	-0.641300*
ζ	0.990972***	0.8696*	0.474088***	0.573720
υ	-0.0774		59.8252	-2.8291
	Variance equation			
φ	0.000271*	0.000272**	6.09E-08	7.26E-06***
ω	0.071281	0.2808**	0.173523**	0.267187*
ϑ	0.509551***	0.1499	0.783626***	0.293791***
γ	0.5780***	-	-	-0.468440***

Note: ***, ** and * denote the level of significance at 1%, 5% and 10%, respectively.

Source: Author’s own estimation (2022)

The autoregressive parameter that captures the effects of previous asset returns was significant for all markets. The parameter was found to be positive and significant for the stock and housing market, implying that past positive returns can be used to determine current stock and housing market returns. In contrast, the parameter was found to be negative for the bond and housing market returns, thus implying that past negative returns can be used to explain current returns. The moving average parameter was significant for all markets, except the oil market. The parameter is negative and significant for the stock market, whilst positive and significant for the bond and housing market.

The second part of the GARCH(1,1) specification, in Table 5.2, was to estimate the conditional variance equation. The ARCH effects parameter was positive and significant for all markets, at varying levels of significance. This result suggests that current asset prices can be predicted using past prices, which implies that markets are informationally inefficient. The parameters for each GARCH specification satisfied the non-negativity and stationarity conditions, thus suggesting the GARCH models were correctly fitted.

5.4.3.2 DCC-GARCH specification

This section provides the results for the DCC GARCH model. The standardized residuals derived from the univariate GARCH (1, 1) are used to estimate the correlation across markets under the assumption of normal and student t-error distributions. Following a similar approach to (Basher et al., 2016), different specifications of the DCC-GARCH model were estimated. Each specification was estimated under the assumption of normally distributed standard errors and student t's error distribution. Table 5.3 summarises the key results of the bivariate DCC-EGARCH (1, 1), ADCC-EGARCH models and the time-varying correlations amongst the four asset markets. In the DCC-GARCH equation, θ_1 denotes the impact of the most recent co-movements and θ_2 denotes the persistence of time-varying correlations. In all the DCC model specifications, the coefficient value was closer to zero, whilst the beta parameter value was closer to one which suggests that the conditional correlation is decreasing over time towards (1-bt)/bt (Do et al., 2020). The parameter value for θ_2 was generally significant for all markets examined, however, θ_1 is only statistically significant for the stock-housing, and housing-oil pairs. The observation was also that the values of θ_2 were generally higher than θ_1, indicating that there was a high long-run persistence. The stationarity condition is met for all models where the sum of θ_1 and θ_2 was less than one. Moreover, the sum was close to one which implies volatility has a long memory and is mean reverting. Thus, implying that the DCC EGARCH was correctly fitted to model the linkages between the asset returns.

Table 5.3 DCC-EGARCH

	Stock-bond	Stock-housing	Stock-oil	Bond-Housing	Bond-oil	Housing-oil
Panel A: DCC						
θ_1	0.0148	0.0210**	0.0299	0.0540	0.0433	0.0504**
θ_2	0.7244*	0.9688***	0.9761***	0.7167***	0.7252***	0.9290***
ρi,j(min)	-0.0181	-0.1643	0.2002	-0.1064	-0.5926	-0.2114
ρi,j(max)	0.1167	0.2953	0.4925	0.2520	-0.2220	0.4739
ρi,j(σ)	0.0224	0.1030	0.0475	0.0739	0.0535	0.1130
Panel B: ADCC						
θ_1	0.0380	0.0198	0.0320	0.0138	0.0433	0.0643***
θ_2	0.4776	0.8111***	0.8940***	0.9607***	0.7252***	0.7601***
Asym term	0.1664	0.0200	0.0126	0.0180	5.56e-05	0.0359***
ρi,j(min)	-0.3089	0.0022	0.2613	-0.1330	-0.5926	-0.0215
ρi,j(max)	0.1749	0.2681	0.5102	0.2745	-0.2220	0.0879
ρi,j(σ)	0.0757	0.0414	0.0427	0.0524	0.0535	0.0168

Panel C: Results of the Bai-Perron test						
Dates	2004M05	2004M05 2015M03 2008M09 2011M08	2003M06	2009M12 2006M06	2015M02 2009M01 2003M07	2009M01

Notes: ***, ** and * denote the level of significance at 1%, 5% and 10%, respectively.

Source: Author's own estimations (2022)

Figure 5.1 displays the bivariate conditional correlation graphs derived from DCC-EGARCH model specifications and Table 3.2 provides the summary statistics for the estimated dynamic correlations. The grey shaded areas represent US financial crisis periods. On average the correlations ranged between -0.59 to 0.49. The mean correlation is generally low and below 0.5, which suggests diversification and hedging benefits across the asset markets. The stock-oil and housing-oil pairs have the highest positive correlations. This result is consistent with the argument that the financialisation of commodities has increased the interdependence with stock markets (Tang and Xiong, 2012). Moreover, there are significant dips in correlations coinciding with extreme market events on a global and local scale.

It is observed that the correlation between the markets is mostly positive for all markets examined, except for the bond-oil linkages which are negative over the sample period. This finding is similar to the unconditional correlation results in Table 3.2 which indicated a negative linkage between the markets. The link between bonds and oil prices is through inflation. During periods of increasing inflation, oil prices will increase and bond prices will decrease. Hence, Nguyen and Liu (2017) found that oil serves as a haven asset for bonds during periods of crisis.

There was a significant dip in the correlations in the periods coinciding with the 2001 South African currency crisis and 2002 Dotcom crisis, the 2007/2008 global financial crisis and the 2012 European sovereign debt crisis. A significant decline in correlations was observed during the 2007-2008 global financial crisis. This finding corroborates the time-varying hedging properties of asset markets. Amongst the asset pairs, stock-bond, stock-oil and bond-oil correlations significantly declined in response to economic shocks during the crisis. An increase in oil prices is accompanied by rising production costs thus transmitting to decreasing corporate earnings and rising inflation (Wen, Bouri and Cheng, 2019). Commodity prices are often related to external risk factors such as geopolitical risks and supply-demand factors (Creti and Nguyen, 2015).

The correlation between the housing and oil market is generally low. This could be because an increase in oil prices is likely to cause a decline in economic growth, and thus cause a decline in the demand for housing. During the 2007-2008 global financial crisis, the collapse of the US housing market transmitted to a commodity market crash (Chan et al., 2011). In 2008, the price of WTI crude oil declined by approximately 80% from its peak. Based on the correlation analysis, including bond or housing markets have a low correlation with highly volatile markets such as stock and oil markets. This finding is consistent with Chang and Cheng (2016) who found that bond and housing markets are less integrated with currency and equity markets. However, Figure 5.1 shows evidence of contagion between these two markets during the crisis because the correlation between the two asset markets increases following the crisis (Forbes and Rigobon, 2002).

5.4.4 Results for the impact of country risk on asset market correlations

The second step of the third objective was to evaluate the impact of economic risk, financial risk and political risk on asset return correlations. The dynamic correlations of asset returns derived from the DCC-GARCH process in section 5.4.3.2 are the dependent variables and the economic risk, financial risk and political risk are the independent variables. This section first discussed the results of stationary tests conducted on the correlation series and country risk components. This will then be followed by a discussion of the results of the NARDL model.

5.4.4.1 Correlation statistical properties and cointegration tests

The estimated DCCs are used in NARDL analysis to examine the impact of economic, financial and political risk on the co-movements between the asset pairs. The purpose is to provide an answer to the question; How do changes in country risk components determine the co-movements between asset markets? First, a stationarity test is conducted to verify whether the series are not integrated with order two, I(2). The three-unit root tests that were conducted are the ADF, KPSS and PP. The results of the test are presented in Table 5.4. The results confirm that all variables are integrated into order one, I(1).

Following the stationarity tests, the next step was to conduct an ARDL bounds test. The results of the test are depicted in Table 5.5. The test was conducted on estimated ARDL and NARDL where economic risk, financial risk and political risk are the independent variables and asset return correlations are the dependent variables. The estimated bound test F-value for all models is greater than the upper bound value at all levels of significance, indicating that the null hypothesis for no-cointegration is rejected, at all levels of significance. Thus, confirming the presence of a long-run relationship between country risk components and asset market co-movements for both models.

The long-run and short-run asymmetric relationship was examined and the results are displayed in Table 5.6. The results of the Wald test show that the null hypothesis of long-run symmetry could not be rejected at all conventional levels of significance, thus indicating that there are no long-run asymmetric effects of country risk components on the asset markets.

The results indicate that country risk components have a significant asymmetric effect on the dynamic correlations of the asset pairs, in the short-run. Economic risk has an asymmetric effect on the correlation between bond and oil market returns, whilst political risk has asymmetric effects on stock-bond and stock-housing market pairs. Financial risk has an asymmetric effect on stock-housing, stock-oil and housing-oil correlations.

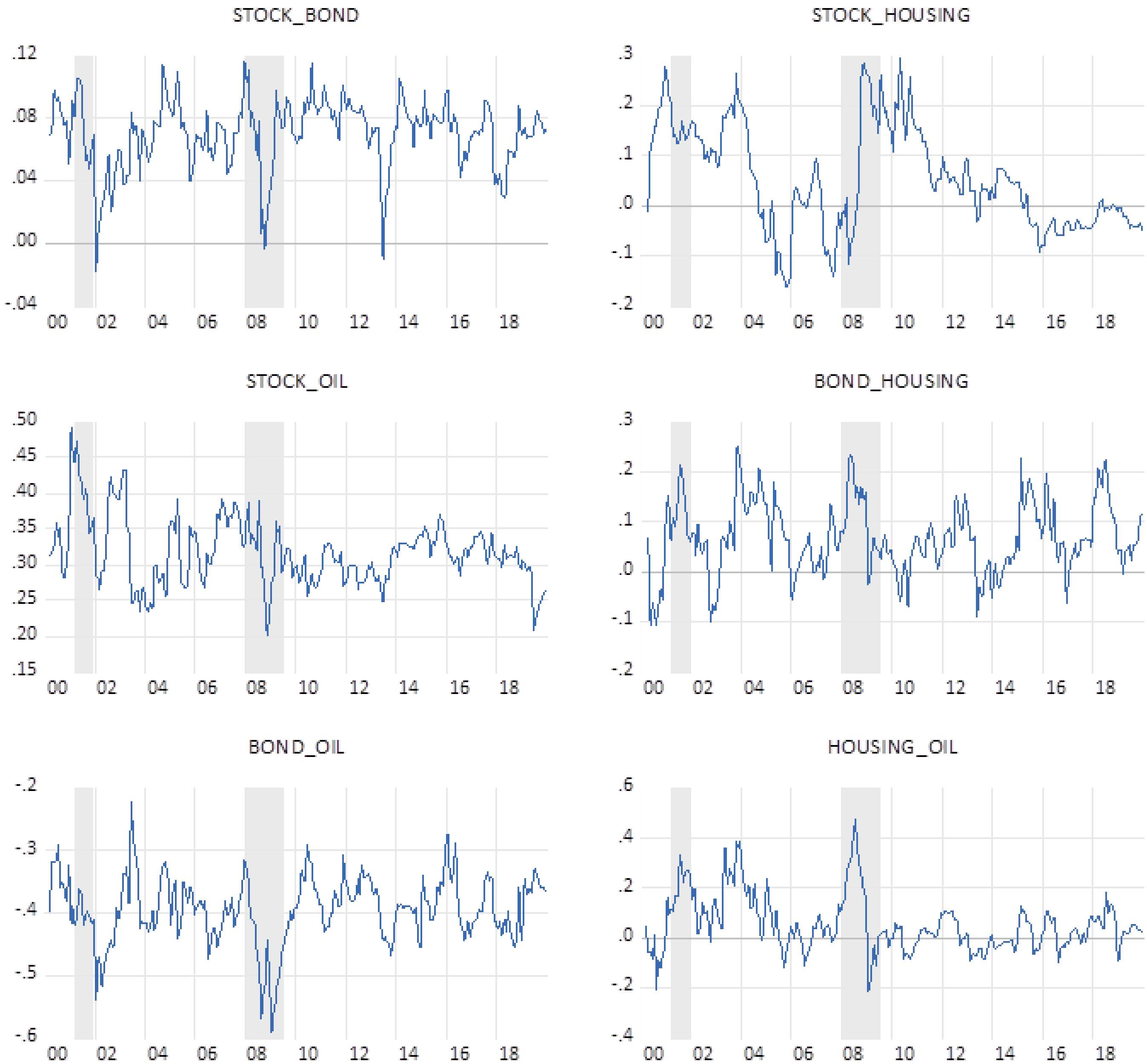


Figure 5.1 Dynamic conditional correlation

Source: Author's own depiction (2022)

Table 5.4 Results for stationarity

	ADF		PP		KPSS	
	I	I&T	I	I&T	I	I&T
Stock-bond	-5.9285***	5.9373***	-5.7851***	-5.7950***	0.1171	0.0785
Stock-housing	-2.7812*	-3.3748*	-2.8654*	-3.5333**	0.2031	0.1747#
Stock-oil	-4.7321***	-5.0047***	-4.9543***	-5.2516***	0.3634#	0.0863
Bond-housing	-5.4426***	-5.4492***	-5.4590***	-5.4705***	0.0544	0.0524
Bond-oil	-5.4171***	-5.4186***	-5.3823***	-5.3852***	0.0861	0.0603
Housing-oil	-4.6166***	-4.8731***	-4.6375***	-4.9181***	0.4678#	0.0709#

Note: # denotes variables that are I(1). ***, ** and * denote the level of significance at 1%, 5% and 10%, respectively. I- intercept only, and I&T- intercept and trend.

Source: Author’s own estimation (2022)

Table 5.5 Results of the Cointegration test

Market	Model specification	F-stat	Conclusion
Stock-bond	ARDL(1, 0, 0, 0, 0, 0, 3)	7.007	Cointegration
Stock-housing	ARDL(1, 4, 1, 2, 3, 0, 1)	3.1376	Cointegration
Stock-oil	ARDL(1, 0, 0, 0, 3, 2, 0)	4.3504	Cointegration
Bond-housing	ARDL(1, 0, 0, 1, 0, 0, 1)	4.7272	Cointegration
Bond-oil	ARDL(2, 1, 2, 0, 0, 0, 0)	5.0322	Cointegration
Housing-oil	ARDL(1, 0, 4, 4, 4, 4, 0)	4.9609	Cointegration
	10% 1.99 2.94 5% 2.27 3.28 2.5% 2.55 3.61 1% 2.88 3.99		

Notes: ***, ** and * denote the level of significance at 1%, 5% and 10%, respectively.

Source: Author’s own estimation (2022)

Table 5.6 Asymmetry Wald test

	W_{LR}			W_{SR}		
	LER	LFR	LPR	LER	LFR	LPR
Stock -bond	0.4539	0.0881	2.2868	No SR	No SR	12.7869***
Stock-housing	0.5455	0.5249	0.5361	0.9193	9.8752***	3.4465*
Stock-Oil	0.1900	0.9880	2.0193	No SR	7.0935***	0.9323
Bond-Housing	2.1095	1.4807	0.0151	No SR	0.7097	2.3514
Bond-Oil	0.0843	0.5864	1.2642	5.8832**	No SR	No SR
Housing-oil	1.2930	0.0207	1.4462	0.9023	6.9419***	0.8037

Note: * represents significance at 10%, ** significance at 5% and *** at 1% significance.W_{LR}: long-run Wald, W_{LR}: short run Wald.

Source: Author’s own estimation (2022)

5.4.4.2 NARDL analysis

The results of the long-run cointegrating equation and the short-run error correction model are summarized in section 5.4.4.2.1 and section 5.4.4.2.2, respectively.

5.4.4.2.1 Long-run analysis

The coefficient values from the long-run equation are presented in equations 5.1.1 to 5.1.6 as follows;

$$Corr_{SB} = -0.0881 + 0.0996LER^{+} + 0.1779LER^{-} — 0.1014LFR^{+} - 0.0865LFR^{-}$$
$$-0.0485LPR^{+} - 0.2576LPR^{-} \quad (5.1.1)$$

$$Corr_{SH} = -0.0955 + 0.8087LER^{+} - 0.0106LER^{-} — 1.5863LFR^{+} - 1.2409LFR^{-}$$
$$+2.2195LPR^{+} + 1.2896LPR^{-} \quad (5.1.2)$$

$$Corr_{SO} = 0.4223 + 0.0634LER^{+} - 0.0878LER^{-} + 0.1652LFR^{+} + 0.3143LFR^{-}$$
$$+0.2895LPR^{+} - 0.2914LPR^{-} \quad (5.1.3)$$

$$Corr_{BH} = -0.0580 + 0.3077LER^{+} - 0.4121LER^{-} — 0.2565LFR^{+} - 0.0031LFR^{-}$$
$$-0.2977LPR^{+} - 0.3620LPR^{-} \quad (5.1.4)$$

$$Corr_{BO} = 0.3539 + 0.4233LER^{+} + 0.3233LER^{-} — 0.1813LFR^{+} - 0.0704LFR^{-}$$
$$-0.2139LPR^{+} - 0.6562LPR^{-} \quad (5.1.5)$$

$$Corr_{HO} = -0.1357 + 0.6834LER^{+} - 0.2020LER^{-} + 0.7518LFR^{+} + 0.7068LFR^{-}$$
$$+0.0509LPR^{+} + 1.1411LPR^{-} \quad (5.1.6)$$

where the dependent variables, $Corr_{SB}$, $Corr_{SH}$, $Corr_{SO}$, $Corr_{BH}$, $Corr_{BO}$ and $Corr_{HO}$ represent the time-varying correlations, for the stock-bond, stock-housing, stock-oil, bond-housing, bond-oil and housing-oil pairs, respectively. The effects of economic, financial and political risk -LER, LFR and LPR, respectively- are decomposed into positive and negative partial sums, thus allowing for an investigation of how asset correlation responds to positive and negative innovations in country risk components (see Nasr et al., 2018, Muzindutsi et al., 2021).

The parameter values in the long-run equations, 5.1.1-5.1.6 suggest that financial and political risk ratings have a linear long-run relationship with asset correlations. This finding corroborates the results of the Wald test where the null hypothesis of long-run symmetry could not be rejected. The positive and negative signs of the parameters in the long-run equation determine the direction of the impact that economic, financial and political risk has on correlations. A positive sign is interpreted as an increase in correlation and a negative sign is an indicator of decreasing correlation.

Financial and political risk have similar effects for stock-bond, bond-housing, bond-oil and housing-oil pairs. Positive and negative innovations in financial and political risk have a negative linear effect on the following asset pairs; stock-bond, stock-housing, bond-housing and bond-oil pairs. This result implies that the upward or downward revision of financial risk ratings scores contributed to the variance in asset correlations. The effects of financial and political risk are, however, heterogeneous for stock-housing and stock-oil correlations.

Although political risk was found to have linear long-run effects on asset correlations, the results show that the effects on stock-oil correlations are asymmetric, to the extent that an increase in political risk ratings coincides with a decrease in their correlation. This suggests that when there is political stability in South Africa (hence the risk rating is favourable), the correlation between these markets will decrease. In contrast, an increase in political instability (LPR^{-}) had a positive impact on stock-oil correlations.

In contrast, economic risk was found to have non-linear long-run effects on most of the correlations, except for the stock-bond pairs and bond-oil pairs. The positive and negative innovations in economic risk had a positive effect on both asset pairs. This result suggests that an increase or decrease in South Africa’s economic risk increases the correlation between stock-bond and bond-oil pairs. These results corroborate the evidence of a common information channel which indicates that stock and bond markets comove because their future cash flows and discount rates are influenced by the same economic factors (Li, 2002). Empirical studies found that inflation rate and interest rates are key determinants of comovements between stock and bond markets (Ilmanen, 2003; David & Veronesi, 2013; Skintzi, 2019). A decrease in the economic risk rating score (LER^{-}) is an indicator of increasing economic risk, thus indicating increasing macroeconomic instability in South Africa. The increase in correlation between these asset pairs, suggests interdependence between the asset pairs. According to the definition provided by Forbes and Rigobon (2002), markets are interdependent when they are positively correlated in normal periods and the direction of this correlation does not change during a market turmoil.

The correlation of stock-housing and housing-oil increases when economic risk falls (when the coefficient value of LER^{+} is positive). An increase in economic risk ratings indicates economic stability. Changes in economic risk reflect changes in macroeconomic fundamentals and shifts in key macroeconomic variables which result in ICRG revising the score upwards or downwards. A high economic risk reflects economic stability to international and domestic investors. Thus, investors can easily access capital to invest in real estate markets which may have a positive impact on stock prices (Nguyen and Bui, 2019).

5.4.4.2.2 Short-run analysis

Table 5.7 shows the estimated coefficients of the short run asymmetry and the error correction terms. The non-linear error correction model (ECM) was estimated to determine the short-run dynamics. The error correction term (ECT) coefficient is negative and statistically significant at the one per cent level of significance for all models estimated. The coefficient values are less than 1%, which indicates a fast speed of adjustment to long-run equilibrium following a short-run disturbance.

Political risk ratings have asymmetric effects on all correlations in the short run except for the bond-oil pair. Bond-oil correlations are only related to economic risk ratings. Positive and negative innovations in economic risk have asymmetric effects on bond-oil correlations. An increase in economic risk ratings reduces bond-oil correlations in the short run. A 1% decrease in economic risk ratings increases the correlation between bonds and oil by approximately 50%.

Political risk is the only country risk component with asymmetric short-run effects on stock-bond correlations. A decrease in political risk ratings (increase in political instability) in the current period and two months ago has a positive and significant impact on stock-bond correlations in the current period. Stock and bonds make up a high proportion of traded assets in investment portfolios of large institutional investors, hence, the increase in correlation during periods of political instability is of importance to investors and policymakers. The crisis dummy variable has no impact on the stock-bond correlation, this result implies that domestic factors are more important than global factors. This result contrasts Lin et al. (2018) who found a positive link between global crisis events and stock-bond comovements. For the correlation between stock and housing markets, the interaction in these markets is affected by all three risk components in the short-run, and the current and lagged adjustments to economic, financial and political risk have a significant impact on the comovements in these markets. A 1% adjustment in economic risk, financial risk and political risk can result in a more than 50% change in stock-housing correlation. Political risk ratings have the highest magnitude impact on this pairing compared to the other markets.

The current and past positive innovations in economic risk have a positive effect on the stock-housing correlation. Whereas a decrease in financial and political risk ratings was associated with a decrease in stock-housing correlations. The response to current negative shocks in political risk is statistically significant and had a higher magnitude, meaning that political risk has more direct linkages to the stock and housing market. A 1% decrease in political risk ratings decreases the correlation between stock and housing markets by 77%. This finding is consistent with the notion that investors overact to bad news relative to good news. Das, Kannadhasan and Bhattacharyya (2019) found that the effects of geopolitical risk significantly affect asset pricing in emerging markets, and Dimic, Orlov & Piljak (2015) and Lehkonen and Heimonen (2015) also reached a similar conclusion. Changes in political risk have spillover effects on asset markets and pose a threat to financial stability (Iwanicz-Drozdowska, Rogowicz, Kurowski and Smaga, 2021).

Stock-oil correlations have a lagged response to positive and negative adjustments of financial and political risk, respectively. The previous two months' decrease in financial risk ratings had a more significant and positive impact on the current stock-oil correlation. This result may be attributed to currency risk or sovereign default risk or oil price risk, which increases volatility in these markets. Hlongwane, Daw, Shogole and Ribese (2022) found a positive relation between oil price and exchange rate volatility in South Africa. It takes one month for positive adjustments in political risk to reflect in current price comovements. Housing-oil correlations are related to economic and financial risk. Bond-oil correlations are also influenced by economic risk only. Both correlations have no short-run relationship with political risk. A 1% increase in economic risk ratings immediately decreases bond-oil correlation by 45%, and a 1% decrease in economic risk ratings is lagged and increases the comovement between these markets by 51%. Saadaoui, Saidi and Kriaa (2020) found that bond market volatility has implications on oil prices during periods of economic instability.

5.4.4.2.2 Diagnostic tests: NARDL

The diagnostic tests for serial correlation, normality and heteroscedasticity were conducted to ensure robustness in the results estimated in the models. Table 5.8 reports that the models were robust as the Ljung-Box test and the Breusch-Godfrey serial correlation LM test confirms no serial correlation at all levels of significance for each model estimated. The Cumulative sum of recursive residuals (CUSUM) and the cumulative sum of recursive residuals (CUSUMSQ) test confirm that the models were stable.

Table 5.7 Results of short-run error correction model

Stock-Bond		Stock- Housing		Stock - Oil		Bond - Housing		Bond - Oil		Housing - Oil	
Variable	Coeff.	Variable	Coeff.	Variable	Coeff.	Variable	Coeff.	Variable	Coeff.	Variable	Coeff.
ΔPR_t^-	0.41489**	ΔER_t^+	0.0895	ΔFR_t^-	0.1559	ΔFR_t^+	-0.1615	Bond-oil$_{t-1}$	-0.0929	ΔER_t^-	0.5943*
ΔPR_{t-1}^-	0.10981	ΔER_{t-1}^+	0.5418**	ΔFR_{t-1}^-	0.1833*	ΔPR_t^-	0.8591*	ΔER_t^+	-0.4535**	ΔER_{t-3}^-	-0.6391*
ΔPR_{t-2}^-	0.4713***	ΔER_{t-2}^+	-0.1688	ΔFR_{t-2}^-	0.2403**	Crisis	0.01012***	ΔER_t^-	0.2641	ΔFR_t^+	-0.4033*
Crisis	0.0001	ΔER_{t-3}^+	0.6248***	ΔPR_t^+	0.1464	ECT	-0.2752***	ΔER_{t-1}^-	0.5080***	ΔFR_{t-3}^+	-0.7455***
ECT	-0.3641***	ΔER_t^-	0.3936**	ΔPR_{t-1}^+	-0.4293**			Crisis	-0.0194***	ΔFR_{t-1}^-	0.4212*
		ΔFR_t^+	0.3455**	Crisis	-0.0016			ECT	-0.2768***	ΔFR_{t-2}^-	0.1635
		ΔFR_{t-1}^+	-0.2461**	ECT	-0.2274***					ΔFR_{t-3}^-	1.1803***
		ΔFR_t^-	-0.6279***							ΔPR_{t-3}^+	0.9733**
		ΔFR_{t-1}^-	-0.3632**							Crisis	0.0280**
		ΔFR_{t-2}^-	-0.2499*							ECT	-0.2493***
		ΔPR_t^-	-0.7702*								
		Crisis	0.0114								
		ECT	-0.0938***								

Notes: * represents significance at 10%, ** significance at 5% and *** at 1% significance

Source: Author’s own estimation (2022)

.

Table 5.8 NARDL model diagnostic tests

Tests	Stock-Bond	Stock-housing	Stock-Oil	Bond-Housing	Bond-Oil	Housing-Oil
Q(12)	11.624	18.086	10.917	6.0608	13.801	8.5525
$Q^2(12)$	13.499	21.577*	11.044	4.2993	6.4963	25.227
LM stat (2)	0.9158	0.4374	0.6771	0.2524	1.5963	0.0507
ARCH	0.3298	0.0781	0.00331	0.0550	0.1478	1.8682
Cusum	Stable	Stable	MS	Stable	Stable	Stable
Cusumsq	Stable	MS	NS	Stable	Stable	MS

Note: * represents significance at 10%, ** significance at 5% and *** at 1% significance. MS- Marginally stable and NS- Not stable.

Source: Author's own estimation (2022)

5.5 Summary and conclusion

Analysing the time-varying asset market linkages has been an area of interest for finance proponents, scholars, portfolio managers and policymakers. Asset market comovements have significant implications for how investors perceive future economic growth. Most of the research has been restricted to developing markets and other emerging markets, and little research has been conducted for African markets. Furthermore, there is a gap in the literature examining the explanatory power of economic, financial and political risk ratings for asset market correlations. The motivation for this study is based on the growing importance of information faced by international investors and the important role played by rating agencies to bridge this gap. This chapter, therefore, examined the effects of economic, financial and political risk ratings on asset market correlations of South African stock, bond and housing markets and oil futures markets.

In the first part of the analysis, the DCC-GARCH framework introduced by Engle (2002) and the ADCC-GARCH framework of Cappiello et al. (2013) was employed to estimate the time-varying correlations among the asset markets. For the second part of the analysis, the NARDL approach of Shin et al. (2014). The study also takes into consideration structural breaks in the correlations and thus, dummy variables were included in each equation to represent each of the structural breaks.

Using data from 2000 to 2019 for three domestic asset markets and crude oil and three country risk components, the study made the following findings. First, there was evidence of significant time variation in the patterns of the dynamic conditional correlation between all asset markets. The correlations were predominantly positive for all pairings except for bond-oil correlations which were negative throughout the sample period. Stock oil and stock housing had the highest positive correlation amongst the asset pairs. It was also documented that there were significant sharp and sudden variations in the correlations during crisis periods, such as the 2002 Dot-com crisis, the 2008 global financial crisis and the 2012 ESDC. The correlation of housing markets with other asset markets increased during the financial crisis, indicating the diminishing diversification benefits of investing in the housing market during periods of high stock and oil market volatility. Stock oil and stock-bond decreased during the financial crisis but remained positive. Investors would be able to hedge against global financial market uncertainty by investing in bond markets.

Second, country risk components play a significant role in explaining the dynamic comovement between South African asset markets and oil markets. This finding sheds light on the asymmetric impact of economic, financial and political risk on market returns. In particular, economic risk had the lowest relative explanatory power in determining comovements in the long-run and short-run, while political risk had the highest significant impact on asset market comovements. The finding on the relevance of political risk ratings is consistent with Dimic et al (2015). Decreases in political risk ratings are more significant than decreases which demonstrated the asymmetric effects of political risk. The impact of financial and political risk ratings is linear in the long run, except for the stock-oil correlations.

Finally, in terms of short-run effects, the findings demonstrated that only economic risk ratings explain bond-oil correlations. An increase in economic risk increases the correlation between these markets. Political risk ratings have an asymmetric and significant influence on stock-bond correlations. An increase in political risk increases stock-bond correlations. This implies that when there is political instability, investors overreact by selling off both securities, thus reducing the diversification benefits of a portfolio. The shocks in economic, financial and political risk ratings have significant implications for stock-housing correlations. The current period's changes in political risk have more influence on the correlation between the stock and housing market. An increase in political risk causes a decoupling effect between stock and housing markets, this effect is consistent with the flight-to-quality phenomenon. For stock-oil, economic risk ratings have no impact on this relationship in the short run, which implies these markets are more efficient at absorbing shocks in economic risk ratings. Political risk does not have any effects on housing-oil correlations in short-run, only economic and financial risk

This analysis provides new insights in the literature on cross-asset comovements from an emerging market perspective. Furthermore, this analysis contributes a new dimension to the literature by analysing the determinants of time-varying comovements, with emphasis on the asymmetric effects of country risk rating components. The results of the study have implications for portfolio managers and policymakers. Moreover, the findings of the study have noteworthy implications for asset allocation decisions. It is suggested that portfolio managers consider investing in South African bonds during periods of high stock market volatility and oil price volatility due to their negative correlation with the other asset markets. Overall the results show that political risk is not a priced risk factor in most asset markets. This finding might be useful for formulating policies that strengthen institutional and regulatory frameworks to maintain financial market stability. From an academic perspective, the findings contribute to the political risk sign paradox.

CHAPTER 6 SUMMARY AND CONCLUSIONS

6.1 Introduction

Over the years, strong linkages have been observed between different asset markets during periods of market downturn. Evidence has indicated that market downturns in one market tend to spill over into others within an economy and across economies, thus posing a threat to financial stability. Increasing financial market integration in global markets has contributed to exacerbating the transmissions from one market to another. Therefore, it is essential to examine the nature of this relationship. There exists a large strand of literature investigating financial market integration. However, co-movements across different asset markets have not been examined extensively in the South African context, thus creating a gap in the literature. Understanding the linkages between asset markets is relevant for asset allocation and efficient investment management. The knowledge gained from investigating this relationship will afford large institutional investors to improve asset allocation decisions and allow policymakers to make decisions that will enable them to stabilise the financial system. For investors and portfolio managers, portfolio diversification depends on the linkages between asset returns. The linkages between asset markets indirectly indicate market participants' expectations about the future state of the economy and also indicate how these markets react to common information.

The result of increasing financial market integration has led to an increase in the speed of information spillovers across global markets. Moreover, the advancements in technology have increased the speed of trading. Due to emerging markets not being fully integrated globally, local risk factors, such as economic, financial, and political risk are significant determinants of asset returns. This also highlights the importance of conducting research in emerging economies as they are known to be resilient to external shocks. Numerous studies have examined the drivers of asset returns.

Most studies (Skintzi, 2019; Poshakwale & Mandal, 2016; Aslandis & Christiansen, 2014) focused on the macroeconomic factors; however, there exists a lack of studies examining the effects of country risk ratings. Furthermore, most of these studies have examined the effects of country risk ratings on individual asset returns (Muzindutsi et al., 2021; Nhlapho & Muzindutsi, 2020; Sari et al., 2013; Mensi et al., 2016) and not the effects on asset return co-movements. There is a clear lack of consideration for the effects of country risk components as drivers of the dynamic interaction between asset markets. Market inefficiency and the limitations of asset pricing models in predicting asset market movements emphasise the need to examine the effects of country risk on asset returns.

To this end, this study aimed to examine the relationship between asset market returns and the impact of country risk factors on individual asset markets and their dynamic relationship. To examine the interaction between asset markets, the study focused on the joint asset return distribution amongst five asset markets; stocks, bonds, currency, housing, and commodities (gold and oil) markets, across different regimes. The analysis then investigated the impact of economic, financial and political risk factors on asset returns. This analysis further examined the impact of country risk components on the dynamic correlation between asset markets.

Analysing multiple assets, over different market conditions, revealed knowledge regarding the implications for asset allocation and portfolio diversification. The regime-switching framework permitted determining the transmission of shocks between markets across two market conditions. This information is relevant for investors that hold a diversified portfolio of various asset classes and it can be used to determine which asset market can be used to hedge market risk. Moreover, because emerging markets are considered to be partially integrated, traditional asset pricing models perform poorly in the pricing of local assets by capturing aggregated country risk and neglecting the pricing of the country risk components. Thus, the study contributes to the strand of literature by comparing the explanatory power of financial, economic, and political risk for asset returns and their comovements.

This doctoral dissertation's consideration of the disaggregated country risk as a determinant of asset market behaviour enables better identification of the sources of country risk related to asset returns. Disaggregated country risk data is an important contribution to knowledge regarding the effects of economic, financial and political risk shocks. Several studies document the significance of disaggregating country risk to assess the true impact on financial markets (Erb, Harvey & Viskanta, 1996; Khan

&Akbar, 2013; Duyvesteyn et al., 2016; Kirkkaleli & Onyibor, 2020). The disaggregated data will allow policymakers and regulators to focus on specific risk factors to ensure a resilient financial market that fosters economic growth.

6.2 Objectives and their associated methodologies

The first objective aimed to analyse the nature of the relationship between various asset markets, in South Africa and globally. The approach used to establish the relationship was a multivariate MSVAR specification (Krolzig, 2013). In particular, the MSIAH specification employed models for the joint return distribution, allowing for the regime switches in the mean, variance-covariance matrices, and autoregressive coefficients. This approach enabled identifying the bull and bear regimes and established the asymmetries in the linkages between asset markets. Further to this, the approach allows for comparing how the relationship between asset markets differs in a crisis period compared to a normal market period.

The second objective focused on examining the impact of country risk on asset returns. The analysis was conducted using a NARDL. The NARDL allows for examining the asymmetric effects of country risk components in the short- and long run. This approach also enabled to decompose of the impact of each risk factor into positive and negative components, thus the analysis provided insight into the effects of an increase or decrease in risk factors on asset returns. This approach has an advantage over the linear approaches typically used to examine this relationship which is unable to capture the short-run and long-run dynamic relations.

The final objective involved examining the effect of country risk on asset return co-movements. The analysis commenced by estimating the dynamic conditional correlations and it was included in the NARDL as the dependent variable used to examine the effects of economic, financial and political risk components of country risk. Whilst approaches such as quantile regressions and GARCH-MIDAS have been employed to measure the determinants of asset market comovements, they have limitations in being able to fully capture the dynamic correlation between markets. The approach used in this study was able to estimate the time-varying correlations, which then allows for examining how the correlation between asset markets is impacted by changes in country risk factors over time. The results were compared to the results from objectives one and two.

These analytical approaches employed the same sample period, data frequency, and market indices. The analysis of the impact of country risk builds from the first and second analytical chapters. The same approach was employed to examine the impact of country risk on individual asset market returns, and asset market correlations.

6.3 Summary of key findings

This section summarises the findings from the three analytical chapters which examine asset market linkages and the impact of country risk on asset markets.

6.3.1 Summary of key results and implications: Asset market co-movements

The nature of the relationship between the asset market returns was investigated in Chapter 3. The results provided in Section 3.4 indicated that the relationship between asset returns is regime-dependent. The analysis identifies two regimes for each asset market, namely, the bull regime and the bear regime. The bull regime was identified by the low volatility in asset returns, and the mean returns in stock and oil markets being positive. In contrast, the crisis regime is characterised as a regime with higher volatility and negative average returns in bond, currency and gold markets. Furthermore, the duration of the normal or bull regime is found to be longer than the bear regime. This finding is consistent with existing empirical research which reveals that the low volatility, the bull regime is more persistent than the crisis or bear regime. The results present evidence of the flight-quality phenomenon and contagion effects. In addition, the results demonstrate that investors can take advantage of the market downturn by shifting capital from assets with positive returns in the bear regime and shifting to other asset markets with positive returns in the bull regime. Furthermore, they suggest potential diversification and risk hedging benefits from switching asset allocation amongst the different asset markets.

The conclusion reached based on the regime-dependent impulse response functions indicates that the response of asset markets is more significant in the short-run in the bull regime. While the response of asset returns is higher in the bear regime, the effects of shocks from other asset markets are only observed in the long run. In the bull regime, the largest impact of fluctuations in asset returns occurs within the first three months and subsides until it reaches equilibrium within the first six months. The results reveal that currency market fluctuations are the highest contributor to asset market volatilities in both normal and crisis market periods. It is also observed that the stock and bond market are more responsive to their own shocks compared to the other markets where their shocks are less significant. In the crisis regime, it is noted that currency market and bond market fluctuations generate higher volatilities in all the other markets. Hence it is evident that the nature of the relationship between asset returns is state-dependent, in other words, bullish or bearish market condition.

The evidence of information spillover between markets provides valuable insights for financial analysts, portfolio managers and investors. The behaviour of asset markets tends to be unpredictable during periods of market turmoil. A portfolio may experience significant losses during crisis periods if asset markets simultaneously experience downturns. Thus, the safe-haven and hedging properties of assets are of main concern for portfolio managers and investors. Therefore, the finding that bond and foreign exchange markets are the main transmitters of shocks in crisis periods will be useful to investors in formulating reallocation strategies that enable them to shift their portfolio weights toward safe haven assets during periods of high market uncertainty to reduce losses. The changing dynamic relationship between markets requires attention from investors as they need to formulate reallocation strategies according to current market conditions to reap the benefits of diversification.

From a policymaker's perspective, regime dependency has implications for the effectiveness of policy decisions. Policymakers should formulate policies that strengthen currency and bond markets to provide reliable hedging tools for volatility in other asset markets. This is imperative because high asset market volatility results in significant capital outflow which can trigger economic and financial instability. For policymakers, it is important to analyse transmission channels and manage the effects of contagion between markets during crisis periods.

6.3.2 Summary of key results and implications: Impact of country risk on asset returns

In Chapter 4, the results from the NARDL demonstrate the heterogeneous effects of country risk components on asset returns. The notion that economic, financial and political risk have symmetric effects is largely rejected, thus implying that positive and negative changes in country risk components have asymmetric effects, particularly the effects of political and financial risk components. Moreover, the impact of country risk adjustments was higher in the short run compared to the long run. Similar to other studies, the results demonstrate that financial and political risk has a significant influence on returns in asset markets. Furthermore, the results demonstrated that a decrease in financial and political risk, which indicates deteriorating market conditions, has significant implications on asset returns in the short run. The impact of negative changes in political risk ratings, when compared to the other risk factors, is significantly higher in the long- and short-run. This observation is supportive of the argument that political risk is one of the key determinants of asset prices in emerging markets.

The effects of economic risk ratings were the highest for stock, gold and exchange market returns. The impact of an increase and decrease in economic risk ratings on gold returns was symmetric. The contrasting results imply that equity, bond, housing and real exchange rate can be included in an investment portfolio to hedge against increasing economic risk (negative innovations in economic risk ratings). Regarding the effects of financial risk ratings in the long run, the effects for positive and negative innovations have positive effects on the bond, housing, forex and gold returns.

Financial risk rating changes tend to decrease real effective exchange rates and oil returns. This result suggests that an increase or decrease in factors such as exchange rate stability and foreign debt/GDP ratio will increase returns gained from investing in the exchange rate and oil futures markets. According to the study findings, only negative shocks in financial risk ratings had a significant impact on domestic asset markets in the short run. This suggests that investors should be cautious regarding overweighting their portfolios with domestic assets. The magnitude of the effects of financial and political risk ratings was higher for rating downgrades, thus policymakers should focus on strategies to reduce risk to improve asset market performance.

In the long run, changes in political risk ratings harmed stock, bond, forex, and commodities returns. In all the equations, the impact of increasing political risk (negative shocks) was significant and had negative implications on asset returns. The magnitude of the negative shocks or decreases in political risk ratings was higher compared to an increase in political risk ratings. However, bond and housing markets were less sensitive to rising political risk. This result is similar to that found by Brooks et al. (2004), Alsakka and ap Gwilym (2012) and Afonso et al (2014) who found that downgrades in credit ratings have a more significant effect compared to upgrades. The impact of the political risk rating decrease was significantly high on equity returns. However, the bond and housing markets were less sensitive to rising political risk (political risk downgrade). This result suggests that bond and housing markets can be included as safe-haven assets in cases where there is an increase in political fundamentals in South Africa.

The evidence also demonstrates that stock markets have a stronger reaction to positive and negative changes in country-specific risk factors. This result relates to the argument that stock markets are more volatile compared to other markets. Moreover, this result suggests that other asset markets can be used to hedge country-specific risk in a stock portfolio. Specifically, bonds, currency and oil, can be used effectively to hedge political risk. In contrast, the effects of political risk downgrade harm gold returns which limits the hedge effectiveness of gold during periods of high political uncertainty.

Overall, the results derived from Chapter 4 emphasised the heterogeneous sensitivity of stock, bond, currency, housing, and commodities markets to shocks in economic, financial and political risk. The significant difference in the impact of these risk factors in the long- and short-run further highlighted the importance of distinguishing investment horizons in portfolio management. When considering South African asset markets, understanding the components of country risk offers a way to better capture the risk of these markets, in an environment where international contagion is known to be a factor.

The different responses to shocks in country risk components will aid in investment decision-making. Portfolio managers with an active management approach can profit from information inefficiencies in the markets. Moreover, investors can adjust their portfolio diversification strategies in response to the type of shock transmitted. Investors may react differently to informative signals in the markets (Pastor and Veronesi, 2017). Changes in country risk ratings may induce herd behaviour amongst market participants if they are perceived to bring new information to markets that were not available and reflected in asset prices. International and domestic investors need to be aware of the exposure to country risk. Investors with longer investment horizons could hedge political risk by investing in stock, currency and housing markets. Because country risk changes have no impact on oil, investors can take advantage of this, by increasing their holding of oil in their portfolios to hedge against country risk in the short term. The impact of financial and political risk is for the most part delayed, thus investors need to be careful when observing country risk information as an indicator of economic growth and performance.

From the policymaker's perspective, policies implemented need to be effective in mitigating the transmission of shocks. An increase in country risk is associated with increasing uncertainty and thus increasing investor risk aversion, which could lead to a decrease in foreign investment as well. For prudential supervision and to maintain financial stability, policymakers should be aware of the markets that are affected by increases in country risk, and formulate policies to protect financial markets from financial and political risk shocks. For scholars, the basic tenet of asset pricing theory is that investors need to be compensated for exposure to risk and uncertainty. Therefore, the findings of the study provide knowledge regarding the relationship between risk and asset returns which will help with the price discovery process for domestic asset markets.

6.3.2 Summary of key results and implications: Impact of country risk on asset market co-movements

The results of the asymmetric impact of economic, financial and political risk on asset returns are outlined in Section 5.4 of Chapter 5. The first section of the analysis establishes that the correlation of asset markets varies over time due to market events. It was observed that there are significant nonlinearities in the correlation between asset markets, and country risk components. Specifically, it is essential to consider the heterogeneous effects of economic, financial and political risk ratings on the co-movements between asset markets. It was revealed that political risk ratings are the main driver of the changes in the dynamic conditional correlations between asset markets. It was also noted that the magnitude and significance of risk ratings were greater in the short run compared to the long run. When considering the impact of country risk, the observation is that political and financial risk has a significant short-run impact on asset market correlations.

It was also revealed that economic and financial risk have no asymmetric effect on the correlation between stock and bond markets. Moreover, negative changes in political risk ratings have a positive and significant effect on the linkage between stock and bond markets. The results indicate that all three country-specific risk components have an impact on the correlation between stock and housing market returns. The impact of political risk rating changes had an immediate impact on the correlation of stock and housing markets, such that deteriorating political risk reduced the correlation. This implies that housing markets have hedging potential for equity investors. The positive and negative shocks in financial risk, in the short-term and long-term, were statistically significant and reduced the correlation between stock and housing markets, whilst a decline in economic risk ratings increased the comovements between stock and housing markets.

Understanding the time-varying comovements between asset markets and their determinants is important for asset allocation and risk management. Asset allocation strategies depend on the comovements between assets in a portfolio. Country risk changes can provide information regarding investor expectations and expected economic performance. The results show that asset return comovements are influenced by changes in country risk. Therefore, country risk should be taken into consideration in the construction of an optimal portfolio. An increase in political and financial risk in South Africa could increase cross-asset comovements and thus minimise the diversification benefits. The negative comovement between stock and bonds in the long-term implies the presence of the flight-to-quality phenomenon during periods of increasing political risk. Investors could take advantage of this relationship by reallocating their portfolios by combining stock and bond investments to reduce losses on the overall portfolio. The results suggest limited risk hedging potential of bonds to equity investors during periods of increasing political risk in the short investment horizon. Investors interested in South African asset markets could rely on stock and housing markets to hedge against increasing political risk over the longer investment horizon.

Policymakers and regulators have the responsibility to regulate financial markets so that international investors are assured of the stability of the markets and the economy. Country risk ratings play the role of reducing information asymmetries between investors. Thus, ensuring economic, financial and political stability is key to increasing capital flows and the flow of funds to the South African markets. Policymakers can adopt structural reforms to reduce the integration among the different asset markets. Structural reforms include improving macroeconomic fundamentals and ensuring that portfolio flows are not predominantly debt (Forbes, 2012). Political uncertainty can have adverse effects on economic performance and financial stability. Political uncertainty is likely to reduce the flow of investments and thereby decrease economic growth (Tabassam et al., 2016). Hedging political risk is also important for multinational firms with operations in emerging markets. Political instability makes it difficult for corporations and institutions to forecast a country's economic growth in the long run. Increases in political risk can have an impact on the ability of the firm to attract foreign investment and thus increasing the probability of bankruptcy and increase the cost of capital. Because stock and bonds are the most frequently traded financial assets and make up a lion's share of most portfolios of institutional investors, the drivers of this comovement are important for policymakers and regulators.

6.4 Limitations of the study and areas for future research

The study focused on six asset markets out of a universe of multiple investment assets. However, the issue of financial market contagion and interdependence could be established over a wider range of asset markets, thus enabling robust analysis compared to existing studies. Future studies could focus on investigating the nature of the relationship between other asset markets not included in this study. Portfolio formation analysis can be improved by considering a portfolio composed of different asset markets.

The study focused on analysing the impact of economic, financial and political risk on asset returns and asset market linkages. However, each component is made up of different variables, thus the scope of the study could be extended to examine which of the composite political risk factors explain asset market behaviour. For example, consider the role of corruption, internal and external conflicts and government policy, amongst others. Future research could also consider other rating agencies such as Moody's, S&P, Fitch, Euromoney, and Institutional Investor, amongst others. This study could be extended to compare the impact of different ratings provided by rating agencies over an extended period. The pricing of country risk may depend on the context; therefore the results of the study are not generalisable to other countries. The study could be extended to consider how country risk affects the comovements of domestic assets of other emerging economies. Furthermore, the studies could consider exploring the roles of different types of risk, such as financial stress or policy uncertainty, to get a better perspective on asset pricing dynamics.

Another limitation of the study is the sample period under examination. This limitation is due to the lack of recorded data for some asset markets. Unfortunately, the write-up of this dissertation started at the peak of COVID-19 and the first research article that is part of this dissertation was published in 2019. To ensure consistency, the dissertation used the same period. Future research can refine the findings with a longer sample period including the recent financial crises as a result of the COVID-19 pandemic.

Due to the impact of country risk on asset return behaviour, future work can take advantage of the information content of country risk for forecasting asset market comovements. The study could be extended to examine the practical investor perspective by running portfolio simulations that take into account changes in country risk to examine the diversification and hedge effectiveness of asset markets. The study could also consider other methodological approaches. There is a growing literature that applies innovative statistical approaches to disentangle the dynamics of asset market behaviour and its determinants. In recent work, approaches have been further developed to include wavelet analysis and network-based analysis. Studies could explore the linkages between asset markets at higher frequencies such as intraday data.

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APPENDIX A

Appendix A1: Results of the Vector autoregressive model

	Equity	Bond	Forex	Housing	Gold	Oil
Equity (-1)	0.014553	-0.027603	-0.112381	-0.001077	-0.017678	0.132634
	(0.07084)	(0.03171)	(0.05291)	(0.00281)	(0.08606)	(0.14472)
	[0.20543]	[-0.87061]	[-2.12390]	[-0.38355]	[-0.20541]	[0.91651]
Bond (-1)	0.062326	0.024520	-0.204681	0.001627	0.130132	-0.360771
	(0.16734)	(0.07489)	(0.12499)	(0.00663)	(0.20329)	(0.34184)
	[0.37246]	[0.32740]	[-1.63762]	[0.24533]	[0.64013]	[-1.05538]
Forex (-1)	0.082167	-0.001212	0.141248	-0.004555	0.085184	-0.262543
	(0.08765)	(0.03923)	(0.06547)	(0.00347)	(0.10648)	(0.17905)
	[0.93745]	[-0.03090]	[2.15756]	[-1.31161]	[0.79999]	[-1.46629]
Housing (-1))	-1.174411	1.449550	0.336939	0.545170	0.441580	-4.589210
	(1.36818)	(0.61233)	(1.02191)	(0.05421)	(1.66213)	(2.79493)
	[-0.85838]	[2.36728]	[0.32972]	[10.0572]	[0.26567]	[-1.64197]
Gold (-1)	-0.081566	0.022433	0.210617	-0.001270	-0.075228	-0.159516
	(0.05870)	(0.02627)	(0.04385)	(0.00233)	(0.07131)	(0.11992)
	[-1.38948]	[0.85387]	[4.80361]	[-0.54624]	[-1.05488]	[-1.33021]
Oil (-1)	-0.060664	-0.020122	-0.009506	4.23E-05	-0.100552	-0.011752
	(0.03868)	(0.01731)	(0.02889)	(0.00153)	(0.04700)	(0.07903)
	[-1.56817]	[-1.16224]	[-0.32898]	[0.02761]	[-2.13959]	[-0.14871]
C	0.009098	0.008447	0.003322	1.11E-05	0.010509	0.011505
	(0.00342)	(0.00153)	(0.00256)	(0.00014)	(0.00416)	(0.00699)
Log-likelihood		3268.377				
Akaike information criterion		-27.34218				
Schwarz criterion		-26.72574				
Number of coefficients		42				

Appendix A2: Lag selection criteria VAR

Lag	LogL	LR	FPE	AIC	SC	HQ
0	3072.151	NA	5.87e-20	-27.25468	-27.16358	-27.21791
1	3191.356	230.9928	2.80e-20	-27.99428	-27.35660*	-27.73691*
2	3237.346	86.66535*	2.57e-20*	-28.08307*	-26.89883	-27.60511
3	3264.402	49.54339	2.78e-20	-28.00358	-26.27275	-27.30501
4	3291.010	47.30155	3.03e-20	-27.92008	-25.64268	-27.00092
5	3316.971	44.76951	3.33e-20	-27.83086	-25.00688	-26.69109
6	3339.130	37.02999	3.80e-20	-27.70782	-24.33727	-26.34745
7	3361.217	35.73135	4.34e-20	-27.58415	-23.66702	-26.00318
8	3384.743	36.80471	4.92e-20	-27.47327	-23.00956	-25.67170
9	3403.524	28.38056	5.84e-20	-27.32021	-22.30993	-25.29804
10	3422.713	27.97394	6.94e-20	-27.17078	-21.61393	-24.92801
11	3458.362	50.06605	7.16e-20	-27.16766	-21.06423	-24.70429
12	3487.770	39.73415	7.86e-20	-27.10907	-20.45906	-24.42510

Source: Author’s own estimation (2022)

APPENDIX B

Appendix B1: ARDL Bounds test

Table B1 Results for ARDL cointegration test

Market	Model specification	F-stat	Conclusion
Stock-bond	ARDL(1, 0, 0, 1)	7.5777	Cointegration
Stock-housing	ARDL(1, 0, 0, 0)	5.3691	Cointegration
Stock-oil	ARDL(1, 0, 3, 2)	5.2310	Cointegration
Bond-housing	ARDL(1, 0, 1, 4)	5.5481	Cointegration
Bond-oil	ARDL(2, 0,4, 0)	5.8353	Cointegration
Housing-oil	ARDL(1, 0, 1, 4)	6.1836	Cointegration
	Critical values		
	10%	2.37	3.2
	5%	2.79	3.67
	2.5%	3.15	4.08
	1%	3.65	4.66

Notes: ***, ** and * denote the level of significance at 1%, 5% and 10%, respectively.

Source: Author’s own estimation (2022)

Appendix B2: – Variance Inflation Factor

Dependent variable: Stock returns			
Variable	Coefficient	Uncentered	Centered
LER	0.003430	4400.007	1.390781
LFR	0.004616	6223.396	1.241786
LPR	0.009382	16796.27	1.585494
Dependent variable: Bond returns			
LER	0.000717	4400.007	1.390781
LFR	0.000965	6223.396	1.241786
LPR	0.001962	16796.27	1.585494
Dependent variable: HPI returns			
LER	9.31E-05	4400.007	1.390781
LFR	0.000125	6223.396	1.241786
LPR	0.000255	16796.27	1.585494
Dependent variable: Forex returns			
LER	0.002219	4400.007	1.390781
LFR	0.002987	6223.396	1.241786
LPR	0.006071	16796.27	1.585494

Source: Author’s own estimation (2022)

Appendix B3: The results for the ARDL Short-run ECM

Stock		Bond		Forex		Housing		Gold		Oil	
Variable	Coeff	Variable	Coeff	Variable	Coeff	Variable	Coeff	Variable	Coeff	Variable	Coeff
ΔFR	0.0616	ΔFR	0.0081	$\Delta Forex_{t-1}$	0.0413	ΔHPI_{t-1}	0.7301***	ΔFR	-0.3822***	Crisis	-0.018
Crisis	-0.0340***	ΔFR_{t-1}	-0.1219**	$\Delta Forex_{t-2}$	-0.0852	ΔHPI_{t-2}	-0.1675***	ΔFR_{t-1}	-0.1969	ECT	-1.0189***
ECT	-1.1112***	ΔPR	0.2414**	ΔER	0.2116	ΔHPI_{t-3}	-0.1808***	ΔFR_{t-2}	-0.2356*		
		ΔPR_{t-1}	0.2335**	ΔFR	-0.4432***	ΔPR	0.0163**	ΔPR	-0.2209		
		ΔPR_{t-2}	0.2047*	ΔPR	-0.6363***	Crisis	-0.0004	ΔPR_{t-1}	-0.4713		
		ΔPR_{t-3}	0.2160**	Crisis	0.0118*	Structural break	-0.0003**	Crisis	0.0118		
		Crisis	0.0015	ECT	-0.8167***	Crisis	-0.0002	ECT	-1.2008		
		ECT	-0.9711***			ECT	-0.0511***				

Appendix B4 – Long-run ARDL equations

STOCK_BOND= 0.0981*LER - 0.0822*LFR - 0.1112*LPR - 0.3475 (B1.1)

STOCK_HPI = -0.1201*LER - 0.1958*LFR +0.4392*LPR - 0.8552 (B1**.2)**

STOCK_OIL = 0.2229*LER + 0.2200*LFR +0.1836*LPR - 1.1007 (B1.3)

BOND_HPI = -0.0269*LER - 0.0788*LFR +0.0965*LPR - 0.0753 (B1.4)

BOND_OIL = 0.1099*LER - 0.0052*LFR - 0.1327*LPR + 0.5783 (B1.5)

HPI_OIL = - 0.9183*LER - 0.6214*LFR +1.0857*LPR + 0.9172 (B1.6)

Appendix B5 :– Results for ARDL Error correction model

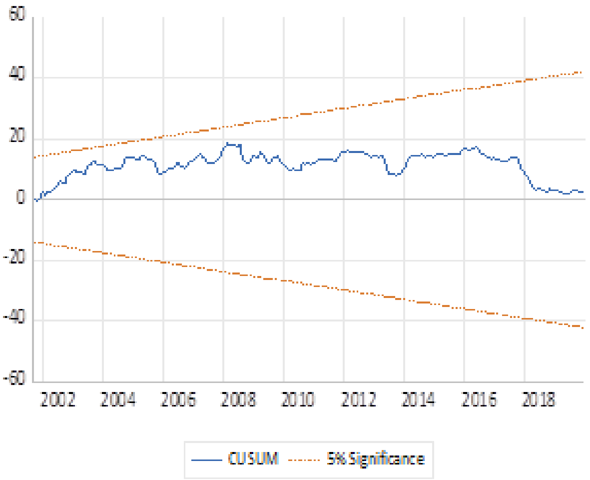
Stock-Bond					Stock- Housing				
Variable	Coefficient	Std. Error	t-Statistic	Prob.	Variable	Coefficient	Std. Error	t-Statistic	Prob.
ΔPR	0.218916	0.088080	2.485420	0.0137	Crisis	0.003866	0.004294	0.900207	0.3690
GFC	-0.001091	0.002882	-0.378547	0.7054	ECT	-0.218287	0.041742	-5.229440	0.0000
ECT	-0.299682	0.048236	-6.212888	0.0000					
Stock-Oil					Bond- Housing				
ΔFR	0.074914	0.065335	1.146616	0.2529	ΔFR	-0.013366	0.060360	-0.221432	0.8250
ΔFR_{t-1}	0.121291	0.066433	1.825775	0.0693	ΔPR	-0.006995	0.146366	-0.047790	0.9619
ΔFR_{t-2}	0.128943	0.067272	1.916742	0.0566	ΔPR_{t-1}	0.059043	0.146376	0.403368	0.6871
ΔPR	0.110658	0.162321	0.681719	0.4962	ΔPR_{t-2}	0.212879	0.146454	1.453553	0.1476
ΔPR_{t-1}	-0.301557	0.163102	-1.848882	0.0659	ΔPR_{t-3}	0.563694	0.145774	3.866895	0.0001
Crisis	-0.001848	0.005206	-0.355022	0.7229	Crisis	0.010779	0.004787	2.251487	0.0254
ECT	-0.212787	0.041211	-5.163358	0.0000	ECT	-1.116728	0.066407	-16.81637	0.0000

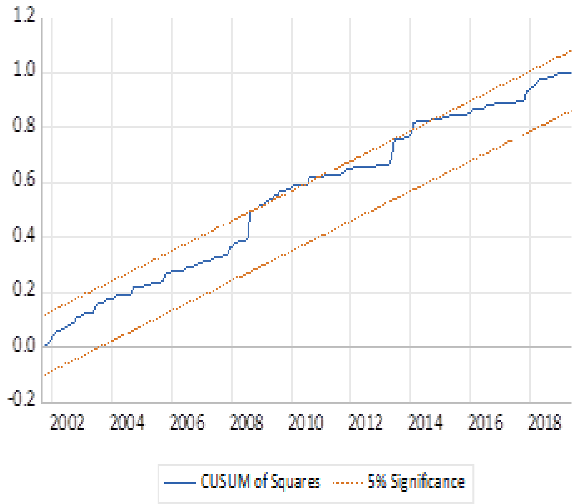
Bond-Oil					Housing-oil				
$\Delta Bond - oil_{t-1}$	-0.123428	0.066615	-1.852865	0.0653	ΔFR	-0.090563	0.148251	-0.610878	0.5420
ΔFR	-0.014440	0.049621	-0.291004	0.7713	ΔPR	-0.306779	0.360462	-0.851073	0.3957
ΔFR_{t-1}	-0.035406	0.048942	-0.723422	0.4702	ΔPR_{t-1}	0.985274	0.359853	2.737988	0.0067
ΔFR_{t-2}	0.093916	0.049014	1.916131	0.0567	ΔPR_{t-2}	-0.168210	0.361322	-0.465541	0.6420
ΔFR_{t-1}	0.153092	0.049400	3.098995	0.0022	ΔPR_{t-3}	0.827274	0.356622	2.319750	0.0213
Crisis	-0.008135	0.004026	-2.020788	0.0446	Crisis	0.023708	0.012473	1.900710	0.0587
ECT	-0.273448	0.050140	-5.453731	0.0000	ECT	-0.216855	0.038627	-5.614125	0.0000

B6 - Results for the CUSUM and CUSUM Squared tests

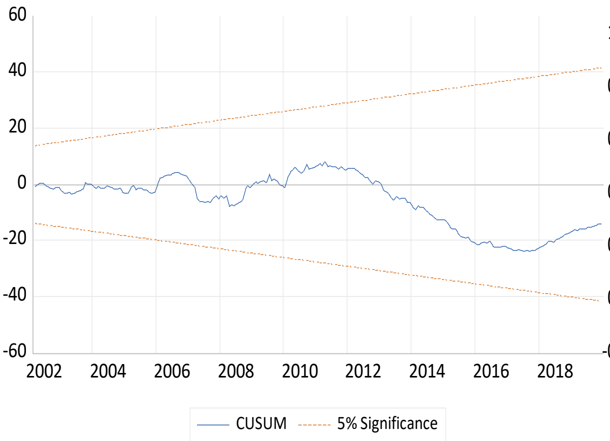
CUSUM | CUSUMSQ

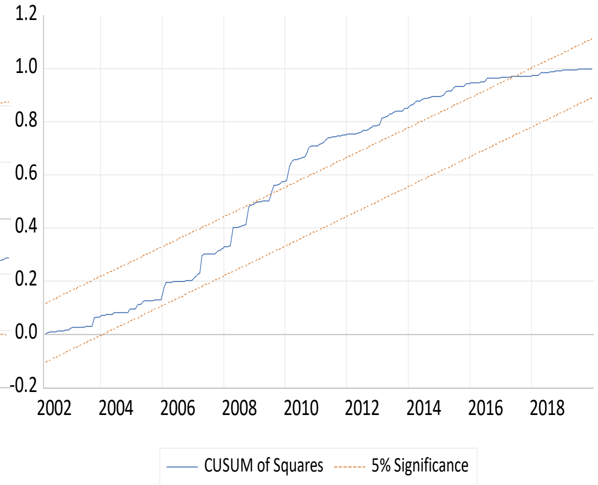
Stock- Bond



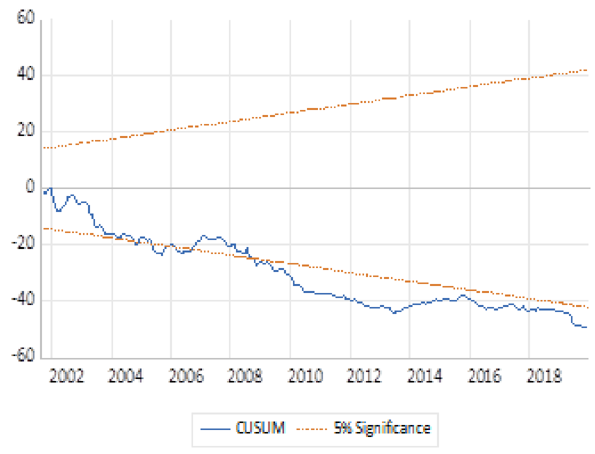


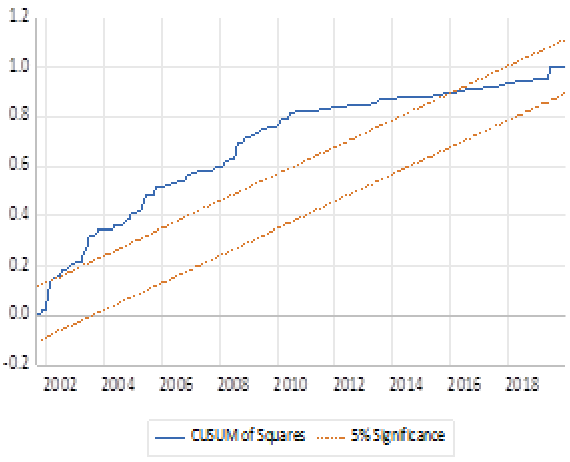
Stock- Housing



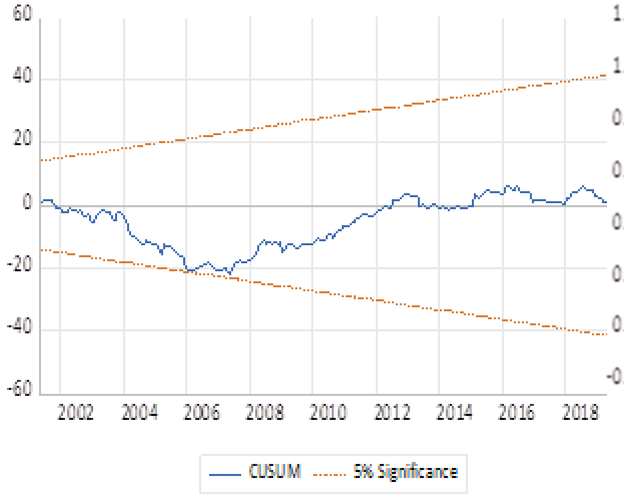


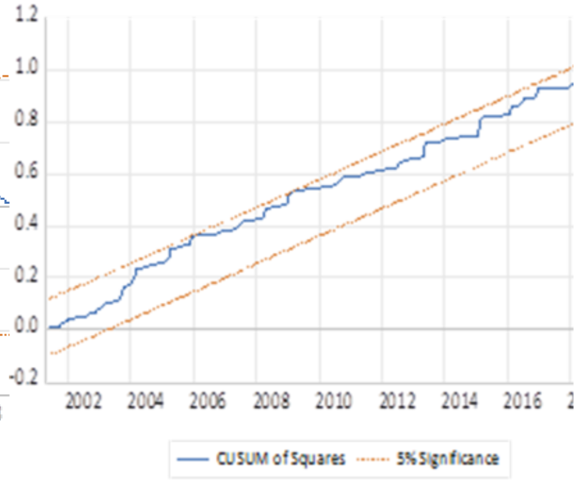
Stock- Oil



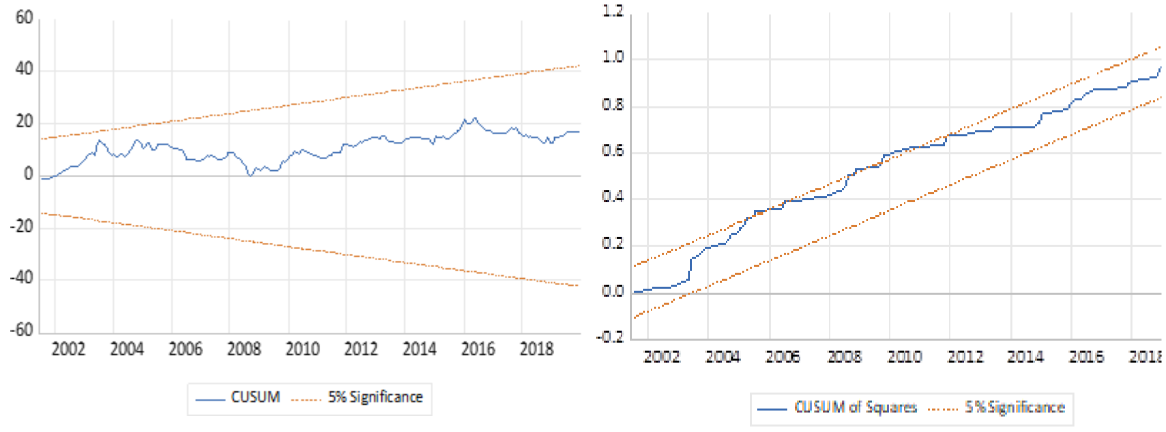


Bond- Housing

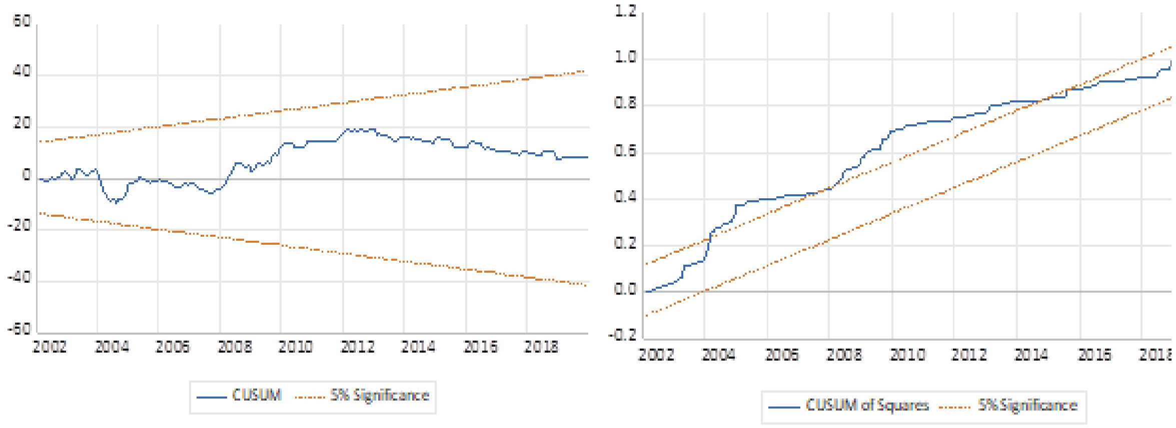




Bond- Oil



Housing- Oil



ETHICAL CLEARANCE

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

13 Oct 2021

Miss Rethabile Nokulunga Nhlapho (210518711)
School Of Acc Economics&Fin
Westville

Dear Miss Rethabile Nokulunga Nhlapho,

Original application number: 00015081
Project title: Country risk components and financial asset markets interdependence: Evidence from South Africa

Exemption from Ethics Review

In response to your application received on 12 October 2021, your school has indicated that the protocol has been granted **EXEMPTION FROM ETHICS REVIEW.**

Any alteration/s to the exempted research protocol, e.g., Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through an amendment/modification prior to its implementation. The original exemption number must be cited.

For any changes that could result in potential risk, an ethics application including the proposed amendments must be submitted to the relevant UKZN Research Ethics Committee. The original exemption number must be cited.

In case you have further queries, please quote the above reference number.

PLEASE NOTE:
Research data should be securely stored in the discipline/department for a period of 5 years.

I take this opportunity of wishing you everything of the best with your study.

Yours sincerely,

Prof Josue Mbonigaba
Academic Leader Research
School Of Acc Economics&Fin